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ORIGINAL ARTICLE

## Prevalence and correlates of hashish use in a national sample of high school seniors in the United States

Joseph J. Palamar, PhD<sup>1,2</sup>, Lily Lee<sup>3</sup>, and Michael Weitzman, MD<sup>4,5,6</sup>

<sup>1</sup>Department of Population Health, New York University Langone Medical Center, New York, <sup>2</sup>Center for Drug Use and HIV Research, New York University, New York, <sup>3</sup>Brooklyn College, City University of New York, Brooklyn, New York, <sup>4</sup>Departments of Pediatrics and <sup>5</sup>Environmental Medicine, New York University Langone Medical Center, New York, and <sup>6</sup>The Global Institute for Public Health, New York University, New York, NY, USA

### Abstract

**Background:** Cannabis (marijuana) use and acceptance towards use are increasing in the US, and state-level policies are becoming more liberal. A wealth of research has been conducted to examine risk factors for use; however, studies rarely differentiate between different forms of marijuana. **Objective:** We sought to determine prevalence of use and delineate who is at risk for use of hashish, a more potent form of marijuana. **Methods:** We examined data from a nationally representative sample of high school seniors in the Monitoring the Future study (2007–2011; weighted  $n = 10\,597$ ). We determined how sociodemographic factors and reasons for marijuana use correlated with recent (12 month) hashish use. **Results:** Prevalence of recent hashish use was 6.5% and it was used by 18.3% of recent marijuana users. Hashish and other marijuana use tended to share many of the same correlates; however, associations were often stronger for hashish use. Females were consistently at low risk for use and users of other drugs were consistently at high risk for use. Black students tended to be at low risk for hashish use. Low risk of identifying as Hispanic or religious and high risk of higher personal income or going out more evenings per week for fun disappeared when controlling for other drug use. Using marijuana because the student felt he/she was “hooked” nearly doubled the odds for hashish use. **Conclusions:** This was the first national study to examine prevalence and correlates of hashish use. These findings can inform prevention in a time of increasing popularity of marijuana use.

### Keywords

Adolescents, epidemiology, hashish, marijuana, prevalence, socioeconomic status

### History

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### Introduction

Public support for cannabis (marijuana) legalization is increasing in the US, alongside increases in use and widespread changes in attitudes towards use (1–4). State-level policy is beginning to shift, with four states plus the District of Columbia legalizing recreational use and at least another 20 states decriminalizing recreational use or legalizing medical use. As a variety of marijuana products become more easily or legally accessible, it is important to examine who is at risk for use of particular products in order to inform prevention and harm reduction strategies. Despite a wealth of research on marijuana, surprisingly very little epidemiologic research has focused on hashish (“hash”), a hypercompressed and more potent form of *cannabis sativa*.

Colorado and Washington were the first two states to legalize recreational marijuana use and there is now no penalty in these states for private possession of up to 1 oz by adults age 21 or older (5–7). In Colorado, the same regulations currently apply to hashish. In Washington, an adult can legally possess up to 16 oz of marijuana-infused products (commonly containing hashish) in solid form (e.g. brownies), or 72 oz of cannabis-infused products in liquid form (e.g. soda, which may contain hash oil). Both hashish and non-hashish marijuana can be smoked, vaporized, or cooked in food. Hashish can be used either in its natural state or converted into a more concentrated oil (8). However, compared to other marijuana, hashish usually contains a higher concentration of  $\Delta^9$ -tetrahydrocannabinol (THC), which is the most potent psychoactive cannabinoid (9–11). While a typical marijuana cigarette (“joint”) contains only 0.5–5% THC, hashish tends to contain 2–20% with some estimates as high as 50% (12).

Different methods of marijuana use can lead to differences in absorption and metabolism of THC. When smoked, THC is absorbed from the lungs into the bloodstream within

Address correspondence to Joseph J. Palamar, 227 East 30th Street, 7th Floor, New York, NY 10016, USA. E-mail: joseph.palamar@nyumc.org

minutes (11). THC reaches its peak levels within 10 min after smoking and rapidly declines to 5–10% of its initial levels within an hour (11). Hashish, however, retains most of its parent THC in a form that can be more readily absorbed, either through ingestion or through smoke (13). When hashish is ingested, THC absorption is slower, taking 1–3 hours to enter the bloodstream; the result is a less intense high of longer duration (13). A major metabolite, 11-hydroxy-THC, is 20% more potent than THC and results in higher concentrations after being swallowed rather than smoked (14).

Teen marijuana use (with hashish use included in the definition) has been researched extensively. In 2013, almost half of high school seniors (45.5%) reported using marijuana in their lifetime (1). Lifetime, annual and 30-day use is more prevalent among males, Hispanics and among those who reside in cities (15). Those who report marijuana use – particularly frequent marijuana use – are also at high risk for using other illicit drugs (16,17). Research is needed to determine not only whether hashish has different effects than what we normally deem “marijuana” on surveys, but also to delineate correlates of use to determine who may be at highest risk for use. Findings from our previous research suggest that it may not always be appropriate to collapse multiple forms of the same drug or drug delivery system into a single category, as is commonly done with marijuana (18–22).

Hashish is usually more potent than non-hashish marijuana, yet there is a remarkably limited literature on its epidemiology and correlates of use. Here we examine whether hashish and (non-hashish) “marijuana” have different sociodemographic correlates of, and reasons for use in a large, nationally representative sample of adolescents approaching adulthood.

## Methods

### Design

Data were examined from Monitoring the Future (MTF), an annual representative survey of high school students in approximately 130 public and private schools throughout 48 states in the US (1). Schools were selected through a multi-stage random sampling procedure; first geographic areas were selected, then schools within geographic areas, and then classes within selected schools. Constructs assessed were divided into six questionnaire forms and distributed randomly. This study focuses on data collected through Form 1, the only form that assesses hashish use, in addition to general marijuana use and sociodemographics. Analyses focused on data collected from high school seniors in years 2007–2011 (2011 was the last year recreational marijuana use was still illegal in all US states). Student response rates in 2007–2011 were 79–85% (1).

### Variables

With regard to sociodemographic variables, MTF assessed student sex, age (dichotomized as <18 vs. ≥18), and race/ethnicity (i.e. white, black, Hispanic). Population density was categorized by non-, small, and large metropolitan statistical areas (MSAs). Small MSAs are defined as counties or groups of counties with at least one city of ≥50 000 inhabitants and

the 24 largest MSAs are defined as large MSAs. Non-MSAs are the remaining areas (1). Religiosity was assessed via a composite of two ordinal items which assessed religious attendance and importance (range: 1–4). We divided the mean-composite into tertiles indicating low (1.0–2.0), moderate (2.5–3.0) and high (3.5–4.0) religiosity (23).

To assess family structure, students were asked to indicate with which parent(s) they resided. Students answered whether they resided with no parents, one parent or two parents. The level of educational attainment of the parents was assessed via ordinal scales and a mean score for both parents (or raw score if only one parent) was coded into three groups representing low (1.0–3.0), medium (3.5–4.0), and high (4.5–6.0) education. Students were also asked about the number of evenings they usually go out per week for fun and recreation and we coded answers into: (1) 0–1 evening(s), (2) 2–3 evenings, and (3) 4–7 evenings. Student weekly income was assessed by asking how much money the student earns during the average week from: (1) a job or other work, and (2) from “other sources”. We recoded responses for each item into \$10 or less, \$11–50, or \$51 or more. Coding of sociodemographic variables was guided by previous research (3,4,19,20,23–25).

With respect to drug use, students were asked about frequency of lifetime use of marijuana, alcohol (“more than just a few sips”), cigarettes and select illicit drugs. Students were asked, “On how many occasions (if any) have you used marijuana in your lifetime?” The survey reminded students that “Marijuana is sometimes called weed, pot, dope; hashish is sometimes called: hash, hash oil” and then asked, “On how many occasions (if any) have you used hashish in your lifetime?” The same questions were asked for use in the last 12 months. Possible responses for these questions were: 0 occasions, 1–2 occasions, 3–5 occasions, 6–9 occasions, 10–19 occasions, 20–39 occasions, and 40+ occasions. We dichotomized recent (12 months) hashish use (into yes/no) and also created a trichotomous variable indicating: (1) no recent use of either, (2) recent use of marijuana, but not hashish, and (3) recent use of hashish (regardless of other marijuana use).

The same response options applied to lifetime use of alcohol and other illicit drugs. The illicit drugs considered in this study were powder cocaine, crack, heroin, LSD, and hallucinogens other than LSD. With regard to nonmedical (illicit) use of prescription drugs, this study considered use of amphetamine/controlled stimulants, narcotics other than heroin, tranquilizers/benzodiazepines, and sedatives/barbiturates. We dichotomized use of each of any of these nine illicit drugs into lifetime use: yes/no. Lifetime alcohol use was dichotomized into use on <10 vs. ≥10 occasions. Lifetime cigarette use was assessed via an ordinal item with different answer options: never, once or twice, occasionally but not regularly, regularly in the past, regularly now. We collapsed the two regular smoker categories because no recent marijuana users identified as past regular smokers. Finally, students who indicated use of marijuana in the last 12 months were asked, “What have been the most important reasons for your using marijuana or hashish?” Students were asked to answer yes/no to 11 items (listed in Table 2).

## Analyses

Descriptive statistics were first examined. We then analyzed data for the 10 597 students (Weighted  $n$ ) with complete drug use data. Specifically, we fit two conditional multinomial logistic regression models to delineate correlates of (1) hashish use (regardless of other marijuana use), and (2) other marijuana use (marijuana users not indicating hashish use) compared to no use. The first model contained only socio-demographic variables; the second model also contained drug use variables. We controlled for a variety of sociodemographic variables commonly utilized in other MTF analyses (3,4,19,20,23,25). In these conditional models, each covariate was associated with its own adjusted odds ratio (AOR) in explaining each categorical outcome (compared to no use). Two binary conditional models were then computed focusing on the subsample of recent (12 months) marijuana users ( $n=2650$ ) in order to more directly examine differences between both forms. The first model contained only socio-demographic variables and the second model also contained drug use variables. For consistency, we entered the same sociodemographic covariates, but in the second model we also included (1) frequency of recent marijuana use, and (2) reasons for marijuana use (which were only assessed with regard to recent use).

All models were adjusted by cohort with indicators for each year (with year 2007 as the comparison) included (26). Multivariable models included missing data indicators for covariates with missing data in order to maximize sample size. For example, 14.9% of the sample was missing race and 26.3% were missing religiosity. Utilizing case-complete data (with no missing values) would have required the deletion of roughly half of the sample. Including a missing data indicator for covariates with missing data allowed the full analytic sample to be retained. Thus, each model technically contained no missing data, which would have led to listwise deletion of missing cases. In order to ensure that inclusion of missing data indicators did not bias results, all models were recomputed using case-complete data and results were almost identical. This is also commonly done in other MTF analyses (3,20,25,27). All analyses were design-based for complex survey data (28), weighted according to the study's sampling scheme, and conducted using SAS 9.3 software.

## Results

As shown in Table 1, the majority of the sample was white or resided in an MSA. A quarter (25.1%) of recent marijuana users reported lifetime hashish use (9.4% of the full sample) and 18.3% of recent marijuana users reported recent (12 month) use of hashish (6.5% of the full sample). Percentages of students indicating specific reasons for use are presented in Table 2.

With regard to recent use among the full sample (Table 3), compared to males, females were at low odds for hashish use, and older students were at decreased odds for both forms only when controlling for other drug use. Compared to white students, black and Hispanic students were at low odds for use of hashish, but when controlling for other drug use, black students were at more than double the odds for using each form of marijuana, and the Hispanic association

lost significance. Residing in an MSA somewhat consistently increased the odds for use of each form, and religiosity was protective against both forms, particularly hashish, and highest religiosity was associated with lower odds. Residing with one or two parents was protective against use of both forms, but controlling for other drug use, residing with two parents remained a protective factor against other marijuana use, but not hashish. Number of evenings out per week robustly increased odds of use of each form, particularly hashish, even when controlling for other drug use. Higher income from a job or other sources tended to be a strong risk factor for use of each form, but when controlling for other drug use, high income from job ( $>\$50/\text{week}$ ) increased odds for use of hashish (AOR = 1.38,  $p=0.019$ ), but not other marijuana. Frequent alcohol use robustly increased odds for use of hashish (AOR = 7.80,  $p<0.001$ ), more so than other marijuana (AOR = 4.27,  $p<0.001$ ). All levels of cigarette smoking strongly increased odds for use of each form, particularly hashish. Regular cigarette smoking was associated with a robust increased in odds of hashish use (AOR = 18.70,  $p<0.001$ ). Likewise, other illicit drug use increased odds of hashish use, more so than it increased odds for other marijuana use.

Among recent marijuana users (Table 4), compared to males, females were consistently at lower odds for hashish use although this association weakened when controlling for other drug use. Compared to white students, black students were at strongly reduced odds for hashish use and Hispanics were also at low risk; however, after controlling for other drug use, black students were at half the odds for hashish use (AOR = 0.48,  $p=0.026$ ) and identifying as Hispanic was no longer significant. Compared to less religious students, moderate and highly religious students were at low risk for hashish use, but these significant associations disappeared when controlling for other drug use. Going out 4–7 evenings per week and earning  $>\$50$  per week from a job were risk factors for hashish use, but these significant associations also disappeared when controlling for other drug use. Frequent alcohol use, regular cigarette smoking and other illicit drug use all increased odds for hashish use, and as frequency of recent marijuana use increased, odds for use of hashish increased. Finally, with regard to reasons for marijuana use, using to seek deeper insight and understanding was associated with increased odds for hashish use (AOR = 1.51,  $p=0.009$ ) and using because the student felt he or she was “hooked” almost doubled the odds of hashish use (AOR = 1.94,  $p=0.024$ ).

## Discussion

The recent increase in popularity of marijuana use coupled with more liberal state-level policies has begun to change the landscape of adolescent marijuana use. More potent forms of marijuana, such as hashish, may present a threat to adolescent health. This is the first paper to examine correlates of hashish use in a nationally representative sample of US high school students. Data from MTF indicates that nearly half (45.5%) of high school seniors have used marijuana at some point in their lives, with a third (36.4%) using it in the past year (1). We examined data from MTF, years 2007–2011 and found that

Table 1. Sample characteristics.

	Full sample <i>n</i> = 10 597		Recent marijuana-using subsample <i>n</i> = 2650	
	<i>n</i>	%	<i>n</i>	%
Sex				
Male	4804	45.3	1312	49.5
Female	5343	50.4	1257	47.4
Missing	450	4.3	81	3.1
Age, years				
<18	4439	41.9	1153	43.5
≥18	5910	55.8	1445	54.5
Missing	248	2.3	52	2.0
Race				
White	6424	60.6	1703	64.3
Black	1140	10.8	231	8.7
Hispanic	1450	13.7	319	12.0
Missing	1584	14.9	397	15.0
Population density				
Non-MSA	2269	21.4	483	18.2
MSA	8328	78.6	2167	81.8
Religiosity				
Low	3109	29.3	1025	38.7
Moderate	2264	21.4	596	22.5
High	2433	23.0	303	11.4
Missing	2791	26.3	727	27.4
Family structure				
0 Parents	588	5.6	178	6.7
1 Parent	2669	25.2	749	28.3
2 Parents	6986	65.9	1633	61.6
Missing	354	3.3	90	3.4
Parent education				
Low	3089	29.2	756	28.5
Moderate	2830	26.7	731	27.6
High	3971	37.5	997	37.6
Missing	707	6.7	166	6.3
Number of evenings out per week				
0–1	2627	24.8	404	15.2
2–3	5042	47.6	1253	47.3
4–7	2086	19.7	738	27.8
Missing	841	7.9	256	9.6
Weekly income from job				
\$10 or less	4339	40.9	932	35.2
\$11–50	1159	10.9	277	10.4
\$51 or more	4115	38.8	1169	44.1
Missing	985	9.2	273	10.3
Weekly income from other source				
\$10 or less	5279	49.8	1195	45.1
\$11–50	3284	31.0	882	33.3
\$51 or more	930	8.8	278	10.5
Missing	1105	10.4	294	11.1
Lifetime hashish use				
No	9599	90.6	1984	74.9
Yes	998	9.4	666	25.1
Recent (12 months) hashish use				
No	9911	93.5	2164	81.7
Yes	686	6.5	486	18.3
Lifetime alcohol use				
<10 times	6097	57.5	609	23.0
>10 times	4500	42.5	2041	77.0
Lifetime cigarette use				
Never smoked	6215	58.6	716	27.0
1–2 times	1808	17.1	660	24.9
Smoke occasionally	1162	10.9	674	25.4
Smoke(d) regularly	1412	13.3	599	22.6
Frequency of recent marijuana use				
0 times	7168	67.6	0	0.0
1–2 times	886	8.4	729	27.5
3–5 times	563	5.3	463	17.5
6–9 times	400	3.8	314	11.8
10–19 times	360	3.4	263	9.9
20–39 times	303	2.9	223	8.4
40+ times	917	8.7	658	24.8
Lifetime other illicit drug use				
No	8132	76.7	1479	55.8
Yes	2465	23.2	1170	44.2

MSA, metropolitan statistical area. Percentages were weighted so they do not always add up perfectly to 100%.



Table 2. Reasons for marijuana use among recent marijuana users (Weighted  $n = 2650$ ).

	<i>n</i>	%
To experiment – to see what it's like	1690	63.8
To relax or relieve tension	1642	62.0
To feel good or get high	1883	71.0
To seek deeper insights/understanding	622	23.5
To have a good time with my friends	1800	67.9
To fit in with a group I like	167	6.3
To get away from my problems/troubles	695	26.2
Because of boredom, nothing else to do	845	31.9
Because of anger or frustration	499	18.8
To get through the day	314	11.9
Because I am 'hooked' – I have to have it	94	3.5

hashish has been used by nearly one out of ten high school seniors. Our findings suggest that (1) users of both forms of marijuana share many of the same risk factors; but (2) various factors tend to be bigger risk factors for hashish use as compared to general marijuana use.

Many sociodemographic factors explaining general marijuana use were similar to those of hashish use; however, we delineated numerous differences in associations, which were often stronger for hashish. Females were consistently at low risk for hashish use, but not general marijuana use. In some respects, these findings corroborate previous research that females tend to be at low risk for "harder" drugs than males (20,25,29,30). Hashish tends to be much more potent than other marijuana, and it is primarily the males that are at higher risk for use of this more potent form. Males are also at higher risk for marijuana dependence (30,31) so further research is needed to examine whether this high potency form of marijuana increases the risk of problematic use patterns.

One particularly consistent difference across use of different forms of marijuana was that students with higher income (earning  $>\$50$  per week from a job) were at increased odds for use of hashish, but not for general marijuana, at least until controlling for other drug use. This corroborates prior research showing that access to higher income can be associated with risk-taking behavior, including drug use (19,20,25,32,33). This association may be due to socioeconomic status – as indicated by higher income – or simply the fact that money is often needed to purchase drugs (20,32,34–36).

Important race/ethnicity findings were delineated from these analyses. Compared to non-users, black and Hispanic students were at low risk for hashish use, but not other marijuana. However, when controlling for other drug use, identifying as Hispanic was no longer protective against hashish use, and black students were at more than double the risk for use of both forms. Interestingly, looking more specifically into the marijuana-using subsample, blacks were (again) only at half the odds for hashish use. So while black students are at risk for general marijuana use (compared to non-users) while controlling for drug use and other factors, they are actually at low risk for hashish use. This finding can help inform interpretation of other national reports that also suggest higher reported rates of marijuana use among whites (e.g. the National Survey on Drug Use and Health [NSDUH]) (15,37). However, despite blacks using at lower

rates into adulthood, marijuana-related arrest and incarceration rates are higher for blacks throughout many US cities (38). We found that among marijuana users, blacks are at low risk for recent hashish use; however, further research needs to be conducted to determine whether this racial-protective factor paradoxically places blacks at greater risk for arrest. Since hashish is often ingested rather than smoked, blacks who smoke (e.g. in public) may be at greater risk for arrest since most other non-hashish marijuana is smoked and thus has a strong odor that can lead to detection by authorities.

Another key finding was that other drug use was a robust risk factor for hashish use. Specifically, other illicit drug use, regular cigarette smoking and frequent alcohol use each increased the risk for use. Results also indicate that higher frequency of cigarette smoking increases odds of use, but frequency of recent marijuana use was perhaps the most robust risk factor, with more frequent use more strongly increasing odds of using hashish. While temporality could not be determined, it may be that those who use non-hashish marijuana very frequently are more likely to be exposed to and/or eventually use this more potent version of the drug. It may also be that higher frequency marijuana use may be linked to increased tolerance, leading many users to seek this more potent marijuana product. In addition, including other drug use in models often drowned out – or in some cases, reversed – associations of sociodemographic variables. Many studies do not control for drug use in models, and this finding points to the importance of doing so because associations commonly change in light of these factors (25).

In addition, we examined how reasons for marijuana use relate to hashish use and found that those who use to seek deeper insights or understanding, a common reason for hallucinogen use (39), are at increased odds for hashish use. Alarming, those who said they are "hooked" on marijuana were at nearly double the odds for use (with more than half of those who felt they were hooked reporting hashish use). This finding helps shed some light regarding understudied aspects of marijuana dependence. Perhaps in some cases hashish use can be viewed as a form of marijuana use "severity" (40,41) as it tends to be more potent, used among more frequent marijuana users, and many marijuana users who feel they are dependent also use this form of the drug.

## Limitations

Since this study was cross-sectional, temporality could not be inferred. Missing data, particularly of religiosity and race, was problematic; however, we included missing data indicators in models in order to avoid listwise deletion, as has been done in previous studies. We also computed case-complete models with no missing data to ensure that results from our fully-retained analytic sample were similar. Hashish (not collapsed with general marijuana use) was only assessed in a sixth of the sample each year so we combined cohorts from five years into a single cross-section to increase power. Hashish use did not significantly differ over time, giving us confidence in combining cohorts. State-level MTF data are not available so it is unknown which students resided in a state where medical marijuana was legal or available. It is possible that

Table 3. Multinomial logistic regressions comparing correlates of hashish and other marijuana use to non-marijuana use (Weighted  $n = 10\,597$ ).

	Model 1				Model 2			
	Hashish		Other marijuana		Hashish		Other marijuana	
	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)
Sex								
Male	Ref		Ref		Ref		Ref	
Female	0.49***	(0.40–0.61)	0.94	(0.81–1.05)	0.42***	(0.34–0.54)	0.89	(0.78–1.02)
Age, years								
<18	Ref		Ref		Ref		Ref	
≥18	0.85	(0.70–1.04)	0.91	(0.81–1.01)	0.74*	(0.59–0.94)	0.81**	(0.71–0.92)
Race								
White	Ref		Ref		Ref		Ref	
Black	0.43***	(0.27–0.69)	0.91	(0.75–1.10)	2.18**	(1.30–3.66)	2.24***	(1.79–2.81)
Hispanic	0.42***	(0.29–0.61)	0.86	(0.72–1.02)	0.77	(0.52–1.15)	1.13	(0.93–1.39)
Population density								
Non-MSA	Ref		Ref		Ref		Ref	
MSA	1.28	(1.00–1.64)	1.27***	(1.11–1.46)	1.67***	(1.25–2.23)	1.67***	(1.42–1.97)
Religiosity								
Low	Ref		Ref		Ref		Ref	
Moderate	0.54***	(0.40–0.73)	0.73***	(0.63–0.84)	0.53***	(0.38–0.74)	0.68***	(0.57–0.81)
High	0.19***	(0.13–0.28)	0.31***	(0.26–0.36)	0.33***	(0.21–0.50)	0.41***	(0.33–0.49)
Family structure								
0 Parents	Ref		Ref		Ref		Ref	
1 Parent	0.51**	(0.34–0.77)	0.67**	(0.53–0.86)	0.79	(0.48–1.28)	0.89	(0.66–1.18)
2 Parents	0.43***	(0.29–0.63)	0.51***	(0.40–0.64)	0.80	(0.50–1.27)	0.75*	(0.57–1.00)
Parent education								
Low	Ref		Ref		Ref		Ref	
Moderate	1.10	(0.84–1.44)	0.99	(0.85–1.14)	1.10	(0.80–1.50)	0.99	(0.84–1.17)
High	1.05	(0.81–1.35)	0.94	(0.81–1.08)	1.28	(0.95–1.72)	1.07	(0.90–1.26)
Number of evenings out per week								
0–1	Ref		Ref		Ref		Ref	
2–3	2.40***	(1.75–3.28)	1.75***	(1.51–2.02)	2.06***	(1.42–2.98)	1.48***	(1.24–1.76)
4–7	5.42***	(3.87–7.57)	2.62***	(2.21–3.10)	3.25***	(2.18–4.85)	1.77***	(1.44–2.18)
Weekly income from job								
\$10 or less	Ref		Ref		Ref		Ref	
\$11–50	1.03	(0.70–1.53)	1.22*	(1.02–1.47)	0.99	(0.62–1.58)	1.17	(0.95–1.44)
\$51 or more	1.86***	(1.50–2.32)	1.41***	(1.24–1.59)	1.38*	(1.05–1.80)	1.09	(0.94–1.27)
Weekly income from other source								
\$10 or less	Ref		Ref		Ref		Ref	
\$11–50	1.32*	(1.04–1.68)	1.33***	(1.17–1.51)	1.07	(0.81–1.41)	1.14	(0.98–1.32)
\$51 or more	2.09***	(1.53–2.85)	1.33***	(1.10–1.62)	1.19	(0.83–1.71)	0.92	(0.72–1.16)
Lifetime alcohol use								
<10 times					Ref		Ref	
>10 times					7.80***	(5.53–11.03)	4.27***	(3.71–4.90)
Lifetime cigarette use								
Never smoked					Ref		Ref	
1–2 times					4.60***	(3.11–6.81)	3.45***	(2.92–4.07)
Smoke occasionally					13.21***	(8.87–19.66)	6.87***	(5.64–8.38)
Smoke(d) regularly					18.70***	(12.75–27.44)	6.60***	(5.38–8.11)
Lifetime other illicit drug use								
No					Ref		Ref	
Yes					6.58***	(5.15–8.43)	2.29***	(1.97–2.66)

The comparison group for use of hashish ( $n = 686$ ) and other marijuana ( $n = 2744$ ) was students who used neither hashish nor other marijuana ( $n = 7168$ ). AORs are adjusted odds ratios as all other variables were controlled in the multivariable model. The models included cohort and missing data indicators. Results were computed both with and without the missing data indicators and results were nearly identical. MSA, metropolitan statistical area; CI, confidence interval. \* $p < .005$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

students in states with medical marijuana dispensaries might have had easier access to hashish (e.g. through diversion) than students in non-medical marijuana states. Although recreational use was illegal in all states during the years of this study, it is unknown how results apply to states where recreational marijuana use is now legal. MTF also did not ask about method of use (e.g. smoked, ingested). Finally, MTF does not include students who were no longer enrolled or dropped out of school before their final year of high school.

## Conclusions

This was the first national study to examine correlates of hashish use. We delineated various correlates of use, which were often different (or stronger) in comparison to use of other marijuana. Frequent marijuana users and those who use marijuana because they feel they are “hooked” are at high risk for hashish use, so in some instances hashish use can be viewed as an indicator of severity of marijuana use. These findings can inform prevention in a time of increasing

Table 4. Binary logistic regressions comparing hashish use to use of other marijuana (Weighted  $n = 2650$ ).

	Raw proportions		Model 1		Model 2	
	No use, %	Use, %	AOR	(95% CI)	AOR	(95% CI)
Sex						
Male	77.5	22.5	Ref		Ref	
Female	86.2	13.8	0.57***	(0.45–0.73)	0.75*	(0.57–1.00)
Age, years						
<18	81.6	18.4	Ref		Ref	
≥18	81.7	18.3	1.01	(0.79–1.30)	0.88	(0.67–1.16)
Race						
White	79.3	20.7	Ref		Ref	
Black	93.0	7.0	0.36***	(0.20–0.65)	0.48*	(0.25–0.92)
Hispanic	85.6	14.4	0.60*	(0.39–0.93)	0.82	(0.52–1.32)
Population density						
Non-MSA	82.3	17.7	Ref		Ref	
MSA	81.5	18.5	0.99	(0.72–1.36)	1.02	(0.70–1.48)
Religiosity						
Low	81.7	18.3	Ref		Ref	
Moderate	87.2	12.8	0.68*	(0.48–0.97)	0.81	(0.55–1.20)
High	89.4	10.6	0.59*	(0.36–0.95)	0.95	(0.52–1.73)
Family structure						
0 Parents	84.3	15.7	Ref		Ref	
1 Parent	84.3	15.7	1.02	(0.60–1.74)	1.29	(0.73–2.29)
2 Parents	80.8	19.2	1.14	(0.68–1.91)	1.58	(0.91–2.76)
Parent education						
Low	84.1	15.9	Ref		Ref	
Moderate	81.5	18.5	1.05	(0.76–1.45)	1.11	(0.77–1.59)
High	80.6	19.4	1.11	(0.82–1.52)	1.33	(0.92–1.91)
Number of evenings out per week						
0–1	87.6	12.4	Ref		Ref	
2–3	84.0	16.0	1.25	(0.84–1.87)	1.17	(0.75–1.84)
4–7	74.8	25.2	2.09***	(1.37–3.19)	1.30	(0.80–2.12)
Weekly income from job						
\$10 or less	82.9	17.1	Ref		Ref	
\$11–50	86.3	13.7	0.78	(0.48–1.29)	0.75	(0.43–1.31)
\$51 or more	80.1	19.9	1.33*	(1.01–1.74)	1.25	(0.92–1.71)
Weekly income from other source						
\$10 or less	82.3	17.7	Ref		Ref	
\$11–50	82.9	17.1	0.91	(0.67–1.21)	0.83	(0.60–1.15)
\$51 or more	76.0	24.0	1.41	(0.95–2.07)	1.03	(0.67–1.83)
Lifetime alcohol use						
<10 times	93.4	6.6			Ref	
>10 times	78.2	21.8			1.59*	(1.02–2.49)
Lifetime cigarette use						
Never smoked	90.8	9.2			Ref	
1–2 times	86.8	13.2			1.18	(0.77–1.83)
Smoke occasionally	78.8	21.2			1.24	(0.80–1.91)
Smoke(d) regularly	68.3	31.7			1.88**	(1.19–2.97)
Frequency of 12-month marijuana use						
3–5 times	95.0	5.0			Ref	
6–9 times	92.9	7.1			2.28**	(1.30–3.98)
10–19 times	89.7	10.3			3.01***	(1.79–5.06)
20–39 times	91.3	8.7			5.06***	(3.00–8.57)
40+ times	62.5	37.5			9.26***	(5.84–14.69)
Lifetime other illicit drug use						
No	90.3	9.7			Ref	
Yes	70.7	29.3			1.64**	(1.21–2.23)
Reasons for marijuana use						
To experiment – to see what it's like	85.8	14.2			0.83	(0.62–1.11)
To relax or relieve tension	76.6	23.4			1.13	(0.79–1.60)
To feel good or get high	77.9	22.1			1.17	(0.80–1.70)
To seek deeper insights/understanding	66.1	33.9			1.51**	(1.11–2.06)
To have a good time with my friends	78.5	21.5			1.06	(0.76–1.49)
To fit in with a group I like	77.8	22.2			1.42	(0.84–2.40)
To get away from my problems/troubles	75.6	24.4			0.86	(0.59–1.25)
Because of boredom, nothing else to do	72.4	27.6			0.98	(0.72–1.33)
Because of anger or frustration	73.6	26.4			0.90	(0.61–1.31)
To get through the day	61.0	39.0			1.29	(0.84–1.98)
Because I am 'hooked' – I have to have it	44.9	55.1			1.94*	(1.09–3.43)

The comparison group for hashish users ( $n = 486$ ) was students who used marijuana, but not hashish ( $n = 2164$ ). AORs are adjusted odds ratios as all other variables were controlled in the multivariable models. The models included cohort and missing data indicators. Results were computed both with and without the missing data indicators and results were nearly identical. Percentages listed for reasons for marijuana use compare those who checked off "yes" to that reason (e.g. 55.1% of those who said they used hashish because they were hooked used hashish). MSA, metropolitan statistical area. CI, confidence interval. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .



popularity of marijuana use and increasing rates of use of hashish products.

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## Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

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