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Recreational Marijuana Legalization and Co-Use with Alcohol Among Adolescents

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Abstract

Introduction: Little is known about possible effects of recreational marijuana legalization (RML) on alcohol and marijuana co-use among underage youth. This study examined the association between RML in California in 2016 and alcohol and marijuana co-use among adolescents. Additional analyses investigated associations between RML and co-use among past-30-day drinkers and marijuana users, and frequency of alcohol and marijuana use among co-users.

Methods: This study used annual cross-sectional data from 7th, 9th, and 11th graders (N=3,319,329) who participated in the California Healthy Kids Survey from 2010–11 to 2018–19. Measures included past-30-day alcohol and marijuana use and student demographic characteristics, survey year, pre/post RML, and urbanicity. Multi-level regression analyses were conducted in 2021.

Results: RML was associated with greater odds of past-30-day alcohol and marijuana co-use in the total sample, odds ratio (*OR*) = 1.06, 95% CI: 1.05, 1.07. RML was more strongly associated with co-use among adolescents who reported past-30-day alcohol use, *OR* = 1.58, 95% CI: 1.52, 1.62, and heavy drinking, *OR* = 1.25, 95% CI: 1.21, 1.29, but was inversely related to co-use among past-30-day marijuana users, *OR* = 0.76, 95% CI: 0.74, 0.78. Among past-30-day co-users, there was a positive association with frequency of marijuana use β = 0.36, SE = .07.

Conclusions: RML may increase the risk of alcohol and marijuana co-use among adolescents. Greater restrictions on numbers of alcohol and marijuana retail outlets, hours of operation and advertising, and higher taxes on alcohol and marijuana products may help reduce availability of these substances to adolescents.

Introduction

As of April 2021, recreational marijuana use is legal for adults ≥ 21 years old in 17 states and the District of Columbia, and recreational marijuana sales are legal in 10 states.[1,2]

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Conflicts of Interest

The authors declare no conflicts of interest related to this study. Drs. Paschall and Grube have received funding from the AB InBev Foundation to conduct an independent evaluation of the Global Smart Drinking Goals initiative. Dr. Grube has received other funding from the alcohol industry within the past three years, through the Responsible Retailing Forum, to develop and evaluate interventions to reduce alcohol sales to youth.

California legalized adult recreational marijuana use in November, 2016, and retail sales in January, 2018.[3] Liberalization of marijuana laws raises public health concerns, especially about potential effects on marijuana use by adolescents, which has been associated with a range of negative consequences.[4,5] Monitoring the Future (MTF) data show that marijuana is now the second most popular drug among young people after alcohol.[6] While there has been a decline in adolescents' alcohol use in recent decades, marijuana use has increased and prevalence rates for these substances are converging.

Whether recreational marijuana legalization (RML) is contributing to the increase in marijuana use among adolescents is unclear, as findings of recent studies are mixed. A national study with data from the Youth Risk Behavior Survey found an 8% decrease in the likelihood of past-30-day marijuana use and a 9% decrease in the likelihood of frequent marijuana use among adolescents after RML.[7] Recent studies in Washington and Colorado also found no evidence that RML and initiation of retail recreational marijuana sales, respectively, were associated with increases in marijuana use among adolescents.[8,9] In contrast, a recent study with statewide samples of adolescents in California found a positive association between RML in 2016 and the prevalence and frequency of past-30-day marijuana use.[10] Similarly, a study in Oregon found significant statewide increases in marijuana use, and perceived availability of marijuana and perceived parent approval of marijuana use after RML.[11]

A potential consequence of RML is greater concurrent or simultaneous co-use of alcohol and marijuana. Concurrent use refers to use of both alcohol and marijuana, but not necessarily at the same time, whereas simultaneous use refers to use of the two substances close in time such that the effects overlap.[12] Co-use of alcohol and marijuana may increase the risk for adverse outcomes beyond use of either substance alone. In a study with high school students, simultaneous use of alcohol and marijuana was associated with a two-fold increase in the likelihood of experiencing problems (e.g., legal., academic, health) in 11th grade after controlling for problems levels in 10th grade.[13] In a study using ecological momentary assessments with a community sample of adolescents, it was found that each occasion of simultaneous use of alcohol and marijuana was associated with an increase in the number of problems reported (e.g., violence, driving under the influence, riding with a drunk driver).[14] Additional analyses suggested that this increase could be attributed largely to the alcohol consumed. Another recent study of adolescents and young adults, however, found that simultaneous marijuana and alcohol use at the last party attended, compared with alcohol only, was associated with experiencing more problems.[15] Recent studies with college students and young adults also indicate that the majority of alcohol and marijuana co-users engage in simultaneous use of these substances, which, in turn, is related to heavier alcohol use and negative consequences such as cognitive impairment, driving while intoxicated, unwanted sex, hangovers, and injury.[16–21] A review of epidemiological, laboratory, and clinical research concluded that co-use of cannabis and alcohol was associated with more frequent and intense use of these substances, increased risk for alcohol and cannabis use disorders, mental health disorders, impaired driving, and other adverse behavioral and social consequences.[22]

A central question is whether marijuana serves as a substitute or a complement to alcohol use for adolescents. That is, with legalization and potentially greater availability, does marijuana use replace alcohol use or is it used in addition to alcohol? Although the evidence is mixed[23], some research suggests that marijuana and alcohol may serve as complements for some adolescents, particularly those who are heavy or frequent drinkers[24].

Few studies have investigated whether RML is associated with increases in alcohol and marijuana co-use among adolescents. A study using statewide samples of adolescents in Oregon from 2010 to 2018 found a significant post-RML increase in past-30-day alcohol and marijuana co-use, particularly among adolescents living in counties with high levels of retail marijuana and alcohol outlet density.[25] However, this study did not ascertain differences in the association between RML and co-use among adolescents who were lighter versus heavier drinkers or marijuana users.

This study examines changes in past-30-day alcohol and marijuana co-use among adolescents who participated in the California Healthy Kids Survey from 2010–11 to 2018–19. The association between RML and co-use is examined for the total sample and for subgroups who engaged in past-30-day alcohol use, heavy drinking, and marijuana use. Based on previous research[23,24], it was hypothesized that RML would be more strongly and positively associated with co-use among adolescents who engaged in alcohol use or heavy drinking at least once per month compared to youth who engaged in marijuana use at least once per month. This study also examines whether the frequency of past-30-day marijuana use, alcohol use, or heavy drinking increased after RML among adolescents who reported any past-30-day co-use.

Methods

Study Design and Sample

California Healthy Kids Survey.—This study used annual cross-sectional survey data from 7th, 9th and 11th grade students who participated in the California Healthy Kids Survey (CHKS) from 2010–11 to 2018–19.[26] CHKS is a statewide self-administered paper-and-pencil survey of health-related behaviors and has been administered every other year since 1998 with about half of the schools participating in alternate years. CHKS is conducted by WestEd, a non-profit research organization in collaboration with the California Department of Education. About 75% of California school districts participate in CHKS. CHKS requirements include participation by students in grades 7, 9, and 11 and a 60% response rate, using passive or active parental consent as determined by the schools. For passive consent, parents were informed of the survey and given the opportunity to refuse permission for their child to participate, while for active consent parents were required to provide written approval. Student participation is voluntary, but written assent is not required. Response rates are typically ≥ 70% for participating schools. The CHKS questionnaire is administered in either the fall or spring semester at the discretion of participating schools.

Survey sample.—This study was conducted in 2021 using annual CHKS data for 2010–11 to 2018–19 school years from 3,319,329 students in 3,796 schools, 852 school districts, and all 58 counties in California. Although complete data were provided by 90.3% of CHKS

respondents, there were some differences between students who did and did not provide complete data. Students who did not provide complete data were more likely to be male (55.7% vs. 49.4%), Hispanic (60.3% vs. 50.3%), past-30-day heavy drinkers (11.2% vs. 8.5%) and marijuana users (13.6% vs. 11.7%). To adjust for differences between the CHKS analytic sample and the statewide population of students in 7th, 9th, and 11th grades, annual enrollment statistics for public schools from the California Department of Education[27] were used to construct sample weights based on the proportions of students in gender and ethnic/race subgroups enrolled in 7th, 9th and 11th grade in each school year relative to proportions in the CHKS sample.

This study also examines the association between RML and past-30-day alcohol and marijuana co-use among students who reported (1) past-30-day alcohol use, but not heavy drinking (n=251,835), (2) heavy drinking (5+ drinks) in the past 30 days (n=281,938), and (3) past-30-day marijuana use (n=386,116). Additionally, this study examines the association between RML and the frequency of alcohol use, heavy drinking and marijuana use among students who reported past-30-day co-use of these substances (n=269,443). The study was deemed exempt by the Pacific Institute for Research and Evaluation IRB because it comprised secondary analyses of anonymous survey data.

Survey Measures

Marijuana use.—From 2010–11 to 2016–17 students were asked, “During the past 30 days, on how many days did you use marijuana (pot, weed, grass, hash, bud)?” (“0 days,” “1 day,” “2 days,” “3 to 9 days,” “10 to 19 days,” and “20 to 30 days”). The same question was asked in 2017–18 and 2018–19 but with the addition of “…(smoke, vape, eat, or drink)?” to reflect the increasing variety of marijuana products. These variables were dichotomized to represent any past-30-day marijuana use. An approximate interval measure of past-30-day marijuana use frequency was created using response midpoint values.

Alcohol use and heavy drinking.—Students were provided with a description of an alcoholic drink, and were asked, “During the past 30 days, on how many days did you have at least one drink of alcohol?” (“0 days,” “1 day,” “2 days,” “3 to 9 days,” “10 to 19 days,” and “20 to 30 days”). They were also asked, “On how many days did you have five or more drinks of alcohol in a row, that is, within a couple of hours?” with the same response options. Dichotomous variables were created to represent any past-30-day non-heavy alcohol use or heavy drinking. Approximate interval measures of past-30-day alcohol use and heavy drinking frequency were created using response midpoint values.

Alcohol and marijuana co-use.—Based on responses to the questions about past-30-day alcohol and marijuana use, a dichotomous variable was created to any past-30-day alcohol and marijuana co-use.

Demographic variables.—Students were asked to report their grade level and gender. They also were asked to report their ethnicity (Hispanic/Latinx) and race (American Indian or Alaska Native, Asian, Black or African-American, Native Hawaiian or Pacific Islander, White, Multi-racial). An “Unknown” race variable was created for students who reported

their ethnicity but not race. All race groups were non-Hispanic. The demographic measures were coded as dummy variables with the following referent groups: 7th graders, males, non-Hispanic/Latinx, and non-Hispanic white students. Survey year was coded 1–9 based on year of data collection and was included to account for the secular trend in alcohol and marijuana co-use.

Urban/rural context.—The most recent (2013) Rural Urban Continuum Code (RUCC) for each of the 58 California counties was used to represent the urban/rural context of schools.[28] The RUCC ranges from 1 (metropolitan areas with at least 1 million population) to 9 (completely rural or less than 2,500 urban population).

Legalization.—RML was coded 0 for the seven school years up to and including the year when RML went into effect on November 9, 2016 (2010–11 to 2016–17) and coded 1 for the two school years after RML (2017–18 and 2018–19).

Data Analysis

Descriptive statistics were examined for the total sample and subgroups that reported past-30-day non-heavy alcohol use, heavy alcohol use, and marijuana use. Multi-level logistic regressions were conducted to assess changes in alcohol and marijuana co-use after RML for the total sample and the three subgroups, controlling for demographics, the secular trend (school year), and urban/rural context. Multi-level linear regression analyses were conducted with past-30-day alcohol and marijuana co-users to examine the association between RML and past-30-day frequency of alcohol use, heavy drinking, and marijuana use with the same covariates. Analyses were conducted in HLM version 8.0 software to account for the non-independence of observations nested within schools, school districts, and counties.[29] Sample weights were applied in all analyses.

Results

Sample Characteristics

About eight percent of students in the total sample reported past-30-day co-use of alcohol and marijuana over the study period, while 31.6% of non-heavy drinkers, 67.8% of heavy drinkers, and almost 70% of marijuana users reported past-30-day co-use (Table 1). Demographic characteristics of students also differed among the three subgroups, with higher percentages of 11th graders and Hispanic students and lower percentages of Asian students in the three subgroups. The majority of students in the total sample and the three subgroups lived in large metropolitan areas in California.

Multi-Level Regression Analyses

Results of multi-level logistic regression analyses (Table 2) indicate that RML was associated with a six percent increase in the odds of alcohol and marijuana co-use among adolescents in the total sample when controlling for the secular trend, student demographic characteristics, and urban/rural context. Greater odds of co-use were observed among Hispanic relative to non-Hispanic students and among American Indian/Alaska Native (AIAN), Black, and Multi-racial students relative to whites. Lower odds of co-use were

observed among Native Hawaiian/Pacific Islander (NHPI) and Asian students. Trends in the prevalence of alcohol and marijuana co-use are shown in Figure 1.

Non-heavy drinkers.—Among students who reported any past-30-day alcohol use, but not heavy drinking, there was a 58% increase in the likelihood of alcohol and marijuana co-use after RML (Figure 1). Hispanic ethnicity was positively related to co-use, and compared to the total sample, there were stronger positive associations between RML and co-use for students who were AIAN, Black, NHPI, Multi-racial, or of unknown race relative to whites.

Heavy drinkers.—There was a 25% greater likelihood of alcohol and marijuana co-use after RML among students who reported any past-30-day heavy drinking (Figure 1). Greater odds of co-use were observed for Hispanic relative to non-Hispanic students and among AIAN, Black, NHPI, Multi-racial and unknown racial groups relative to whites. Lower odds of co-use were observed for Asian students.

Marijuana users.—Among past-30-day marijuana users, there was a 24% reduction in the likelihood of alcohol and marijuana co-use after RML (Figure 1). Female gender and being in 11^{th} grade were positively related to co-use in this subgroup. In contrast to the total sample, Hispanic ethnicity, Black, Multi-racial and unknown race categories were inversely associated with co-use relative to whites.

Alcohol and marijuana co-users.—Multi-level linear regression analyses with the subgroup of past-30-day alcohol and marijuana co-users indicated no significant changes in the frequency of past-30-day alcohol use or heavy drinking after RML (Table 3). However, there was a significant increase in the frequency of past-30-day marijuana use [beta (SE) = 0.36 (.07), $p < .001$]. These trends are shown in Appendix Figure 1. More frequent alcohol use and heavy drinking were reported by Hispanic relative to non-Hispanic students and among AIAN, Asian, Black, NHPI and Multi-racial students relative to whites. More frequent marijuana use was observed among AIAN, Black, and Multi-racial students relative to whites.

Discussion

The prevalence of past-30-day alcohol and marijuana co-use among California adolescents was higher after RML in 2016 than would be expected given the downward secular trend in co-use before RML. Consistent with expectations, the increase in co-use was more pronounced among adolescents who reported any past-30-day alcohol use and heavy drinking, possibly reflecting elevated risk for marijuana use after RML among these youth. These findings may also reflect an increase in complementary use of alcohol and marijuana after RML among adolescents who are regular drinkers. In contrast, the prevalence of co-use decreased significantly among past-30-day marijuana users, which may reflect the substantial decline in alcohol use among adolescents in recent decades[6], or a substitution of marijuana for alcohol.

Ethnic/racial differences in the likelihood of alcohol and marijuana co-use were observed for the total sample of adolescents and the three subgroups of past-30-day alcohol users,

heavy drinkers, and marijuana users. In the total sample, Hispanic, AIAN, Black, and Multi-racial youth were at elevated risk for co-use compared to non-Hispanic and white youth, respectively, while Asian and NHPI youth were at lower risk. The likelihood of co-use was even greater among AIAN, Black, NHPI and Multi-racial youth who reported past-30-day alcohol use or heavy drinking. These disparities are concerning and may reflect greater availability of both legal and illegal marijuana in economically disadvantaged communities in California.[30–32]

Study findings indicate a significant increase in the frequency of marijuana use, but not alcohol use and heavy drinking, after RML among adolescents who reported past-30-day co-use. These results are consistent with a previous study showing an overall increase in the prevalence of marijuana use among California adolescents and substantial increases in marijuana use frequency in the past 30 days among regular marijuana users.[10] While some research indicates that perceived availability of marijuana from retail and social sources and norms favorable to marijuana use have increased in the adolescent population after RML,[11] this study suggests that RML may be contributing to more frequent use among youth who also engage in alcohol use or heavy drinking. This increase also coincides with recent rises in electronic vaping of tobacco and marijuana products among adolescents in the U.S.[33]

Among co-users there were significant ethnic/racial subgroup differences in the frequency of past-30-day alcohol and marijuana use. For example, Hispanic, AIAN, Asian, Black, NHPI, and Multi-racial adolescents reported more frequent alcohol use than non-Hispanic and white youth, respectively. AIAN, Black, and Multi-racial youth also reported more frequent marijuana use than whites. These differences suggest that adolescents in ethnic and racial minority groups who use both alcohol and marijuana may be at elevated risk for problems related to alcohol and marijuana co-use.

Limitations

Study findings should be considered in light of some limitations. The CHKS sample of 7th, 9th, and 11th graders may not be representative of all adolescents in California, and non-response to survey questions may have introduced bias. Responses to survey questions about alcohol and marijuana use may be subject to social desirability and recall biases. The measures for past-30-day frequency of alcohol and marijuana use were not true interval measures, and may not accurately reflect the absolute frequency of these behaviors. Additionally, there may be other historical changes not considered in this study that might account for the association between RML and alcohol and marijuana co-use.

Conclusions

RML may be increasing the risk of alcohol and marijuana co-use among California adolescents, particularly among youth who regularly engage in alcohol use or heavy drinking. Findings also indicate disparities in alcohol and marijuana co-use among adolescents in some ethnic and racial minority groups, which may be attributable to greater availability of marijuana in economically disadvantaged communities.[30–32]

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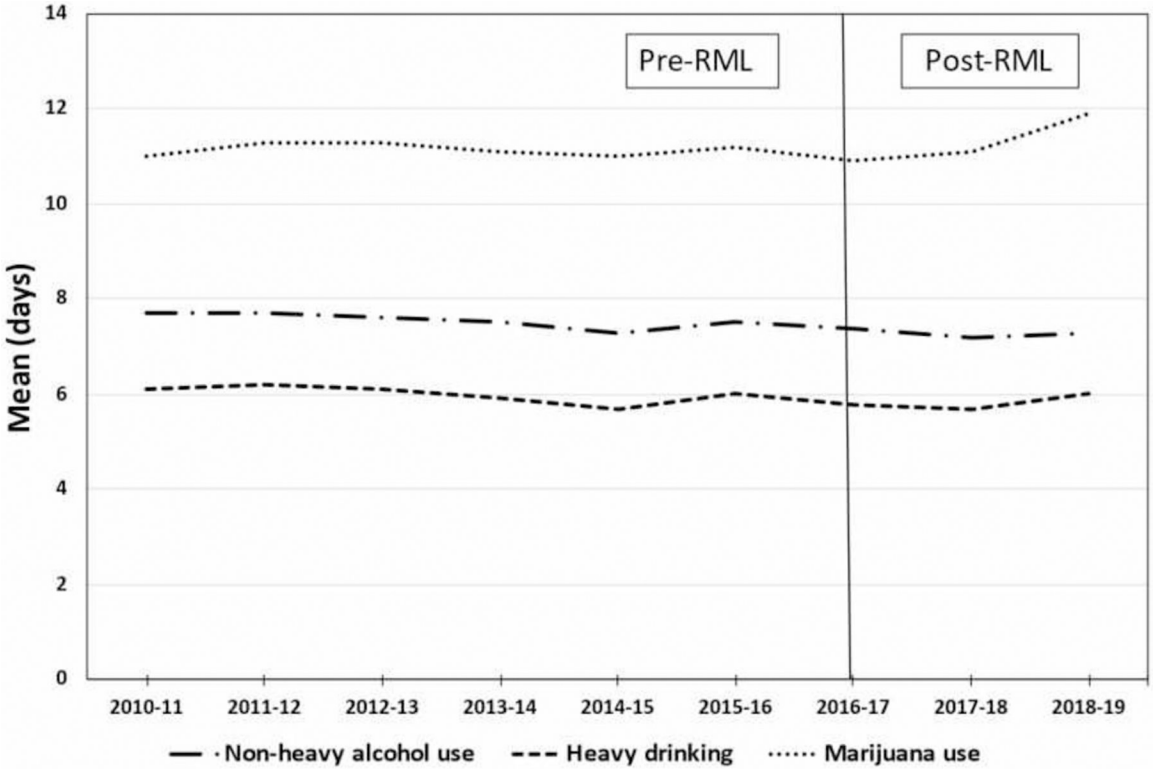
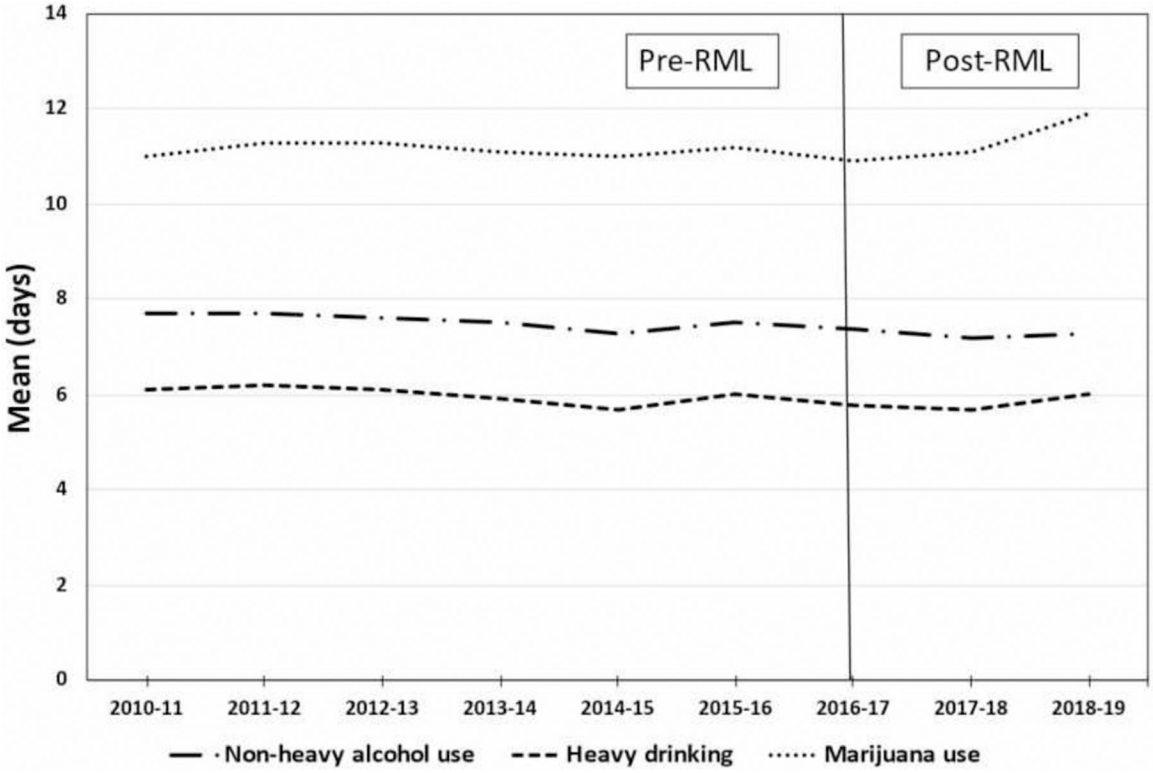


Appendix Figure 1.

Trends in past-30-day frequency of alcohol use, heavy drinking, and marijuana use among alcohol and marijuana co-users.



Appendix Figure 1.
Trends in past-30-day frequency of alcohol use, heavy drinking, and marijuana use among alcohol and marijuana co-users.

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Implications

This study indicates the need for efforts to prevent or reduce alcohol and marijuana co-use among adolescents where adult recreational marijuana use and retail sales are legal. Greater local restrictions on numbers of licensed alcohol and marijuana retail outlets, hours of operation and advertising, and higher taxes on alcohol and marijuana products may help to reduce both retail and social availability of these substances.

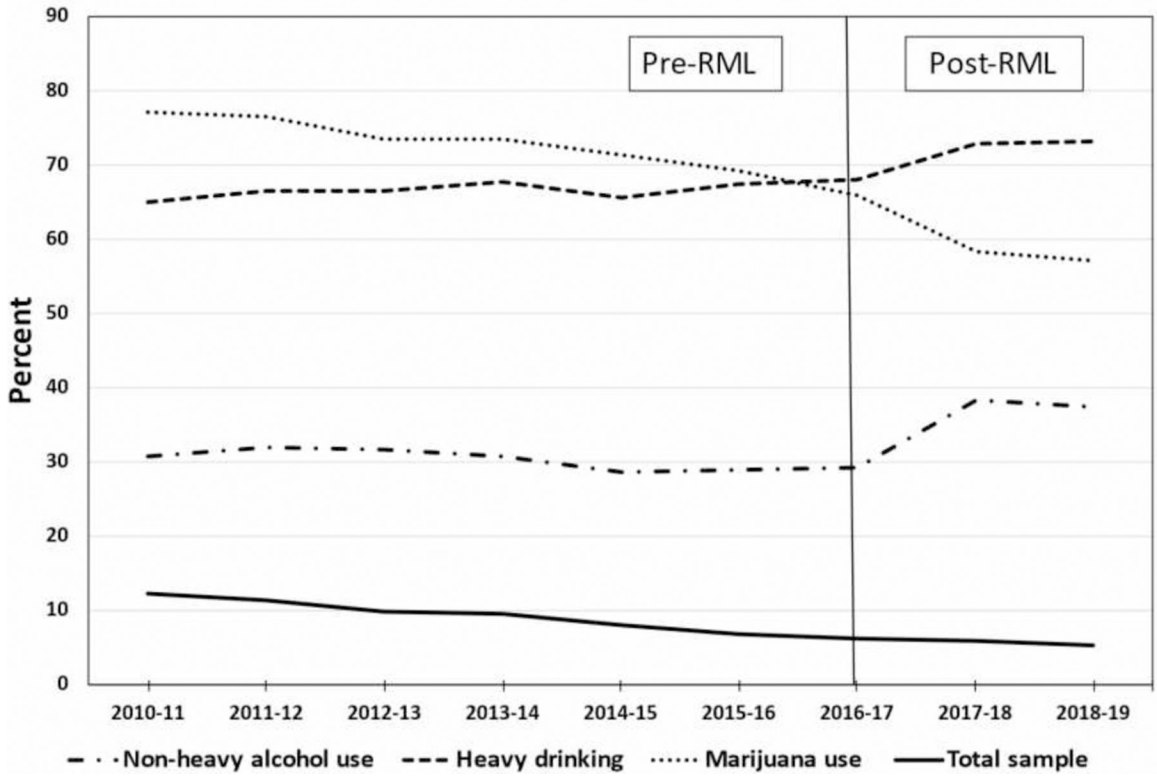

Figure 1.

Trends in the percentage of adolescents who reported both alcohol and marijuana use in the past 30 days for the total CHKS sample and for subgroups who engaged in past-30-day non-heavy alcohol use, heavy drinking, and marijuana use.

Table 1.

Sample characteristics, percent

Variable	Total Sample (N=3,319,329)	Non-heavy drinkers (n=251,835)[a]	Heavy drinkers (n=281,938)[a]	Marijuana Users (n=386,116)[a]
Past-30-day alcohol and marijuana co-use	8.1	31.6	67.8	69.7
Past-30-day non-heavy drinking	7.5	100.0	0.0	20.4
Past-30-day heavy drinking	8.4	0.0	100.0	49.3
Past-30-day marijuana use	11.6	31.6	67.8	100.0
Grade 7	34.0	19.7	11.0	12.1
Grade 9	34.9	37.0	33.4	36.2
Grade 11	31.1	43.3	55.6	51.7
Female	48.5	56.4	46.5	45.1
Hispanic	52.8	60.2	58.6	59.5
American Indian/Alaska Native	3.0	3.5	4.1	4.0
Asian	12.3	6.1	4.9	4.6
Black	7.0	6.1	7.2	9.7
Native Hawaiian/Pacific Islander	0.9	0.9	1.2	1.2
White	31.9	32.7	34.7	30.8
Multi-racial	32.3	35.1	33.6	35.7
Unknown race	0.7	0.6	0.7	0.7
Urban/rural context				
≥ 1 million population	71.7	69.5	67.9	68.6
250K – 1M population	21.9	23.0	23.2	23.5
Metro (< 250K pop.)	3.7	4.2	4.8	4.2
Nonmetro (≥ 20K pop.)	1.3	1.7	2.2	1.9
Nonmetro (<20K pop.)	1.3	1.5	2.0	1.7

Note: Percentages are weighted whereas sample (N) and subsample (n) sizes are unweighted.

[a]The two subgroups of past-30-day drinkers are mutually exclusive, but these subgroups overlap with past-30-day marijuana users

Table 2.

Results of multi-level logistic regression analyses, odds ratio (95% confidence interval)

Variable	Total Sample (N=3,319,329)	Non-heavy drinkers (n=251,835)	Heavy drinkers (n=281,938)	Marijuana Users (n=386,116)
Student level [a]				
Pre-post RML [b]	**1.06 (1.05, 1.07)**	**1.58 (1.54, 1.62)**	**1.25 (1.21, 1.29)**	**0.76 (0.74, 0.78)**
Grade 11	**5.64 (5.60, 5.68)**	**2.32 (2.28, 2.36)**	**0.97 (0.93, 1.01)**	**1.21 (1.19, 1.23)**
Grade 9	**3.10 (3.06, 3.13)**	**1.93 (1.90, 1.97)**	**1.09 (1.05, 1.13)**	**1.02 (1.00, 1.04)**
Female	**0.90 (0.89, 0.90)**	**0.78 (0.76, 0.80)**	**0.66 (0.65, 0.68)**	**1.17 (1.16, 1.19)**
Hispanic	**1.20 (1.19, 1.21)**	**1.23 (1.21, 1.25)**	**1.14 (1.12, 1.16)**	**0.84 (0.82, 0.86)**
American Indian/ Alaska Native	**1.49 (1.45, 1.53)**	**1.60 (1.50, 1.70)**	**1.55 (1.47, 1.63)**	0.96 (0.90, 1.01)
Asian	**0.31 (0.29, 0.33)**	**0.67 (0.63, 0.71)**	**0.83 (0.79, 0.87)**	**0.76 (0.72, 0.79)**
Black	**1.12 (1.10, 1.14)**	**2.48 (2.43, 2.54)**	**2.08 (2.02, 2.13)**	**0.53 (0.49, 0.57)**
Native Hawaiian/ Pacific Islander	**0.90 (0.87, 0.94)**	**1.20 (1.12, 1.28)**	**1.21 (1.13, 1.29)**	**0.76 (0.70, 0.81)**
Multi-racial	**1.10 (1.08, 1.11)**	**1.39 (1.35, 1.43)**	**1.25 (1.21, 1.29)**	**0.73 (0.71, 0.75)**
Unknown race	0.96 (0.92, 1.00)	**1.26 (1.18, 1.34)**	**1.12 (1.04, 1.19)**	**0.84 (0.78, 0.90)**
School year	**0.88 (0.87, 0.89)**	**0.98 (0.97, 0.99)**	1.01 (1.00, 1.02)	**0.91 (0.90, 0.92)**
County level				
Rurality	**1.09 (1.05, 1.13)**	1.00 (0.96, 1.04)	**0.96 (0.94, 0.98)**	1.02 (0.98, 1.06)

Note: RML – recreational marijuana legalization. Significant results are indicated in boldface ($p < .01$).

[a] Referent groups are 7th graders, males, non-Hispanic students, and non-Hispanic white students.

[b] Pre-post RML is a dummy variable coded 0 for pre-RML years (2010–11 to 2016–17) and 1 for post-RML years (2017–18 to 2018–19).

Table 3.

Results of multi-level linear regression analyses among co-users (n=269,443), beta (standard error)

Variable	Alcohol use	Heavy drinking	Marijuana use
Student level [a]			
Pre-post RML [b]	−0.02 (.06)	0.05 (.06)	**0.36 (.07)****
Grade 11	**−1.10 (.06)****	**−0.99 (.07)****	0.98 (.09)
Grade 9	**−0.59 (.07)****	**−0.60 (.07)****	0.74 (.09)
Female	**2.02 (.03)****	**−2.37 (.03)****	**−3.33 (.04)****
Hispanic	**0.39 (.04)****	**0.44 (.04)****	0.01 (.05)
American Indian/Alaska Native	**1.44 (.15)****	**1.49 (.15)****	**1.21 (.17)****
Asian	**0.88 (.09)****	**0.95 (.09)****	**−0.86 (.11)****
Black	**1.30 (.09)****	**1.27 (.09)****	**1.50 (.10)****
Native Hawaiian/Pacific Islander	**0.78 (.14)****	**0.76 (.13)****	0.05 (.16)
Multi-racial	**0.27 (.06)****	**0.27 (.06)****	**0.67 (.07)****
Unknown race	**1.01 (.15)****	**1.10 (.15)****	**0.21 (.17)***
School year	**−0.05 (.01)****	**−0.05 (.01)****	−0.01 (.01)
County level			
Rurality	**0.08 (.04)***	**0.11 (.04)***	**0.33 (.06)****

Note: RML – recreational marijuana legalization. Significant results are indicated in boldface (*$p < .05$, **$p < .01$).

[a] Referent groups are 7th graders, males, non-Hispanic students, and non-Hispanic white students.

[b] Pre-post RML is a dummy variable coded 0 for pre-RML years (2010–11 to 2016–17) and 1 for post-RML years (2017–18 to 2018–19).