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Nicotine and cannabis vaping among adolescents in treatment for substance use disorders

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Abstract

This study examined nicotine and cannabis vaping among adolescents in treatment for substance use disorders. Participants were 363 adolescents aged 12–17 (66% male, mean age=15.5 [SD=1.3], 46% non-Hispanic white) seen for a specialty addiction intake evaluation between 2017 and 2019 at one of six medical offices of a large, integrated health care system in Northern California. Multivariable logistic regression models tested for associations of sociodemographics, cigarette smoking, and substance use disorders with vaping behaviors. A majority of adolescents reported ever (68%) or current vaping (60%) of nicotine and/or cannabis; current vaping was similar for nicotine (50%) and cannabis (51%); 40% reported current vaping of both. Current smokers (6% of the sample) had higher odds of ever vaping (aOR=3.95, 95%CI:1.04–14.95). Black (versus non-Hispanic white) adolescents had lower odds of current nicotine vaping (aOR=0.08, 95%CI:0.02–0.37) and current vaping of both nicotine and cannabis (aOR=0.12, 95%CI:0.03–0.60). Having an alcohol use disorder was associated with current vaping (aOR=2.14, 95%CI:1.06–4.33). Those who endorsed that most friends get drunk/high (aOR=1.87,

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Conflict of Interest

JPP has provided consultation to pharmaceutical and technology companies that make medications and other treatments for quitting smoking and has served as an expert witness in lawsuits against the tobacco companies. The other authors declare that they have no financial relationships with any organizations that might have an interest in the submitted work. Other authors report no conflicts of interest.

95% CI: 1.02–3.42) or that cannabis was their substance of choice (aOR=2.36, 95% CI: 1.16–4.81) had higher odds of current cannabis vaping. Higher neighborhood household income (\$80,000–\$120,000 and >\$120,000 vs. <\$80,000, aORs=2.05–9.48), never versus ever blunt use (aORs=2.47–8.68), and intakes in 2018 and 2019 versus 2017 (aORs=2.18–5.38) were associated with higher odds of all vaping outcomes. Vaping was common among adolescents in addiction treatment and varied with sociodemographics and substance-related factors. Research should assess how vaping impacts the development of substance use disorders and whether it interferes with addiction treatment.

Keywords

E-cigarette; Adolescents; Vaping; Nicotine; Cannabis; Addiction treatment

1. Introduction

Vaping is an increasingly common mode of nicotine and cannabis administration among adolescents (Cullen et al., 2019; Dai, 2019; Miech, Patrick, O'Malley, Johnston, & Bachman, 2019; Wang et al., 2019). National data indicate that past-month nicotine vaping increased among U.S. high school students from 11% in 2016 to 20% in 2020, with 23% of users reporting daily use (Cullen et al., 2019; Wang et al., 2020). Similarly, from 2017 to 2019, past-month cannabis vaping increased from 4% to 13% among 10th grade students and from 5% to 14% among 12th grade students (Miech et al., 2019). Nicotine and cannabis vaping during adolescence is associated with significant harms (Singh et al., 2020; U.S. Department of Health and Human Services, 2016, 2019), and the U.S. Surgeon General has declared youth vaping an epidemic (U.S. Department of Health and Human Services, 2019).

A number of factors are associated with adolescent nicotine vaping, including use among peers, e-cigarette marketing, psychological problems, illicit drug use, cigarette smoking and harmful alcohol consumption, household exposure to smoking, and Hispanic or non-Hispanic white race/ethnicity (Barrington-Trimis et al., 2015; Barrington-Trimis et al., 2016; Fielding-Singh, Epperson, & Prochaska, 2020; Kwon, Seo, Lin, & Chen, 2018; Pike et al., 2019). Less is known about correlates of adolescent cannabis vaping, but initial studies indicate that it is more prevalent among current cigarette smokers, older adolescents, and Hispanic or non-Hispanic white adolescents (Dai, 2019).

Despite increased attention to adolescent vaping, few studies have examined vaping among adolescents in addiction treatment. Data from adults in addiction treatment suggest that one-quarter to one-third report current e-cigarette use, compared to 3% of the U.S. population in 2018 (Villarroel, Cha, & Vahratian, 2020), with quitting or reducing combustible cigarette smoking the most commonly endorsed reason for use (Campbell, Le, Gubner, & Guydish, 2019; Gubner, Andrews, Mohammad-Zadeh, Lisha, & Guydish, 2016; Peters et al., 2015; Stein et al., 2015). Studies of vaping among adolescents in addiction treatment and identifying covariates of use are critical to our understanding of at-risk subgroups.

This study capitalizes on the pilot implementation of a new intake template for adolescent specialty addiction treatment that included questions about nicotine and cannabis vaping in

six Kaiser Permanente Northern California (KPNC) medical offices as part of standard care. Study goals are to examine: 1) the prevalence of ever and current nicotine and cannabis vaping in this population, and 2) whether vaping behaviors differ by sociodemographics and behavioral health characteristics.

2. Materials and methods

2.1. Study setting and participants

KPNC is a nonprofit, integrated health care delivery system providing comprehensive health services to 4.5 million members. Adolescents for whom nicotine use is their only substance of abuse are typically treated within primary care. The KPNC Addiction Medicine and Recovery Services (AMRS) Department provides treatment to adolescents for other substance use disorders, including cannabis. The AMRS Department rolled out a new intake form with questions about ever and current vaping of nicotine and cannabis in six medical offices between January 1, 2017, and July 1, 2019. A total of 485 adolescents aged 12–17 received an intake for addiction treatment between the roll-out of the form at each office and December 31, 2019; of those, 363 patients (75%) completed the new intake form and are included in this study. The 122 patients who received an older version of the form without the vaping question did not differ significantly from those who were included on age, sex, or race/ethnicity; however, they were less likely to be diagnosed with a cannabis use disorder ($p < .001$), perhaps in part because the form did not assess cannabis vaping specifically.

2.3. Measures

This study extracted data on age, race/ethnicity, sex, median neighborhood household income (geocoded from census data using patients' addresses), smoking status, and year of intake from the electronic health record (EHR). The study used *International Classification of Diseases, Tenth Revision, Clinical Modification* diagnosis codes to define anxiety disorders (F41, F42, F43, F930, excluding F43.21, F43.23); depressive disorders (F32, F33, F34.1, F43.21, F43.23, excluding F32.5, F33.42); and substance use disorders (excluding “in remission” codes), including alcohol use disorder (F10), cannabis use disorder (F12), other substance use disorders (for opioids; sedatives, hypnotics, or anxiolytics; cocaine; other stimulants; hallucinogens; inhalants; or other psychoactive substances; F11, F13–F16, F18–F19). The study derived ever and current vaping of nicotine and cannabis, substance of choice (cannabis versus other), and whether most of one's friends get drunk/high from standardized response options within the intake template. The study did not assess vaping of other substances, such as nicotine-free e-liquids, or cannabis use as an edible or joint. However, since smoking cannabis within a cigar casing is a common method among African American and Latinx adolescents and distinct enough to detect if reported in the EHR (Fairman, 2015; Montgomery & Mantey, 2017; Ream, Benoit, Johnson, & Dunlap, 2008; Schauer, Rosenberry, & Peters, 2017; Timberlake, 2009), a text search of the intake notes determined history of ever smoking a blunt. Outcomes included: 1) ever vaping nicotine and/or cannabis, 2) current nicotine vaping, 3) current cannabis vaping, 4) any current vaping (nicotine and/or cannabis), and 5) current vaping of both nicotine and cannabis.

2.4. Statistical analyses

The study reported prevalence of vaping outcomes specified here overall and by patients' sociodemographics and comorbidity status; chi-square tests assessed differences in vaping outcomes by patient characteristics. Multivariable logistic regression analyses evaluated whether outcomes were associated with age, sex, race/ethnicity, geocoded household income, alcohol use disorder, other substance use disorder, current smoking status, blunt use, whether most friends get drunk/high, whether cannabis was listed as a substance of choice, and intake year. Cannabis use disorder, depressive disorder, and anxiety disorder were not associated with vaping outcomes in bivariate analyses, and this study excluded them from multivariable models.

3. Results

The sample (N=363) had a mean age of 15.5 years (SD=1.3) and was 66% male; 13% Asian/Pacific Islander, 9% Black, 26% Hispanic, 46% non-Hispanic white, and 6% other/unknown race/ethnicity. Approximately two-thirds of the adolescents reported ever vaping (68%, Table 1); half reported current nicotine vaping (50%) or current cannabis vaping (51%), 60% reported any current vaping of nicotine and/or cannabis, and 40% reported current vaping of both. Six percent reported current cigarette smoking and 19% reported ever using blunts. Two-thirds (66%) had a cannabis use disorder, 16% an alcohol use disorder, and 14% another substance use disorder; 75% said cannabis was their only substance of choice and another 11% named cannabis as one of multiple substances of choice; 35% and 40% had an anxiety or depressive disorder, respectively.

Ever and current vaping of nicotine and/or cannabis was significantly more likely among those residing in neighborhoods of higher household income; who endorsed that most of their friends get drunk or high; who had an intake in 2018 or 2019 versus 2017; and among Asian/Pacific Islander and non-Hispanic white adolescents (Table 1). Ever and current vaping of nicotine and/or cannabis was less likely among Black adolescents and those of other/unknown race/ethnicity, and more likely among adolescents who had never used a blunt. Current nicotine vaping was significantly more likely among adolescents with alcohol use disorders.

In multivariable models (Table 2), those with higher incomes had greater odds of all vaping outcomes (\$80K–120K, aORs=2.05–3.34; >\$120K, aORs=3.68–9.48) relative to those with neighborhood household incomes <\$80K. Having an alcohol use disorder was associated with higher odds of current nicotine vaping (aOR=2.14, 95%CI:1.06–5.05), and current smokers had higher odds of ever vaping (aOR=3.95, 95%CI:1.04–15.95). Never blunt use was associated with higher odds of all vaping outcomes (vs. ever blunt use, aORs=2.47–8.68). Reporting most friends get drunk/high (aOR=1.87, 95%CI:1.02–3.42) or cannabis as a substance of choice (aOR 2.36, 95%CI:1.16–4.81) were associated with higher odds of current cannabis vaping. Having an intake in the last two years of the study (2018 and 2019) was associated with higher odds of all vaping outcomes (versus 2017, aORs=2.18–5.38). Finally, Black adolescents had lower odds of current nicotine vaping (aOR=0.08, 95%CI:0.02–0.37) and current vaping of both nicotine and cannabis (aOR=0.12, 95%CI:0.03–0.60) relative to non-Hispanic white adolescents. In post hoc analyses, we found that Black

adolescents were more likely to report ever blunt use (50%) compared to adolescents with non-Hispanic white (12%), Asian (24%), Hispanic (18%), and other/unknown (23%) race/ethnicity (chi-square $p < .001$). Current smoking was very low for Black adolescents (3%) and adolescents with other/unknown race/ethnicity (0%) and slightly higher for adolescents with non-Hispanic white (7%), Asian (7%), and Hispanic (7%) race/ethnicity, although the difference was not statistically significant (Fisher's Exact Test $p = .81$).

4. Discussion

To our knowledge, this is the first study of vaping behaviors among adolescents entering addiction treatment, and findings indicate higher prevalence than surveillance estimates for adolescents in the U.S. (Cullen, et al., 2019, Miech et al., 2019). Most (85%) reported cannabis as one of their substances of choice, 60% reported current vaping of nicotine and/or cannabis, and about two-thirds had a cannabis use disorder. Of concern, cannabis vaping is associated with vaping use-associated lung injury (EVALI) (American Lung Association, 2020). The high prevalence of cannabis-related problems is consistent with national data on adolescent admissions to addiction treatment (Substance Abuse and Mental Health Services Administration & Center for Behavioral Health Statistics and Quality, 2017).

Notably, adolescents who reported ever using blunts had significantly lower odds of all vaping outcomes, suggesting that those who smoke cannabis via blunts may be less inclined to vape. Study findings also suggested racial/ethnic differences in mode of cannabis administration, with vaping of both nicotine and cannabis less likely, and ever blunt use more likely, among Black versus non-Hispanic white adolescents. Nicotine and cannabis vaping were more common among adolescents who lived in neighborhoods with higher versus lower median household incomes, consistent with prior research in California among young adults (Meng & Ponce, 2020). These findings may be mediated by greater vaping advertisements in higher income neighborhoods (Dai, 2019; Simon et al., 2018). However, other studies of adolescent vaping and socioeconomic status have reported no association (Barrington-Trimis et al., 2015; Moore et al., 2015) or increased risk with lower socioeconomic status (Simon et al., 2017). Research is needed to better understand the mechanisms that contribute to racial/ethnic and socioeconomic differences in vaping among adolescents in addiction treatment.

Interestingly, current smoking was rare (6%) and only associated with increased odds of ever vaping. The lack of association with current vaping behaviors may be due to the low prevalence of smoking in our sample and a potential lack of power to detect associations with vaping outcomes. Adolescents with an alcohol use disorder or who identified cannabis as their substance of choice had higher odds of current cannabis vaping. Other substance use disorders were not significantly associated with vaping outcomes.

This study took place over the period that cannabis was being legalized for adult use in California in January 2018, and we found that all adolescent vaping behaviors increased significantly from 2017 to 2019. Legalization could increase youth use of cannabis via greater availability and desirability, reduced prices, and increased access to cannabis vaping,

the latter of which is considered a more discreet, healthier and cost-effective mode of cannabis delivery than smoking (Budney, Sargent, & Lee, 2015; Malouff, Rooke, & Copeland, 2014). Initial data from Colorado indicate that adolescent addiction medicine providers perceived that adult-use cannabis legalization contributed to normalization of cannabis; validation of its consumption; greater access to new, potent cannabis products; and increased treatment need (Sobesky & Gorgens, 2016).

4.1. Limitations

Participants were treated within a large health care delivery system and results may not generalize to adolescents outside of KPNC or to those without health care access. We cannot determine whether vaping started before or after the onset of other substance use. Outcomes are based on self-report during standard care and may underestimate the prevalence of vaping behaviors. The intake template did not systematically capture other modes of cannabis administration (e.g., edibles, joint) or ever smoking status. Blunt use was based on a text search of the intake notes and is likely under-detected. Finally, the lack of association between cannabis use disorders and vaping may be due to the high prevalence of cannabis use disorders in our sample. Future studies with larger samples should replicate this study's findings. Nevertheless, this study provides useful data on vaping among adolescents receiving addiction treatment that can inform future efforts to improve vaping screening and better assess the impact of vaping on addiction treatment in this population.

5. Conclusion

Given the high prevalence of vaping, results suggest that health care systems and clinicians who treat adolescent substance use may benefit from education and training in how to screen for and address vaping behaviors as part of addiction treatment. Further, the low prevalence of cigarette smoking indicates that exposure to nicotine may be overlooked if adolescent addiction treatment intake screenings for tobacco are limited to cigarettes and do not include nicotine vaping. Future large, longitudinal studies should look at the temporal relation between adolescent vaping and the development of substance use disorders and identify how vaping influences addiction treatment and recovery.

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Highlights

- This study examined nicotine and cannabis vaping in adolescents in addiction treatment.
- Ever and current vaping of nicotine and cannabis was common.
- Vaping was more common among adolescents residing in higher income neighborhoods.
- Vaping prevalence varied by race/ethnicity and alcohol use disorder status.
- Addiction medicine clinicians should screen for and address nicotine and cannabis vaping.

Table 1

Patient characteristics and the prevalence of vaping among adolescents in treatment for substance use disorders, overall and by patient characteristics.

Patient characteristics	Study cohort (N=363)		Ever vaped nicotine and/or cannabis (N=246)		Current nicotine vaping (N=180)		Current cannabis vaping (N=184)		Any current vaping (nicotine and/or cannabis) (N=217)		Current vaping of both nicotine and cannabis (N=147)	
	N (column %)	N (row %)	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a
Overall	363 (100.0%)	246 (67.8%)	180 (49.6%)		184 (50.7%)		217 (59.8%)		147 (40.5%)			
Sex				.24		.91		.17		.08		.78
Female	124 (34.2%)	89 (71.8%)	62 (50.0%)		69 (55.6%)		82 (66.1%)		49 (39.5%)			
Male	239 (65.8%)	157 (65.7%)	118 (49.4%)		115 (48.1%)		135 (56.5%)		98 (41.0%)			
Age				.63		.48		.65		.39		.76
12–15	164 (45.2%)	109 (66.5%)	78 (47.6%)		81 (49.4%)		94 (57.3%)		65 (39.6%)			
16–17	199 (54.8%)	137 (68.8%)	102 (51.3%)		103 (51.8%)		123 (61.8%)		82 (41.2%)			
Race/ethnicity				<.001		<.001		<.001		<.001		<.001
Asian/Pacific Islander	46 (12.7%)	36 (78.3%)	30 (65.2%)		30 (65.2%)		32 (69.6%)		28 (60.9%)			
Black	34 (9.4%)	14 (41.2%)	2 (5.9%)		10 (29.4%)		10 (29.4%)		2 (5.9%)			
Hispanic	95 (26.2%)	58 (61.1%)	45 (47.4%)		42 (44.2%)		53 (55.8%)		34 (35.8%)			
Non-Hispanic White	166 (45.7%)	125 (75.3%)	94 (56.6%)		96 (57.8%)		111 (66.9%)		79 (47.6%)			
Other/unknown	22 (6.1%)	13 (59.1%)	9 (40.9%)		6 (27.3%)		11 (50.0%)		4 (18.2%)			
Geocoded median household income ^b				<.001		<.001		<.001		<.001		<.001
<\$80K	122 (33.6%)	64 (52.5%)	33 (27.0%)		37 (30.3%)		49 (40.2%)		21 (17.2%)			
\$80K–120K	125 (34.4%)	86 (68.8%)	63 (50.4%)		63 (50.4%)		76 (60.8%)		50 (40.0%)			
>\$120K+	115 (31.7%)	96 (83.5%)	84 (73.0%)		84 (73.0%)		92 (80.0%)		76 (66.1%)			
Alcohol use disorder				.13		.03		.55		.10		.23
Yes	59 (16.3%)	45 (76.3%)	37 (62.7%)		32 (54.2%)		41 (69.5%)		28 (47.5%)			
No	304 (83.7%)	201 (66.1%)	143 (47.0%)		152 (50.0%)		176 (57.9%)		119 (39.1%)			
Cannabis use disorder				.07		.08		.21		.09		.16
Yes	240 (66.1%)	155 (64.6%)	111 (46.3%)		116 (48.3%)		136 (56.7%)		91 (37.9%)			
No	123 (33.9%)	91 (74.0%)	69 (56.1%)		68 (55.3%)		81 (65.9%)		56 (45.5%)			

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Patient characteristics	Study cohort (N=363)		Ever vaped nicotine and/or cannabis (N=246)		Current nicotine vaping (N=180)		Current cannabis vaping (N=184)		Any current vaping (nicotine and/or cannabis) (N=217)		Current vaping of both nicotine and cannabis (N=147)	
	N (column %)	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a	P value ^a
Other substance use disorder ^c			.27		.04		.21		.16			.05
Yes	51 (14.0%)	38 (74.5%)		32 (62.7%)		30 (58.8%)		35 (68.6%)		27 (52.9%)		
No	312 (86.0%)	208 (66.7%)		148 (47.4%)		154 (49.4%)		182 (58.3%)		120 (38.5%)		
Depressive disorder			.32		.51		.59		.37			.75
Yes	147 (40.5%)	104 (70.7%)		76 (51.7%)		77 (52.4%)		92 (62.6%)		61 (41.5%)		
No	216 (59.5%)	142 (65.7%)		104 (48.1%)		107 (49.5%)		125 (57.9%)		86 (39.8%)		
Anxiety disorder			.65		.66		.89		.49			.92
Yes	127 (35.0%)	88 (69.3%)		65 (51.2%)		65 (51.2%)		79 (62.2%)		51 (40.2%)		
No	236 (65.0%)	158 (66.9%)		115 (48.7%)		119 (50.4%)		138 (58.5%)		96 (40.7%)		
Current smoker			.05		.36		.71		.20			.97
Yes	22 (6.1%)	19 (86.4%)		13 (59.1%)		12 (54.5%)		16 (72.7%)		9 (40.9%)		
No	341 (93.9%)	227 (66.6%)		167 (49.0%)		172 (50.4%)		201 (58.9%)		138 (40.5%)		
Ever blunt use			<.001		<.001		<.001		<.001			<.001
Yes	70 (19.3%)	27 (38.6%)		16 (22.9%)		9 (12.9%)		18 (25.7%)		7 (10.0%)		
No	293 (80.7%)	219 (74.7%)		164 (56.0%)		175 (59.7%)		199 (67.9%)		140 (47.8%)		
Most friends get drunk/high ^b			.005		.01		<.001		.01			<.001
Yes	270 (74.4%)	194 (71.9%)		145 (53.7%)		152 (56.3%)		173 (64.1%)		124 (45.9%)		
No	88 (24.2%)	49 (55.7%)		34 (38.6%)		31 (35.2%)		43 (48.9%)		22 (25.0%)		
Substance of choice = cannabis			.98		.16		.15		.69			.66
Yes ^d	310 (85.4%)	210 (67.7%)		149 (48.1%)		162 (52.3%)		184 (59.4%)		127 (41.0%)		
No	53 (14.6%)	36 (67.9%)		31 (58.5%)		22 (41.5%)		33 (62.3%)		20 (37.7%)		
Intake year			.005		<.001		<.001		<.001			<.001
2017	60 (16.5%)	30 (50.0%)		17 (28.3%)		16 (26.7%)		23 (38.3%)		10 (16.7%)		
2018	105 (28.9%)	74 (70.5%)		61 (58.1%)		61 (58.1%)		70 (66.7%)		52 (49.5%)		

Patient characteristics	Study cohort (N=363)		Ever vaped nicotine and/or cannabis (N=246)		Current nicotine vaping (N=180)		Current cannabis vaping (N=184)		Any current vaping (nicotine and/or cannabis) (N=217)		Current vaping of both nicotine and cannabis (N=147)	
	N (column %)	N (row %)	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a	N (row %)	P value ^a
2019	198 (54.5%)	142 (71.7%)	102 (51.5%)		107 (54.0%)		124 (62.6%)		85 (42.9%)			

^a χ^2 test P values; bold indicates $p < .05$

^b One patient was missing income information, and five patients were missing information for friends' substance use.

^c Other substance use disorders included disorders related to opioids; sedatives, hypnotics, or anxiolytics; cocaine; other stimulants; hallucinogens; inhalants; or other psychoactive substances; ICD-10 codes F11, F13–F16, and F18–F19 were used, excluding “in remission” codes.

^d Some patients listed substances in addition to cannabis.

Adjusted odds ratios with 95% confidence intervals of ever and current vaping among adolescents in treatment for substance use disorders.^a

Table 2.

	Ever vaped nicotine and/or cannabis	Current nicotine vaping	Current cannabis vaping	Any current vaping (nicotine and/or cannabis)	Current vaping of both nicotine and cannabis
Age (per year)	1.02 (0.82, 1.26)	1.05 (0.85, 1.29)	0.98 (0.79, 1.21)	1.08 (0.87, 1.33)	0.95 (0.76, 1.19)
Female (Ref. = male)	1.49 (0.85, 2.64)	1.00 (0.58, 1.71)	1.61 (0.92, 2.82)	1.72 (0.99, 3.00)	0.94 (0.53, 1.68)
Race/ethnicity (Ref. = non-Hispanic White)					
Asian	1.43 (0.56, 3.66)	1.89 (0.80, 4.44)	2.24 (0.90, 5.56)	1.66 (0.67, 4.12)	2.67 (1.10, 6.49)
Black	0.52 (0.21, 1.26)	0.08 (0.02, 0.37)	0.84 (0.31, 2.29)	0.47 (0.18, 1.20)	0.12 (0.03, 0.60)
Hispanic	0.69 (0.37, 1.28)	1.11 (0.61, 2.01)	0.86 (0.47, 1.58)	0.93 (0.51, 1.69)	1.03 (0.55, 1.93)
Other/Unknown	0.68 (0.25, 1.90)	0.75 (0.27, 2.09)	0.33 (0.10, 1.02)	0.72 (0.26, 2.00)	0.30 (0.08, 1.09)
Geocoded household income (Ref. = <80K)					
\$80K–120K	2.05 (1.12, 3.74)	2.91 (1.57, 5.39)	2.34 (1.26, 4.32)	2.44 (1.35, 4.42)	3.34 (1.69, 6.62)
>\$120K	3.68 (1.79, 7.55)	7.42 (3.68, 14.95)	6.08 (2.99, 12.37)	5.79 (2.84, 11.77)	9.48 (4.49, 20.00)
Alcohol use disorder	1.68 (0.79, 3.57)	2.14 (1.06, 4.33)	1.31 (0.64, 2.65)	1.71 (0.83, 3.50)	1.75 (0.85, 3.62)
Other substance use disorder ^b	1.14 (0.52, 2.49)	1.41 (0.67, 2.96)	1.28 (0.60, 2.71)	1.26 (0.59, 2.67)	1.49 (0.69, 3.21)
Current smoking	3.95 (1.04, 14.95)	1.67 (0.61, 4.58)	1.69 (0.60, 4.75)	2.39 (0.80, 7.11)	1.25 (0.44, 3.56)
Never blunt use	3.89 (2.05, 7.37)	2.47 (1.21, 5.05)	8.68 (3.76, 20.03)	4.33 (2.21, 8.49)	5.78 (2.24, 14.91)
Most friends get drunk/high	1.68 (0.94, 3.00)	1.39 (0.77, 2.53)	1.87 (1.02, 3.42)	1.40 (0.79, 2.50)	2.01 (1.04, 3.90)
Substance of choice = cannabis ^c	1.35 (0.65, 2.79)	0.79 (0.39, 1.61)	2.36 (1.16, 4.81)	1.25 (0.61, 2.54)	1.57 (0.75, 3.31)
Intake year (Ref. = 2017)					
2018	2.18 (1.01, 4.69)	3.88 (1.73, 8.73)	3.53 (1.54, 8.07)	3.30 (1.51, 7.23)	4.73 (1.86, 12.00)
2019	2.71 (1.36, 5.40)	3.60 (1.72, 7.55)	4.21 (1.97, 9.02)	3.37 (1.67, 6.81)	5.38 (2.23, 12.95)

^aN=357; 6 patients were excluded due to missing geocoded household income (n=1) or friends' substance use (n=5). Bold indicates p <.05.

^bOther substance use disorders included disorders related to opioids; sedatives, hypnotics, or anxiolytics; cocaine; other stimulants; hallucinogens; inhalants; or other psychoactive substances; ICD-10 codes F11, F13–F16, and F18–F19 were used, excluding “in remission” codes.

^cSome patients listed substances in addition to cannabis.