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## Self-reported exposure to, perceptions about, and attitudes about public marijuana smoking among US adults, 2018

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### Abstract

**Background and Aims**—Eleven US states and the District of Columbia have legalized the non-medical use of marijuana. Public marijuana smoking is generally prohibited, although some states have considered exemptions. This study assessed attitudes about public marijuana smoking, perceptions of harm from marijuana second-hand smoke (SHS) and self-reported marijuana SHS exposure.

**Design**—Internet panel survey fielded in June–July 2018.

**Setting**—United States.

**Participants**—US adults aged ≥ 18 years ( $n = 4088$ ).

**Measurements**—Current (past-30 day) tobacco product use, current marijuana use, opinions about public indoor marijuana smoking, perceptions of harm from marijuana SHS and self-reported past-7 day exposure to marijuana SHS in public indoor or outdoor areas were assessed. Weighted prevalence estimates were computed and correlates were assessed using logistic and multinomial regression.

**Findings**—Overall, 27.4% [95% confidence interval (CI) = 25.7, 29.1] of adults reported past-week marijuana SHS exposure in indoor and/or outdoor public areas; younger adults, blacks, Hispanics, those in the Northeast or West, and current marijuana and/or tobacco users were more commonly exposed ( $P_s < 0.0001$ ). More than half of adults (52.4%; 95% CI = 50.7, 54.2) regarded marijuana SHS as harmful, and most (81.0%; 95% CI = 79.5, 82.4) opposed public marijuana smoking. Correlates of favoring public marijuana smoking included being male, younger ( $P_s < 0.01$ ), black or Hispanic, past-month tobacco and/or marijuana users and perceiving no/low harm from marijuana SHS ( $P_s < 0.0001$ ).

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Declaration of interests

None.

**Conclusion**—While one in four US adults report recent marijuana second-hand smoke exposure, a majority believe marijuana second-hand smoke is harmful and most oppose public marijuana smoking.

### Keywords

Cannabis; marijuana; public attitudes; public exposure; public policy; second-hand smoke; smoke-free

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## INTRODUCTION

As of 31 July 2019, 11 US states, the District of Columbia and the Northern Mariana Islands (a US Territory) had legalized non-medical use of marijuana, also called cannabis [1]. Ten of these states also have a planned or established state-based market-place where marijuana is cultivated, distributed, processed and can be sold to and consumed by any adult age 21 years and over [2]. As of July, 2019, the state of Alaska is currently the only state with rules in place to allow for combusted marijuana consumption in specific public places [3]. Those rules allow for people to smoke or consume cannabis at retail cannabis locations, provided they have secured the appropriate retail license [4]. In May 2019, the governor of Colorado signed legislation into law allowing ‘marijuana hospitality establishments’ or social use spaces, including smoking lounges [5]. Emergency rules released in Michigan also create a specific license for marijuana consumption establishments [6].

While no other state-wide policies exist legalizing any on-site or public smoking of marijuana [2], some states (e.g. California and Illinois) leave the decision up to localities. Policy exceptions that have been considered at the local level have typically included legalizing combusted marijuana smoking in various public spaces—typically with an age restriction of 21 years and older, and pursuant to a specific license or permit allowing for marijuana use [7,8]. States and municipalities have also considered, or are actively considering, permits for restaurant or café-style lounges where individuals would be allowed to smoke and/or vape cannabis [9–11], in addition to temporary event permits or licenses that would allow for cannabis consumption (including smoking and/or vaping) at fair-grounds, concerts, festivals and/or in other event spaces [9,12,13]. For example, prior to state-wide legalization of marijuana consumption establishments, the city of Denver had established procedures for businesses to seek approval to allow cannabis vaping and edibles consumption indoors and combustible marijuana smoking outdoors (obscured from view) in licensed cannabis consumption establishments, provided that the establishments did not sell the products being consumed (or sell tobacco or alcohol products), were only open to people aged 21 years and older, and met other licensing criteria [14]. Other countries, such as Canada, have also legalized marijuana and are considering allowing public or onsite consumption [1,2].

These policies have unknown public health implications. While the long-term health effects of exposure to marijuana SHS remain unclear [15], evidence suggests that burning any plant material releases toxic chemicals and emissions that can go deep into the lungs, impairing blood vessel function, increasing the risk of cardiovascular disease and

exacerbating heart and lung disease [16–18]. Furthermore, studies suggest that marijuana smoke contains many of the same constituents as tobacco smoke, and some in higher concentrations (e.g. tar, ammonia and hydrogen cyanide) [19]. A recent study in rats found that second-hand marijuana smoke exposure impairs endothelial function and vasodilation, and that these effects occurred even when marijuana does not contain cannabinoids [such as tetrahydrocannabinol (THC) and cannabidiol (CBD)] or is consumed without a rolling paper [20]. The study found that brief exposure to marijuana SHS impairs endothelial function longer than brief exposure to second-hand tobacco smoke [20]. Furthermore, a World Health Organization review of the health effects of cannabis concluded that evidence suggests that marijuana smoke is carcinogenic [21] and, in 2009, the California Office of Environmental Health Hazard Assessment added marijuana smoke to its list of carcinogens, noting at least 33 individual constituents present in both marijuana and tobacco smoke that have been classified as carcinogenic [22].

In addition, because it can be challenging to tell what substance(s) people are smoking or vaping, policies making it legal to smoke or vape marijuana in specific locations could complicate the enforcement of existing clean indoor air policies related to tobacco. While the health effects from marijuana SHS are not yet well understood [15], the deleterious health effects from exposure to tobacco SHS are well documented, and include cancer, heart attack and other cardiovascular effects, respiratory effects and reproductive health effects [23,24]. As more became known about the adverse health effects of exposure to tobacco SHS, states and communities began to adopt comprehensive smoke-free laws in the 1990s and 2000s [23–26]. These laws protect employees and the public by prohibiting smoking tobacco in all indoor areas of work-places, restaurants and bars [23–26].

The public is now well informed about the harms from tobacco SHS and the benefits of smoke-free policies [23]. However, less is known about prevalence and correlates of public exposure to marijuana SHS, public perceptions of the harms of marijuana SHS or opinions about public marijuana smoking. In light of recent changes in state laws and increased legislative and regulatory activity related to public consumption of marijuana, this study aimed to assess (1) self-reported public exposure to marijuana SHS in the United States, (2) public perceptions of the harms of marijuana SHS and (3) public opinions about indoor marijuana smoking in public spaces.

## METHODS

### Sample

Data came from *SummerStyles*, an internet panel of 4088 US adults aged 18 years fielded by Porter Novelli in June–July 2018. Panel respondents come from the KnowledgePanel<sup>®</sup>, which uses address-based probability sampling to recruit participants randomly by mail, regardless of whether they have landline telephones or access to the internet. Households that need it are provided with a laptop or tablet and internet access. The response rate for *SummerStyles* 2018 was 73.2%. Data were weighted to match US Current Populations Survey proportions on 79 demographic variables: sex, age, race/ethnicity, household income, household size, education, census region, metropolitan areas and internet access. In the final weighted sample, 51.7% were females; 11.8% were aged 18–24 years, 17.9% were

aged 25–34, 50.4% were aged 35–64 and 20.1% were aged 65 and older; 64.1% were white, non-Hispanic (NH), 11.8% were black, NH, 7.0% were other, NH, 15.8% were Hispanic and 1.3% were multi-racial, NH; 15.0% had a household income of < \$25 K; and 11.1% had less than high school education, 28.9% had equal to high school, 28.5% had some college and 31.5% had a Bachelor's degree or higher. More details about the methodology can be found else-where [27].

## Measures

All respondents were asked: 'During the past 7 days, did you smell smoke from someone who was smoking marijuana products in an indoor or outdoor public place?', with response options: 'yes, in an indoor public place only', 'yes, in an outdoor public place only', 'yes, in indoor and outdoor public places', 'no' and 'don't know/not sure'. For descriptive analyses, responses were collapsed into three mutually exclusive categories: 'yes, indoor OR outdoor', 'yes, indoor AND outdoor' and 'no', and for multivariable analyses, responses were collapsed into 'yes' (reported exposure) versus 'no'. People who reported 'don't know/not sure' were excluded from these analyses ( $n = 240$ , 5.8% of the total sample), because of challenges in interpreting that response. People who refused to respond were also excluded ( $n = 20$ ).

Respondents were also asked about the perceived harm of marijuana second-hand smoke: 'How harmful do you believe it is to be exposed to second-hand smoke from someone else who is smoking marijuana?'. Response options included: 'not at all harmful', 'a little bit harmful', 'harmful', 'very harmful' and 'don't know/not sure'. To stabilize estimates for multivariable analyses and to facilitate data interpretation, responses were collapsed into: 'not at all/a little bit harmful', 'harmful/very harmful' and 'don't know/not sure'.

Respondents were asked about their opinions of public marijuana smoking: 'Do you favor or oppose allowing people to smoke marijuana or cannabis in indoor areas of public places such as workplaces, restaurants, and bars?'. Response options included: 'strongly favor', 'somewhat favor', 'somewhat oppose' and 'strongly opposed'. For these analyses, we dichotomized responses to: 'strongly/somewhat favor' and 'strongly/somewhat oppose'.

Respondents were asked about current (past-30 day) tobacco product use (including any past month use of cigarettes, cigars, electronic vapor products, smokeless tobacco, pipes, water pipes/hookah or some other tobacco product) and current use of marijuana or cannabis. These two questions were used to create a variable for co-use of both tobacco and marijuana in the past month, identifying those who used both substances, those who used only tobacco, those who used only marijuana and those who used neither.

The following demographic variables are included in these analyses: sex, age (18–29 years, 30–44, 45–59, 60+), race/ethnicity (white, NH; black, NH; other, NH; and Hispanic), education (less than high school, high school, some college and Bachelor's degree or higher) and region of the country (Northeast, Midwest, South and West).

## Analysis

Weighted prevalence estimates were computed for each of the three questions regarding marijuana smoking (e.g. exposure, perceived harm and opinions) overall and across demographic and substance use variables. Weighted logistic regression was used to assess correlates of past 7-day (past-week) exposure to marijuana smoking and correlates of favoring versus opposing public marijuana smoking. Weighted multinomial regression was used to assess correlates of perceptions of harm from marijuana secondhand smoke, respectively. All demographic variables were included in multivariable and multinomial regressions; no model selection processes were utilized. Significance was assessed for all models using Wald test statistics with a  $P$ -value  $< 0.05$  and by assessing non-overlapping confidence intervals (CIs). Additionally, this study's research questions were not pre-registered on a publicly available platform, and the results should be considered exploratory.

## RESULTS

### Demographic and substance use characteristics

Overall, 17.6% of respondents reported use of a tobacco product in the past 30 days (cigarettes, cigars, electronic vapor products, smokeless tobacco, pipes filled with tobacco, water pipes or hookahs filled with tobacco or some other tobacco product), 11.3% were current cigarette smokers, 10.9% reported past 30-day marijuana use and 4.6% reported past 30-day use of both tobacco and marijuana.

### Past-week self-reported marijuana SHS exposure by demographic characteristics

Overall, 18.9% of respondents reported past-week exposure to outdoor marijuana SHS, 8.5% reported exposure to both indoor and outdoor marijuana SHS (for a total of 27.4% [95% confidence interval (CI) = 25.7, 29.1] reporting exposure to indoor and/or outdoor marijuana SHS); 72.6% reported no exposure (Table 1). The prevalence of past-week exposure was similar by sex and education. By age, individuals aged 60 years and older had a lower prevalence of reported past-week outdoor-only marijuana SHS exposure, and young adults aged 18–29 years had a higher prevalence of both indoor and outdoor reported exposure, compared with all other age groups (Table 1). Compared to whites, a higher percentage of Hispanics and people of other, NH race/ethnicity reported past-week outdoor-only marijuana SHS exposure, and a higher percentage of blacks and Hispanics reported both indoor and outdoor exposure. Adults residing in the Northeast and West regions of the United States reported a higher prevalence of both outdoor-only and indoor and outdoor marijuana SHS exposure compared with other regions. Past 30-day marijuana-only users and past 30-day tobacco and marijuana co-users reported higher percentages of outdoor-only and outdoor and indoor marijuana SHS exposure, compared to adults with no past month tobacco or marijuana use (Table 1).

### Perceived marijuana SHS harm by demographic characteristics

Overall, 32.0% of the sample perceived marijuana SHS to have no or a little harm (12.3% reported perceiving no harm and 22.7% reported perceiving only a little harm), 52.4% perceived marijuana SHS to be harmful or very harmful and 15.6% said they did not know

about the harm of marijuana SHS (Table 1). Perceptions of harm were generally similar by sex, race/ethnicity, education and region. With regard to age, young adults aged 18–29 years had a higher prevalence of perceiving no or a little harm from marijuana SHS exposure compared with those aged 45–59 and 60 years and older. Past 30-day marijuana-only users, tobacco-only users and marijuana and tobacco co-users all had a higher prevalence of perceiving no or a little harm from marijuana SHS, compared to those not using marijuana and/or tobacco (Table 1).

### **Opinion about indoor marijuana smoking by demographic characteristics**

Overall, 19.0% of the sample strongly or somewhat favored and 81.0% strongly or somewhat opposed allowing people to smoke marijuana in indoor public places (Table 1). Males had a higher prevalence of strongly/somewhat favor, compared with females; adults aged 60 years and over had a lower prevalence of strongly/somewhat favor, compared with all other age groups. By race/ethnicity, blacks and Hispanics had a higher prevalence of strongly/somewhat favor compared with whites. By education, those with a Bachelor's degree or higher had a lower prevalence of strongly/somewhat favor, compared with those with less than or equal to a high school education. There were no differences by region. Past 30-day marijuana-only users, tobacco-only users and marijuana and tobacco co-users all had a higher prevalence of strongly or somewhat favoring indoor public marijuana smoking, compared to those not using marijuana and/or tobacco.

### **Multivariable regression assessing correlates of self-reported exposure to marijuana second-hand smoke**

In a binary logistic regression model, significant correlates of self-reported exposure to marijuana SHS exposure (versus no exposure) included being younger in age, being black or Hispanic, residing in the Northeast or West and having past 30-day use of tobacco, marijuana or both (Table 2).

### **Multinomial regression assessing correlates of perceived harm from marijuana SHS**

In a multinomial regression model, significant correlates of perceiving no/little harm from marijuana SHS (versus perceiving harm) included: being male, being younger in age; and having past 30-day use of tobacco-only, marijuana-only or co-use of both tobacco and marijuana. Significant correlates of not knowing the harms of marijuana SHS (versus perceiving harm) included having less than or a high school education, and having past 30-day use of tobacco-only, marijuana-only or co-use of both tobacco and marijuana (Table 3).

### **Multivariable regression assessing correlates of favoring or opposing public marijuana smoking**

In a binary logistic regression model assessing demographic and substance use correlates of strongly or somewhat favoring (versus strongly or somewhat opposing) public marijuana smoking, males had a higher odds of favoring public marijuana smoking (versus females), as did younger age groups (versus those aged 60 years and older), blacks (versus whites), those with less than or a high school education (versus those with a Bachelor's degree or



higher) and those with past 30-day use of tobacco-only, marijuana-only or co-use of tobacco and marijuana (Table 4). Adjusting for demographic and substance use variables, individuals who perceived no or a little harm from marijuana SHS had 7.4 times the odds (95% CI = 5.6, 9.8) of favoring public marijuana smoking compared with those who perceived harm, and individuals who did not know about the harm of marijuana SHS had 3.7 times the odds (95% CI = 2.6, 5.1) of favoring public marijuana smoking. Self-reported exposure to marijuana SHS had no association with opinions about favoring or opposing public marijuana smoking.

**Conclusions**—This is the first national study, to our knowledge, to assess US adults' self-reported exposure to, perceptions about, and opinions concerning marijuana SHS. One of the most important findings from this study is that while adults over-whelmingly reported opposing indoor public marijuana smoking, and more than half of adults perceived marijuana second-hand smoke to be harmful, approximately a quarter of adults reported being exposed in the past week to marijuana SHS in outdoor and/or indoor public places (and nearly one of every six adults with no marijuana or tobacco use was exposed). Findings from this study can be used to inform public education and prevention programs related to marijuana SHS.

With regard to self-reported past-week exposure to marijuana SHS in outdoor and/or indoor public places, differences in exposure existed by age, race and region. In particular, young adults aged 18–29 years had more than six times the odds of reporting being exposed to marijuana SHS in both indoor and outdoor environments compared to those age 60 years and older. The prevalence of marijuana use is significantly higher among young adults [28], which might explain their disproportionate exposure. In addition, blacks had two times the odds, and Hispanics had nearly two times the odds of reporting marijuana SHS exposure, compared to whites. More research is warranted to understand why this disparity exists, given that the prevalence of past-month marijuana use has not been shown nationally to be substantially higher among blacks compared to whites [29]. Regional differences were also found, with those in the Northeast and Western United States reporting higher odds of exposure. These findings are not unexpected, considering that most of the states that have legalized the use and sale of non-medical marijuana are in the West (Alaska, California, Colorado, Nevada, Oregon and Washington) or East (Massachusetts, Maine, Vermont, District of Columbia). Finally, tobacco-only users, marijuana-only users and co-users were all more likely to report being exposed to marijuana SHS in indoor and outdoor spaces. The fact that tobacco only users had higher odds of exposure to marijuana SHS than non-tobacco users may be indicative of the overlap in tobacco and marijuana use among adults [30].

This study also found that more than half of adults (52.4%) perceived marijuana SHS to be harmful/very harmful and 15.6% reported they did not know about harm. These results were similar among different subgroups for sex, age, race, education level and region. The current science supports the 'don't know/not sure' response in this case, as little definitive research is available on the health effects of marijuana SHS [15,20,21]. However, while we do not know the exact short- and long-term harms caused by marijuana SHS, current science is also sufficient to suggest that there are probably some associated harms, and that these harms may parallel some of those seen from tobacco SHS [9–12]. Importantly, nearly half of

tobacco-only users (42.9%), more than two-thirds of marijuana-only users and three-quarters of users of both marijuana and tobacco (75%) believed marijuana smoke was not harmful or only a little harmful. These findings suggest that public health efforts to educate marijuana and tobacco users and the general public about what we know and continue to learn related to the health risks of exposure to marijuana SHS may be warranted.

With regard to favoring or opposing marijuana smoking in indoor public places, a majority of adults reported opposition regardless of sex, age, race, education level and region. The only subgroups with majority support for indoor marijuana smoking were adults who reported past 30-day use of both marijuana and tobacco (66.3%). Notably, half of marijuana-only users and almost three-quarters of tobacco-only users strongly or somewhat oppose public indoor marijuana smoking. However, an important caveat is that the question asked broadly about indoor public smoking in restaurants, work-places and bars. Current state and local policies, as well as policies under discussion, allow for marijuana smoking in specific areas or types of businesses (not, for example, in all work-places, restaurants, or bars) [1,2]. Nevertheless, these findings could inform US states and jurisdictions as well as other countries, such as Canada, considering public and on-site marijuana consumption policies.

This study is subject to some limitations. First, *SummerStyles* is a web-based survey and may be subject to coverage and non-response bias. However, data are weighted to match key demographics of the national population. Secondly, data were self-reported and not biochemically verified, which could result in misreporting of product use behaviors and reported exposure to marijuana smoke. Thirdly, the cross-sectional design of *Styles* precluded establishing any causal relationships between the assessed covariates and attitudes toward marijuana smoking indoors. Fourthly, assessment of exposure to second-hand marijuana smoke was subjective, and based on olfactory sense. Finally, *SummerStyles* data cannot be analyzed by state, and it is therefore not possible to assess differences based on state legal status of marijuana. While differences in attitudes and beliefs could exist among states with and without medical and non-medical marijuana use laws, at the regional level, findings showed minimal differences for perceived harm and favorability and significant differences among self-reported exposure by region. Exploration of these constructs at a state level is warranted.

Findings from this study have implications for all countries and US states, including those that have not legalized marijuana for non-medical adult use. Despite a dearth in research about the precise effects of marijuana SHS, these data suggest that some populations may be disproportionately exposed. While more research is needed to understand the acute and long-term effects of marijuana SHS exposure, data suggest that the smoke contains toxicants and can be harmful [19,20,31]. Following a precautionary principle [32], public health efforts to minimize exposure and eliminate disparities in exposure are warranted. Further, this study demonstrates an opportunity to raise awareness about the potential health effects of secondhand marijuana smoke, considering that 32% of adults and 75% of marijuana and tobacco users believe that marijuana second-hand smoke is not harmful or is a little harmful. Finally, state-level surveillance about marijuana SHS exposure, perceptions of harm, and



opinions may be warranted to more effectively guide states' efforts to educate the public and to provide a baseline for monitoring changes that may occur in the face of changing policies.

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**Table 1**

Frequencies of past 7 day self-reported exposure to marijuana (MJ) smoke, perceiving harm from secondhand MJ smoke, and favoring or opposing public MJ smoking, respectively, by demographics and substance use behaviors

Variable	Q1: Past 7 Day MJ Secondhand Smoke (SHS) Exposure <sup>a</sup> N=5,827		Q2: Perceived Harm From MJ SHS <sup>b</sup> N=4,068		Q3: Favor or Oppose Indoor MJ Smoking <sup>c</sup> N=4,071			
	Outdoor only OR indoor only exposure	Indoor and Outdoor Exposure	Not exposed	Not/A little Harmful	Harmful/Very Harmful	Don't Know	Strongly/Somewhat Favor	Strongly/Somewhat Oppose
	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)
Overall	18.9 (17.5, 20.5)	8.5 (7.4, 9.7)	72.6 (70.9, 74.3)	32.0 (30.3, 33.6)	52.4 (50.7, 54.2)	15.6 (14.4, 17.0)	19.0 (17.6, 20.5)	81.0 (79.5, 82.4)
Sex								
Male	20.0 (17.5, 20.5)	8.9 (7.3, 10.7)	71.1 (68.5, 73.5)	35.6 (30.3, 33.6)	50.6 (48.1, 53.1)	13.8 (12.2, 15.6)	22.4 (20.2, 24.6)	77.6 (75.4, 79.8)
Female	17.9 (15.9, 20.1)	8.0 (6.6, 9.7)	74.1 (71.6, 76.3)	28.6 (26.3, 30.9)	54.2 (51.7, 56.6)	17.3 (15.4, 19.3)	15.9 (14.1, 17.9)	84.1 (82.1, 85.9)
Age								
18–29 years	24.3 (20.0, 29.1)	17.0 (13.4, 21.4)	58.7 (53.5, 63.8)	40.5 (35.7, 45.4)	46.7 (41.7, 51.7)	12.9 (9.9, 16.6)	26.2 (17.6, 20.5)	73.8 (69.2, 77.9)
30–44	24.5 (21.5, 27.7)	10.0 (8.0, 12.5)	65.5 (62.0, 68.9)	36.0 (32.8, 39.4)	49.5 (46.1, 53.0)	14.5 (12.2, 17.1)	21.4 (22.1, 30.8)	78.6 (75.5, 81.3)
45–59	20.6 (18.1, 23.4)	5.7 (4.4, 7.4)	73.7 (70.8, 76.5)	31.9 (29.1, 34.8)	53.0 (49.9, 56.0)	15.2 (13.0, 17.6)	19.4 (17.0, 22.0)	80.6 (78.0, 83.0)
60+	8.8 (7.3, 10.6)	3.4 (2.5, 4.7)	87.8 (85.7, 89.6)	21.8 (19.6, 24.2)	59.0 (56.2, 61.7)	19.2 (17.0, 21.6)	10.9 (9.3, 12.8)	89.1 (87.2, 90.7)
Race/Ethnicity								
White, NH	16.2 (14.7, 17.8)	5.8 (4.9, 6.9)	78.0 (76.2, 79.7)	33.3 (30.3, 33.6)	51.5 (49.5, 53.5)	15.1 (13.8, 16.6)	16.6 (15.1, 18.2)	83.4 (81.8, 84.5)
Black, NH	18.7 (14.5, 23.7)	15.2 (11.2, 20.4)	66.1 (60.2, 71.5)	29.7 (24.8, 35.2)	53.3 (47.6, 58.9)	17.0 (13.2, 21.6)	25.5 (20.8, 30.8)	74.5 (69.3, 79.2)
Other, NH	23.6 (18.3, 29.8)	8.2 (4.8, 13.7)	68.2 (61.3, 74.3)	25.5 (19.8, 32.0)	61.4 (54.5, 67.9)	13.1 (9.2, 18.5)	17.8 (12.8, 24.2)	82.2 (75.8, 87.2)
Hispanic	28.0 (23.0, 33.5)	14.3 (10.7, 19.0)	57.7 (51.9, 63.3)	31.3 (26.4, 36.7)	50.8 (45.3, 56.3)	17.9 (14.0, 22.5)	24.6 (20.1, 29.7)	75.4 (70.3, 79.9)
Education								
<high school	21.4 (15.9, 28.2)	8.1 (5.0, 13.0)	70.5 (63.3, 76.8)	35.5 (29.3, 42.3)	45.9 (39.1, 52.8)	18.6 (14.0, 24.4)	28.5 (22.8, 35.0)	71.5 (65.0, 77.2)
High school	16.6 (14.1, 19.5)	8.2 (6.3, 10.6)	75.2 (71.9, 78.2)	30.9 (27.9, 34.1)	49.4 (46.1, 52.7)	19.7 (17.2, 22.4)	20.9 (18.2, 23.9)	79.1 (76.1, 81.8)

Variable	Q1: Past 7 Day MJ Secondhand Smoke (SHS) Exposure <sup>a</sup> N=5,827		Q2: Perceived Harm From MJ SHS <sup>b</sup> N=4,068		Q3: Favor or Oppose Indoor MJ Smoking <sup>c</sup> N=4,071			
	Outdoor only OR indoor only exposure	Indoor and Outdoor Exposure	Not exposed	Not/A little Harmful	Harmful/Very Harmful	Don't Know	Strongly/Somewhat Favor	Strongly/Somewhat Oppose
	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)	Wt% (95% CI)
Some college	19.4 (16.7, 22.3)	10.3 (8.2, 12.9)	70.4 (67.0, 73.5)	32.3 (29.2, 34.5)	53.5 (50.2, 56.7)	14.2 (12.1, 16.6)	18.3 (15.8, 21.1)	81.7 (78.9, 84.2)
Bachelor's degree or higher region	19.9 (17.6, 22.3)	7.1 (5.6, 9.0)	73.0 (70.3, 75.6)	31.4 (28.8, 34.0)	56.5 (53.8, 59.3)	12.1 (10.4, 14.1)	14.6 (12.7, 16.7)	85.5 (83.3, 87.3)
Region								
Northeast	21.3 (17.9, 25.2)	9.2 (6.8, 12.5)	69.4 (65.2, 73.4)	34.2 (30.4, 38.2)	49.8 (45.7, 53.8)	16.0 (13.2, 19.3)	18.8 (15.8, 22.2)	81.2 (77.8, 84.2)
Midwest	14.0 (11.5, 17.0)	5.6 (4.1, 7.8)	80.3 (77.0, 83.2)	34.3 (30.8, 38.1)	48.7 (45.0, 52.5)	17.0 (14.4, 19.9)	18.9 (16.0, 22.1)	81.1 (77.9, 84.0)
South	13.6 (11.5, 15.9)	5.7 (4.3, 7.6)	80.7 (78.0, 83.1)	30.4 (27.8, 33.2)	54.1 (51.1, 56.9)	15.5 (13.5, 17.8)	20.3 (17.8, 22.9)	79.7 (77.2, 82.0)
West	30.1 (26.6, 33.9)	14.7 (11.9, 17.9)	55.2 (51.2, 59.1)	30.6 (27.2, 34.2)	55.1 (51.3, 58.9)	14.3 (11.9, 17.1)	17.3 (14.4, 20.5)	82.7 (79.5, 85.6)
Past 30 day marijuana and/or tobacco use								
Neither tobacco nor marijuana use	16.1 (14.6, 17.8)	6.9 (5.8, 8.2)	77.0 (75.1, 78.7)	24.4 (22.7, 26.2)	60.6 (58.6, 62.5)	15.0 (13.7, 16.5)	12.2 (10.9, 13.5)	87.8 (86.5, 89.1)
Tobacco only use	21.5 (17.5, 26.1)	9.6 (6.7, 13.6)	68.9 (63.8, 73.6)	42.9 (38.1, 47.8)	37.9 (33.3, 42.8)	19.2 (15.7, 23.2)	27.5 (23.3, 32.3)	72.5 (67.7, 76.7)
Marijuana only use	36.7 (29.0, 45.2)	16.3 (11.0, 23.5)	47.0 (38.9, 55.2)	69.6 (62.1, 76.2)	13.2 (9.0, 18.8)	17.2 (12.0, 24.1)	50.0 (42.1, 57.9)	50.0 (42.1, 57.9)
Co-use <sup>b</sup>	33.5 (25.8, 42.3)	19.6 (12.9, 28.6)	46.9 (38.2, 55.7)	75.0 (66.2, 82.1)	12.0 (6.8, 20.4)	12.9 (8.2, 19.8)	66.3 (58.1, 73.5)	33.7 (26.5, 41.9)
Past 30 day marijuana use (any)								
Yes	35.4 (29.7, 41.4)	17.7 (13.3, 23.2)	46.9 (41.0, 53.0)	71.9 (66.3, 76.9)	12.7 (9.3, 17.2)	15.4 (11.6, 20.2)	56.9 (51.1, 62.5)	43.1 (37.5, 48.9)
No	16.9 (15.5, 18.4)	7.3 (6.3, 8.5)	75.8 (74.0, 77.5)	27.1 (25.5, 28.8)	57.3 (55.4, 59.1)	15.6 (14.3, 17.0)	14.4 (13.1, 15.8)	85.6 (84.2, 86.9)
Past 30 day tobacco use (any)								
Yes	24.7 (21.0, 28.8)	12.3 (9.4, 16.0)	63.0 (58.5, 67.3)	51.2 (46.9, 55.5)	31.2 (27.4, 35.3)	17.6 (14.6, 20.9)	37.6 (33.5, 42.0)	62.4 (58.0, 66.5)
No	17.7 (16.2, 19.4)	7.6 (6.5, 8.9)	74.7 (72.8, 76.5)	27.8 (26.1, 29.6)	56.9 (55.0, 58.9)	15.2 (13.9, 16.7)	15.0 (13.7, 16.5)	85.0 (83.5, 86.3)

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<sup>g</sup> Complete survey question: During the past 7 days, did you smell smoke from someone who was smoking marijuana products in an indoor or outdoor public place? People who reported they “don’t know/not sure” if they had been exposed were excluded from these analyses (N=240, 5.8% of the total sample). People who refused to respond were also excluded (n=20). Exposure was self-reported.

<sup>h</sup> Complete survey question: How harmful do you believe it is to be exposed to secondhand smoke from someone else who is smoking marijuana? “Not/A little harmful” includes response options “not at all harmful” and “a little bit harmful;” “somewhat/very harmful” includes response options “harmful/very harmful;” “don’t know” includes response option “don’t know/not sure”. N=20 refused to answer this question.

<sup>c</sup> Complete survey question: Do you favor or oppose allowing people to smoke marijuana or cannabis in indoor areas of public places such as workplaces, restaurants, and bars? “Favor” includes response options: “strongly favor” and “somewhat favor;” “Oppose” includes response options “strongly oppose” and “somewhat oppose.” N=17 refused to answer this question.

Binary logistic regression model assessing correlates of past 7-day self-reported exposure to second-hand marijuana smoke (versus no exposure).

**Table 2**

	Self-reported exposure (any) (versus not <sup>a</sup> )	aOR (95% CI)	P-value
Sex: male (versus female)	1.1 (0.9, 1.3)		<i>P</i> = 0.6
Age:			<i>P</i> < 0.0001
18–29 years	4.3 (3.2, 5.8)		
30–44	3.4 (2.6, 4.3)		
45–59	2.3 (1.8, 3.0)		
60+	Ref		
Race/ethnicity:			<i>P</i> < 0.0001
White, NH	Ref		
Black, NH	2.0 (1.5, 2.7)		
Other, NH	1.1 (0.8, 1.6)		
Hispanic	1.9 (1.5, 2.6)		
Education:			<i>P</i> -value
< high school	0.9 (0.6, 1.3)		
High school	0.8 (0.6, 1.0)		
Some college	1.0 (0.8, 1.3)		
Bachelor's degree or higher	Ref		
Region:			<i>P</i> < 0.0001
Northeast	1.8 (1.3, 2.4)		
Midwest	Ref		
South	0.9 (0.7, 1.1)		
West	3.1 (2.4, 4.1)		
Past 30-day marijuana and/or tobacco use:			<i>P</i> < 0.0001
Neither tobacco nor marijuana use	Ref		
Tobacco only use	1.6 (1.2, 2.1)		
Marijuana only use	2.4 (1.6, 3.5)		
Co-use <sup>b</sup>	3.6 (2.4, 5.3)		

aOR = adjusted odds ratio; 95% CI = 95% confidence interval; Ref = reference; NH = non-Hispanic.



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<sup>b</sup>Exposure was self-reported. Exposure is defined as individuals who responded to the following question: 'During the past 7 days, did you smell smoke from someone who was smoking marijuana products in an indoor or outdoor place?' with response options: 'yes, in an indoor public place only' AND/OR 'yes, in an outdoor public place only'.

<sup>c</sup>Co-use is defined as past 30-day use of both marijuana and tobacco.

<sup>d</sup>People who reported 'don't know/not sure' were excluded from these analyses ( $n = 240$ , or 5.8% of the total sample) because of challenges in interpreting that response. People who refused to respond ( $n = 20$ ) were also excluded.

Table 3

Multinomial logistic regression model assessing correlates of perceiving harm or being unsure of harms from second-hand marijuana smoke (versus perceiving no harm).

	No/little harm (versus harm) <sup>d</sup> aOR (95% CI)	Don't know (versus harm) <sup>d</sup> aOR (95% CI)	P-value
Sex: male (versus female)	1.2 (1.1, 1.5)	0.9 (0.7, 1.1)	<i>P</i> < 0.05
Age:			
18–29 years	1.9 (1.5, 2.5)	0.8 (0.5, 1.1)	<i>P</i> < 0.0001
30–44	1.8 (1.4, 2.2)	0.9 (0.7, 1.2)	
45–59	1.4 (1.2, 1.8)	0.9 (0.7, 1.1)	
60+	Ref	Ref	
Race/Ethnicity:			
White, NH	Ref	Ref	<i>P</i> = 0.06
Black, NH	0.8 (0.6, 1.0)	1.0 (0.7, 1.5)	
Other, NH	0.7 (0.5, 0.9)	0.9 (0.6, 1.4)	
Hispanic	0.7 (0.5, 1.0)	1.1 (0.8, 1.5)	
Education:			
< high school	1.1 (0.7, 1.5)	1.6 (1.1, 2.5)	<i>P</i> < 0.01
High school	1.0 (0.8, 1.2)	1.7 (1.3, 2.2)	
Some college	1.0 (0.8, 1.2)	1.1 (0.9, 1.5)	
Bachelor's degree or higher	Ref	Ref	
Region:			
Northeast	0.9 (0.7, 1.2)	0.9 (0.7, 1.3)	<i>P</i> = 0.16
Midwest	Ref	Ref	
South	0.8 (0.6, 1.0)	0.8 (0.6, 1.1)	
West	0.7 (0.6, 0.9)	0.7 (0.5, 1.0)	
Past 30-day marijuana and/or tobacco use			
Neither tobacco nor marijuana use	Ref	Ref	<i>P</i> < 0.0001
Tobacco only use	2.6 (2.1, 3.4)	1.9 (1.4, 2.6)	
Marijuana only use	13.2 (8.4, 20.7)	5.4 (3.1, 9.5)	
Co-use <sup>b</sup>	14.0 (7.3, 26.6)	4.4 (2.0, 9.4)	

aOR = adjusted odds ratio; 95% CI = 95% confidence interval; Ref = reference; NH = non-Hispanic.

Perceiving no/a little harm was defined as individuals who responded to the following question: 'How harmful do you believe it is to be exposed to second-hand smoke from someone else who is smoking marijuana?' with response options: 'not at all harmful' or 'a little bit harmful'. The comparison group are individuals who responded with response options 'harmful' or 'very harmful'. Those who responded 'don't know' are also compared with those who perceived exposure to be 'harmful' or 'very harmful'.

<sup>g</sup> Co-use is defined as past 30 day use of both marijuana and tobacco.

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**Table 4**  
Multivariable logistic regression model assessing correlates of favoring or opposing public marijuana (MJ) smoking.

	Model 1		Model 2			
	Favor versus oppose <sup>a</sup>	aOR (95% CI) n = 4071	P-value	Favor versus oppose <sup>a</sup>	aOR (95% CI) n = 3802	P-value
Sex: male (versus female)	1.4 (1.2, 1.7)		<i>P</i> < 0.001	1.4 (1.1, 1.7)		<i>P</i> < 0.01
Age:						
18–29 years	2.1 (1.5, 2.8)			1.7 (1.2, 2.4)		<i>P</i> < 0.01
30–44	1.9 (1.4, 2.4)		<i>P</i> < 0.0001	1.6 (1.2, 2.1)		
45–59	1.7 (1.3, 2.2)			1.5 (1.1, 1.9)		
60+	Ref			Ref		
Race/ethnicity:						
White, NH	Ref			Ref		
Black, NH	1.6 (1.2, 2.2)		<i>P</i> < 0.05	1.9 (1.4, 2.7)		<i>P</i> < 0.0001
Other, NH	1.2 (0.8, 1.8)			1.3 (0.9, 2.1)		
Hispanic	1.2 (0.9, 1.6)			1.5 (1.1, 2.1)		
Education:						
< high school	1.7 (1.2, 2.5)			1.9 (1.2, 2.8)		<i>P</i> < 0.01
High school	1.4 (1.1, 1.8)		<i>P</i> < 0.05	1.5 (1.1, 2.0)		
Some college	1.1 (0.9, 1.5)			1.2 (0.9, 1.5)		
Bachelor's degree or higher	Ref			Ref		
Past 30-day marijuana and/or tobacco use						
No tobacco or marijuana use	Ref			Ref		<i>P</i> < 0.0001
Tobacco only use	2.5 (1.9, 3.2)		<i>P</i> < 0.0001	1.8 (1.3, 2.4)		
Marijuana only use	6.3 (4.5, 8.8)			2.8 (1.9, 4.0)		
Co-use	11.8 (8.2, 17.0)			5.5 (3.5, 8.5)		
Perceptions of marijuana second-hand smoke exposure:						
Not harmful				7.4 (5.6, 9.8)		<i>P</i> < 0.0001
Harmful				Ref		
Don't know				3.7 (2.6, 5.1)		
Self-reported exposure to MJ SHS smoke in past 7 days:						
Indoor or outdoor only				1.3 (0.9, 1.7)		<i>P</i> = 0.07

	Model 1	Model 2
	Favor versus oppose <sup>d</sup> aOR (95% CI) n = 4071	Favor versus oppose <sup>d</sup> aOR (95% CI) n = 3802
	P-value	P-value
Indoor and outdoor		1.5 (1.0, 2.2)
Not exposed		Ref

aOR = adjusted odds ratio; 95% CI = 95% confidence interval; Ref = reference; NH = non-Hispanic; SHS = second-hand smoke.

<sup>d</sup>Favoring public marijuana smoking was defined as those individuals who responded to the following question: 'Do you favor or oppose allowing people to smoke marijuana or cannabis in indoor areas of public places such as workplaces, restaurants, and bars?' with response options, 'strongly favor' or 'somewhat favor'. Opposing public marijuana smoking was defined as those who responded with response options, 'strongly oppose' or 'somewhat oppose'.