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Modes of Cannabis Use: A Secondary Analysis of an Intensive Longitudinal Natural History Study

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Abstract

Introduction: There is a paucity of research on modes of cannabis use (e.g., joint vs. blunt), and further, little consensus on how to accurately assess both modes of use and route of administration. This secondary analysis used a longitudinal design with data collected daily to characterize mode of cannabis use.

Methods: 193 adult daily cannabis users who were considering quitting at some point enrolled in the study. No treatment was provided. Each day for 84 days, participants reported on mode of cannabis use (i.e., joints, blunts, pipes/vaporizer and food) using an interactive voice response system. We report on single and poly-use of modes across study days and weeks and examine characteristics associated with different modes of use.

Results: White participants were most likely to use pipes/vaporizer, with use on 57% of study days, while Black participants were most likely to use blunts with use on 53% of days. Thus, joint use was less common in both groups. Poly-use of different modes within the same week was very common (i.e., 56% of weeks among White participants and 60% of weeks in Black participants).

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Contributors

JRH and AJB designed the parent study and wrote the protocol. ABH conducted data analyses. JMS wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of interest

Dr. Hughes has received consulting and speaking fees from several companies that develop or market pharmacological and behavioral treatments for smoking cessation or harm reduction, and from several non-profit organizations that promote tobacco control. He has received consulting fees from Swedish Match, Altria and Philip Morris International to assist their efforts to develop less-risky tobacco products.

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Age, gender, race, cannabis dependence, presence of others during cannabis use, and alcohol use were associated with different modes of use.

Conclusions: The major limitation of this study was use of a convenience sample and lack of detailed data on vaporizer use. Joint use is no longer the most common mode of use in either White or Black participants and exclusive use of a single modality is uncommon.

Keywords

Cannabis; Marijuana; Route of administration; Joint; Blunt; Pipes; Race; Interactive voice response

1. Introduction

Recent national estimates suggest that the prevalence of cannabis use and use disorder is increasing over time (Hasin et al., 2015), yet there is little consensus on how to measure cannabis use (Asbridge, Duff, Marsh, & Erickson, 2014; Cuttler & Spradlin, 2017; Gray, Watson, & Christie, 2009; Lopez-Pelayo, 2015). One of the critical aspects of such measurement is specifying the route of administration (e.g., smoke, eat, vaporize). Indeed, a major problem in cannabis studies is that most do not assess cannabis route of administration (National Academies of Sciences, 2017). Investigating and accurately characterizing cannabis route of administration is important because of the growing number of methods used to administer cannabis (e.g., blunts, vaporizers, dabbing) (National Academies of Sciences, 2017). Given this, route of administration must be considered when forming policies to legalize or decriminalize cannabis (Budney, 2017; Wen, Hockenberry, & Cummings, 2015). In addition, accurate evaluation of the impact of cannabis legalization and other regulatory policies will require valid assessments of the different methods of cannabis use.

Route of administration affects the onset, intensity and duration of drug effects and adverse health outcomes (Ehrler, 2015; Russell, Rueda, Room, Tyndall, & Fischer, 2018). For example, smoking cannabis delivers delta-9-tetrahydrocannabinol (THC) to the central nervous system more rapidly than oral ingestion, and this can lead to greater adverse events and abuse liability (Vandrey et al., 2017).

Within each route of administration, there are different modes of cannabis use. For example, smoking cannabis can be via joint, blunt, bong, pipe, or waterpipe. Differing modes of cannabis use may also be associated with differing drug effects and outcomes. For example, smoking blunts is associated with greater levels of perceived intoxication and withdrawal than other smoking modes (Hughes et al., 2014), and joints produce more plasma THC than blunts (Cooper & Haney, 2009).

In the past, joints were considered the most common mode of use, but the current picture of modes of use is much less clear. For example, one recent nationally-representative, US cross-sectional study found that pipes are as commonly used as joints (Schauer, King, Bunnell, Promoff, & McAfee, 2016), and an online survey study found pipes to be the most common route of administration (Cuttler, Mischley, & Sexton, 2016). Yet a clinical study

reported that blunt use is the most common followed by joints then pipes (Mariani, Brooks, Haney, & Levin, 2011) in a sample of predominantly black participants. These mixed findings may be in part due to the inconsistent assessment of cannabis modes of use in the literature. In fact, we conducted a literature search of articles containing text on any mode of cannabis use, and of the most recent 20 published articles, 9 reported data on modes of use, 7 assessed only joint use, 2 assessed multiple modes of use (i.e., 2-3 modes), none assessed more than three modes, and none reported on poly-use of different modes.

Taken together, there is little empirical work examining cannabis modes of use, and the studies published to date have been limited in generally examining only one or two modes of use, not assessing poly-use, and measuring mode of use at only one timepoint (Supplemental Table 1).

Clear racial differences in modes of use also exist; i.e., there is a substantially higher prevalence of blunt use among US Black individuals (Mariani et al., 2011; Montgomery & Mantey, 2017) than among US White individuals, and a higher percentage of White individuals use joints and pipes compared to Black individuals (Mariani et al., 2011; Schauer et al., 2016).

In this study, we add to the prior literature by examining the natural history of cannabis modes of use, including poly-mode use, using daily monitoring across a three-month period in a racially diverse sample. The major assets of this approach are that it minimizes retrospective recall bias and avoids restricting analysis to treatment seekers.

The aims of the present analyses were to: 1) Longitudinally quantify modes of cannabis use, including poly-use, across a three-month period, 2) Explore racial differences in modes of use, and 3) Determine the association between demographic, substance use and other characteristics with modes of use. Data for this secondary analysis come from an intensive natural history study examining cannabis use among daily cannabis users who planned to stop or reduce their use at some point in the future (Hughes, Naud, Budney, Fingar, & Callas, 2016). We refer to this prior study as the “parent study.” We previously reported on modes of use from this trial (Hughes et al., 2014), but reported only on ever use at any point in the 84-day study.

2. Methods

2.1. Parent Study

Participants in the parent study were 193 daily cannabis users who planned to quit or reduce their use at some point in the future, recruited to join a 3-month longitudinal, non-treatment study. Full study methodology has been described in detail elsewhere (Hughes et al., 2014). Briefly, participants were adults (≥ 18 years of age), using cannabis on at least 5 days of the week, reported an interest in reducing or stopping cannabis at some point in the next 3 months and were not dependent on illicit substances other than cannabis. Participants were recruited online and through flyers posted in the community. All participants provided written informed consent prior to participating, and the University of Vermont Committees on the Use of Human Participants approved this study.

2.1.1 Study Design and Procedures—Participants called an interactive voice response (IVR) system each morning by phone for 3 months to report cannabis use the prior day. IVR is a phone-based system in which participants respond to questions using their telephone keypad (Corkrey & Parkinson, 2002). Substance use outcomes are more accurately reported on IVR versus telephone interview, written assessments or in person interview formats (Aquilino, 1992; Kobak et al., 1997).

2.2. Measures

2.2.1. Baseline Demographics and Cannabis Use History—The baseline survey collected data on demographic characteristics and cannabis use history including age of onset of cannabis use, number of times per day of use of each mode of cannabis, problems associated with cannabis use via the Marijuana Problem Scale (MPS) (Stephens, Roffman, & Simpson, 1994), and cannabis abuse and dependence diagnoses using a self-report version of the DSM-IV Checklist (Hudziak et al., 1993). The MPS is a 19-item self-report measure assessing problems associated with marijuana use on a three point scale ranging from “0 = not at all a problem” to “2 = a serious problem.” Depression was also assessed at baseline using the Brief Symptom Inventory (Derogatis, 1993).

2.2.2. Modes of Cannabis Use—Each day, participants were asked “How many joints did you smoke yesterday,” “Yesterday, how many blunts did you smoke,” “Yesterday, how many times did you use marijuana via a pipe, bong, vaporizer, or water pipe?”, and “Yesterday, did you use marijuana in food (i.e., “edibles”)? (yes vs no).” When developing the parent study, we thought that joint and blunt use would be the most common modes, and thus we combined the other modes (i.e., pipe, bong, vaporizer, water pipe) into one category. Herein, we refer to this category as pipes/vaporizer for brevity.

2.3. Data Analysis

As reported in the parent study publication (Hughes et al., 2016), 11% of participants dropped out during the study. For the present secondary analysis, we excluded an additional 79 of the 193 enrolled participants. Participants in the pilot phase of the study (n=38) were excluded because they were not asked cannabis mode of use questions. We required at least 14 days of data across the 3 month IVR period to obtain sufficient data for an accurate assessment of modes of use, this excluded an additional 28 participants. Because mode of use was likely to vary between White and Black participants and because other racial categories (e.g. Hispanic) were rare (n=13), we included only participants who were White or Black. Demographic and cannabis use characteristics of the remaining 114 subjects were compared by race using chi square tests and one-way ANOVA.

To best capture single and poly-use of modes, we constructed the following dependent variables by summarizing reported use of modes across the 84 study days: Joint only use, blunts only use, pipes/vaporizer only use, and poly-use only. Herein, for brevity, we refer to these variables as joints, blunts, pipes/vaporizer, and poly-use. Edibles as an exclusive mode of cannabis use was minimal (only 31% reported any use of edibles during the 84 study days with the majority of participants who did use reporting use on <3 days). Thus, the incidence

of edible use was insufficient to perform any inferential statistical methods and only descriptive statistics are presented for this outcome.

We used both daily and weekly units of analysis to descriptively quantify modes of cannabis use. This was based on our prior finding that participants in the parent trial made frequent changes in their cannabis smoking behavior throughout the study (Hughes et al., 2016). Thus, we wanted to quantify these changes using granular units of analyses. When calculating prevalence rates for modes of cannabis use we only used data from days and weeks that participants reported use of cannabis. When we analyzed data on a weekly basis, we required subjects to have data on at least 4 days of that week in order to minimize bias from missing data.

For our third aim to examine predictors of each primary mode of use, we fit finite mixture models (FMM)(Kessler, 2012) using baseline variables that were associated with cannabis administration in the literature (i.e., gender, race, alcohol use, education level, use of marijuana alone vs. with others, intention to quit cannabis, current cigarette smoking, DSM-IV cannabis dependence, baseline depression level measured by the BSI). We were unable to include the use of medical marijuana, synthetic marijuana (e.g., K2 Spice) and other illicit drug use in the models because too few participants endorsed this type of use ($n < 20$). To ensure that each participant provided the same amount of data, we calculated the percentage of days each participant used each mode and then averaged across participants.

Many participants reported no use of one or more modes during the study (i.e., 37%, 48%, 38% and 11% of participants did not use joints, blunts, pipes/vaporizer, and poly-use, respectively). Given this, we chose FMM because the distribution of the proportion of use of each mode had a large number of zero proportions (indicating that many respondents did not use that mode of use exclusively on any day), with non-zero proportions having a symmetric distribution around a mean. FMM thus allowed us to fit a logistic model to describe the probability of having a non-zero proportion of use, while simultaneously fitting a linear regression model to the non-zero proportions. The FMM analyses were run on transformed proportions of modes of use using the arcsine of the square root of the proportion, given that proportions of modes of use were not normally distributed within participants. Four distinct multivariable FMM models were run, each using a primary mode of use (e.g., joints, blunts, pipes/vaporizer, poly-use) as the dependent variable.

Descriptive analyses were conducted in IBM SPSS Statistics 25.0 (Armonk, NY: IBM Corporation) with significance set at $p < .05$. Finite mixture modeling was performed with the FMM procedure of the SAS System for Windows, version 9.4 (Cary, NC: SAS Institute, Inc.).

2.4. Participants

Participants were 35% Black, 57% female, began using cannabis regularly at a mean age of 16, and reported using cannabis a mean of four times per day (Table 1). Demographic and cannabis use characteristics in our sample were largely similar to those reported in the National Survey on Drug Use and Health (NSDUH) using NSDUH data from the timeframe when we enrolled subjects in the parent trial (NSDUH, 2010; Table 1).

3. Results

3.1. Prevalences of Modes of Use

The analyses of modes of cannabis use across days were based on a median of 61 days (25th and 75th percentiles of 38 and 78 days) in White participants and 70 days (53-81) in Black participants (i.e., 73% and 83% of a possible 84 study days). The analyses across study weeks was based on a median of 11 weeks (5-12) in White participants and 11 weeks (9-12) in Black participants; i.e. 92% of a possible 12 weeks. For White and Black participants, abstinence from cannabis was reported on a median of 7 and 2 days, and data were missing on a median of 5 and 3 days, respectively.

On most days and weeks, White participants predominantly reported using pipes/vaporizer, whereas Black participants predominantly used blunts (Figure 1, Table 2). Overall, 62% of White participants used pipes/vaporizer on most (i.e., > 50%) days of the study, and 55% of Black participants used blunts on most study days (Table 3). Surprisingly, very few White (14%) and Black (18%) participants used joints on most days. Sole use of blunts by White participants (5% of weeks) and sole use of pipes/vaporizer by Black participants (1% of weeks) during a week was very rare.

Use of multiple modes on the same day was rare (17% of days in White participants and 24% of days in Black participants) but use of multiple modes in the same week was very common (56% of weeks in White participants and 60% of weeks in Black participants). In fact, for both White and Black participants, use of all three modes occurred on 15% of the weeks. The most common source of poly-use among White participants was joints combined with pipes and among Black participants was joints combined with blunts (Figure 1, Table 2).

Use of cannabis via edibles was reported by 35 respondents (7 Black and 28 White participants), and of these 35, there was a median of 2 days (IQR = 1, 3) of edible use. The maximum number of days of edible use by any respondent was 8 days. Most of the edible use (89%) occurred on the same day as use of another mode of cannabis administration.

3.2. Finite Mixture Modeling

In the logistic model predicting any use of joints during at least one day of the study, older age and absence of cannabis dependence were significantly associated with any use of joints (Table 4). In the linear models predicting the proportion of days in which joint use occurred during the study, older age was positively and significantly associated with a higher proportion of days of joint use, whereas greater occasional alcohol use (vs. never use) was associated with fewer days of joint use (Table 4).

For any use of blunts, younger age, Black race, using cannabis with others, and reporting never using alcohol (vs. regular use) at baseline were all associated with any use of blunts during the study. Female gender was associated with an increased proportion of days of blunts use, whereas White race was associated with a lower proportion of days of blunt use in the linear models.

In the logistic model predicting any use of pipes/vaporizer on a day during the study, younger age and White race were associated with any use of pipes/vaporizer. In the linear models of pipes/vaporizer usage, White race, using cannabis alone, and regular and occasional alcohol use at baseline were all associated with increased pipes/vaporizer use.

Finally, in the logistic model predicting poly-use, none of the predictors examined were significantly associated with any poly-use during the study. In the linear model predicting the proportion of days of poly-use, using cannabis alone was associated with a lower proportion of days of use of poly modes.

Taken together, only age and race were consistent and significant predictors across logistic and linear models within a mode. Specifically, age predicted joint use in both types of models with older age associated with any joint use during the study and with a higher proportion of days of joint use. For race, across both linear and logistic models, Black participants were more likely to use blunts, and White participants were more likely to use pipes/vaporizer.

4. Discussion

The present study reported on single and poly-modes of cannabis use (i.e., joints, blunts, pipes/vaporizer) across 84 study days in an intensive natural history study, and examined characteristics associated with different modes of use. White participants were most likely to use pipes/vaporizer, while Black participants were most likely to use blunts, and joint use was less common in both groups. Poly-use of different modes within the same week was very common in both racial groups. Edible use was uncommon among both races. Age, gender, race, cannabis dependence, presence of others during cannabis use, and alcohol use were all associated with use of different modes of cannabis.

Our findings are consistent with prior studies that found Black participants preferring cannabis administered by blunts and White participants cannabis administered via pipes (Mariani et al., 2011). Further, similar to our study, a prior report concluded that the second most common mode of use in both White and Black participants is joints (Mariani et al., 2011). Also, consistent with a prior report (Schauer et al., 2016), younger participants reported more pipes/vaporizer and blunt use, and older participants reported more joint use. This finding suggests a secular trend such that joint use is being replaced by use of pipes and vaporizers. However, it is difficult to make comparisons between our sample and the prior literature as the prior work used different time frames of assessment (e.g., past 30 days or past year vs. 84 consecutive days), examined different modes of use, and did not always examine racial differences in modes of use.

Several US states and some nations have moved to decriminalize and legalize cannabis. Evaluation of the consequences of these changes is important and our results suggest that to successfully do so, it will be important to consider modes of use when measuring cannabis use, especially considering different modes may affect different clinical outcomes and potentially the development of cannabis use disorder (Budney, 2017). It is not clear whether legalizing cannabis will result in the uptake of modes of use that are different than those

observed when cannabis is illegal. Our results also suggest that evaluations should ask separately about joint, blunt, pipe, and vaporizer use. In addition, given the high frequency of poly-use, asking about “most common” or “typical” mode could produce misleading results. Our results support calls to examine results by White vs. Black race; whether results should be examined separately for other races/ethnicities needs to be determined. Given the compelling racial differences observed for prevalence of modes of use in our sample and in the prior literature, the legalization/decriminalization of cannabis may affect different geographic areas in different ways. Additionally, given that younger age was associated with increased use of some modes, our findings support close monitoring of youth uptake of cannabis in the context of the shifting cannabis regulation landscape. Finally, edible use was relatively uncommon in our study, a promising finding given the unique regulatory concerns associated with edibles (e.g., delayed onset of drug effects, package labeling)(Barrus et al., 2016).

The present study has several limitations. First, as mentioned, we combined pipes and vaporizers into one category preventing us from examining them as two distinct modalities and due to limited use of edibles, we were unable to examine this mode of use. Additionally, we did not provide participants with detailed descriptions (e.g., pictures) of each mode and it’s possible that some participants were not familiar with some modes. Second, we were unable to answer our research question in nationally-representative surveys including NSDUH or NESARC as they provide very little data on mode of use. Third, we did not biochemically assess cannabis use and THC levels and thus cannot objectively verify cannabis intake. This may be especially important as many individuals often mix cannabis and tobacco potentially affecting THC levels (Van der Kooy, Pomahacova, & Verpoorte, 2009). Finally, our sample was limited to daily cannabis users planning to quit or cut down on their use and thus our findings do not generalize to individuals not motivated for treatment or intermittent or recreational cannabis users.

One major asset of the current study is that our assessment of modes of cannabis use was not via a single question about typical use but based on data from 84 days using an IVR system that maximized accuracy of reporting and led to minimal missing data. In addition, the study assessed multiple modes of cannabis use including poly-use. Further, our sample was generally similar to a nationally-representative sample of NSDUH participants in terms of demographic and smoking characteristics. Finally, the study was one of the first to examine demographic and other predictors of which mode cannabis users choose.

4.1 Conclusions

Hopefully, our results will convince clinicians, researchers and administrators that assessment of cannabis use requires careful assessment of mode of use including polyuse of modes. Future directions include replicating the current findings in a larger and more representative sample, determining how the present results extend to vaping and edibles as distinct modes of use, and examining the consistency of modes of use over time and frequency of transitions among modes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- White participants predominantly used pipes/vaporizer
- Black participants predominantly used blunts
- Joints are not the most common mode of cannabis use
- Poly-use on a weekly basis was very common
- Correlates of modes of use are discussed

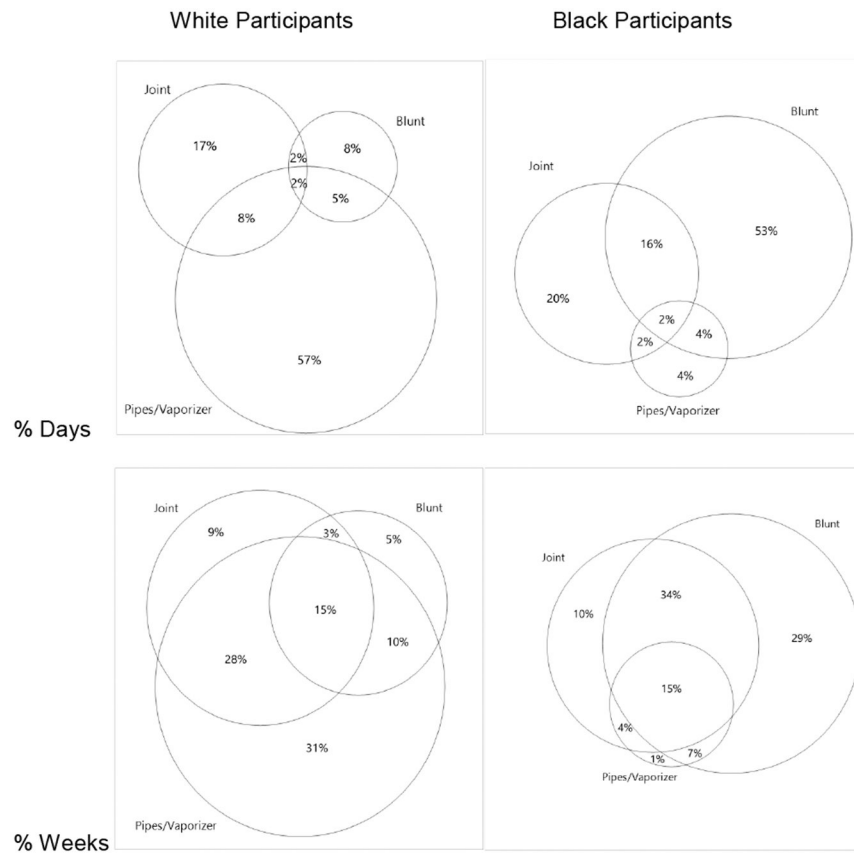


Figure 1. Mean percent of days and percent of weeks of use of each mode throughout the study by race

Note. Overlap between modes is approximate. Upper two panels represent % of days of use of each mode across the study and lower panels represent % of weeks of use of each mode across the study.

Demographic and cannabis use characteristics by race in the current sample and compared to the National Survey on Drug Use and Health (NSDUH) 2010

Table 1.

	Current Sample ^a			NSDUH 2010 ^b	
	White (n=74, 65%)	Black (n=40, 35%)	p-value	White (n=852, 79%)	Black (n=226, 21%)
Demographics					
Age ^c	30.7 ± 11.2	34.2 ± 10.8	0.10	32	28
Gender			0.21		
Female	53	65		29	36
Male	47	35		71	64
Education			0.002		
< High school	5	3		18	28
High school degree/equivalent	15	47		29	32
Some college	51	37		34	35
College degree or higher	28	13		19	5
Marital Status			0.35		
Never married	78	76		52	76
Divorced/separated	7	16		19	8
Widowed	1	0		2	1
Married	14	8		28	15
Employment status			0.33		
Full time job	35	23		53	51
Part time job	19	20		19	12
Unemployed	19	33		8	21
Student or other	27	25		20	16
Cannabis use					
Age of first cannabis use ^c	15.5 ± 3.4	17.1 ± 3.8	0.023	15	14
Times of cannabis use/day ^c	4.2 ± 2.6	4.8 ± 3.2	0.20	n/a	n/a

	Current Sample ^a			NSDUH 2010 ^b	
	White (n=74, 65%)	Black (n=40, 35%)	p-value	White (n=852, 79%)	Black (n=226, 21%)
DSM-4 Cannabis use					
Abuse	10	8	0.72	4	10
Dependence	72	60	0.21	14	24
Marijuana Problem Scale (MPS) ^c					
MPS total score	10.6 ± 0.8	7.5 ± 0.9	0.020	--	--
MPS total # of items endorsed	7.8 ± 0.5	5.6 ± 0.7	0.021	--	--

^a% unless otherwise indicated^b% unless otherwise indicated^cMean ± SD for current sample and median for NSDUH sample

Note. MPS total score derived by summing scores on all items on the measure (scores range 0-2; total score range 0-38); MPS total number of items endorsed refers to the sum of items with scores >0 ; NSDUH, National Survey on Drug Use and Health, examining data from individuals (n=1078, weighted) who used cannabis on 20 days per month in the past year and were not abusing other substances including alcohol.

Table 2.

Mean percent of days and percent of weeks of use of each mode overall, alone, and in combination with other modes throughout the study by race

	% of Days Used		% of Weeks Used	
	White	Black	White	Black
Any Use of a Mode *				
Joints	29	40	55	63
Blunts	17	76	33	84
Pipes/vaporizer	72	12	87	27
Sole Use of a Mode				
Joints only	17	20	9	10
Blunts only	8	53	5	29
Pipes/vaporizer only	57	4	31	1
Use of a Mode in Combination with Another Mode				
Joints plus other mode	12	20	46	53
Blunts plus other mode	9	22	28	56
Pipes/vaporizer plus other mode	15	8	53	26

* Columns can add to more than 100% because participants use more than one mode in a given day or week.

Table 3.

Majority use of daily and weekly modes of cannabis use.

Percent of participants who used each mode of cannabis on the majority of study days (>50% of days)				
	Joints	Blunts	Pipes/vaporizer	Poly-use
White	10 (14)	8 (7)	46 (62)	7 (9)
Black	7 (18)	22 (55)	1 (3)	4 (10)
Percent of participants who used each mode of cannabis on the majority of study weeks (>50% of weeks)				
White	5 (7)	4 (5)	16 (21)	42 (57)
Black	3 (7)	13 (32)	0 (0)	23 (59)

Note. Tabled values represent n (%)

Multivariable analyses predicting any use of a cannabis mode and the proportion of days participants primarily used a given mode of cannabis

Table 4.

	Logistic Model (Any vs. No Use) OR (95% CI)				Linear Model (Proportion of Days Used) Beta (95% CI)			
	Joints Only	Blunts Only	Pipes/Vaporizer Only	Poly-use Only	Joints Only	Blunts Only	Pipes/Vaporizer Only	Poly-use Only
Demographics								
Age	1.08 (1.02, 1.14)	0.95 (0.90, 0.99)	0.89 (0.83, 0.95)		0.05 (0.02, 0.07)			
Female vs. male						0.43 (0.09, 0.78)		
White vs. Black		0.04 (0.01, 0.16)	17.47 (4.70, 64.9)			-0.63 (-1.01, -0.25)	0.77 (0.47, 1.07)	
Cannabis Use								
DSM-IV cannabis dependent vs. not dependent	0.24 (0.08, 0.73)							
Uses cannabis alone vs. does not use alone		0.34 (0.12, 0.96)					0.31 (0.14, 0.48)	-0.21 (-0.36, -0.06)
Alcohol Use								
Regular alcohol use vs. never use		0.19 (0.04, 0.94)					0.38 (0.03, 0.73)	
Occasional alcohol use vs. never use					-0.64 (-1.16, -0.12)		0.38 (0.03, 0.72)	

Note: Table displays odds ratios (OR) (95% confidence interval) for logistic models and beta estimate (95% confidence interval) for linear models in the finite mixture modeling procedure. The logistic component models variables predicting whether or not participants ever reported the outcome (e.g., use of joints only) on a day during the study, while the linear component evaluates which variables predict the amount of use among those subjects who did use a given mode. The table displays only significant predictors ($p < .05$), however the models also included the following variables: Education level (college degree, some college, high school degree or less), plan to quit marijuana in future (yes/no), current cigarette smoker status (yes/no), and depression measured by the Brief Symptom Inventory. DSM-IV refers to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition.