



Co-use of cigarettes and cannabis among people with HIV: Results from a randomized controlled smoking cessation trial

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HIGHLIGHTS

- Increased cannabis use over 6 months was associated with reduced odds of quitting cigarettes at 6 months among people with HIV.
- Preliminary evidence suggests that increasing cannabis use may impact cigarette cessation among people with HIV who are motivated to quit cigarettes.
- Interventions that address cigarette and cannabis use concurrently warrant further investigation.

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ABSTRACT

Significance: People with HIV (PWH) who smoke cigarettes have lower cessation rates than the general population. This study investigated whether changes in cannabis use frequency impedes cigarette cessation among PWH who are motivated to quit.

Methods: Between 2016-2020, PWH who smoked cigarettes were enrolled in a randomized controlled trial for cigarette cessation. Analyses were limited to PWH who reported on their past 30-day (P30D) cannabis use during four study visits (baseline, 1-month, 3-month, and 6-month) (N=374). Descriptive statistics and multivariable logistic regression were used to evaluate changes in cannabis use frequency from baseline to 6 months and associations with cigarette abstinence at 6 months among PWH who reported no use during all four visits (n=176), as well as those who reported use during at least one visit and who increased (n=39), decreased (n=78), or had no change (n=81) in use frequency.

Results: Among those who reported cannabis use during at least one visit (n=198), at baseline, 18.2% reported no use. At 6 months, 34.3% reported no use. Controlling for covariates, increased cannabis use frequency from baseline was associated with reduced odds of cigarette abstinence at 6 months versus decreased use frequency (aOR=0.22, 95% CI=0.03, 0.90) or no use at either time-point (aOR=0.25, 95% CI=0.04, 0.93).

Conclusions: Increased cannabis use over 6 months was associated with reduced odds of cigarette smoking abstinence among PWH who were motivated to quit. Additional factors that influence cannabis use and cigarette cessation simultaneously are in need of further study.

1. Introduction

Past-year cannabis use prevalence reached 18% in the U.S. in 2019 (Substance Abuse and Mental Health Services Administration, 2020),

with even higher prevalence among people who smoke cigarettes. As of 2018, ~29% of people in the U.S. who smoke cigarettes reported cannabis use in the past 12 months. Approximately 35% of people who smoke cigarettes daily are also using cannabis daily (Gravelly et al.,

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2022; Gravely et al., 2020). Moreover, co-use of cigarettes/cannabis is associated with greater nicotine dependence compared to cigarette smoking alone (Weinberger et al., 2021) and cigarettes/cannabis co-use may undermine cigarette smokers' motivation to quit cigarettes and quit success (Driezen et al., 2022; Goodwin et al., 2022; Schauer et al., 2017; Strong et al., 2018; Vogel et al., 2018; Weinberger, Delnevo, et al., 2020; Weinberger, Pacek, et al., 2020; Weinberger et al., 2018), though other work suggests that cannabis use may not hinder cigarette smoking cessation after adjusting for other factors (Rabin et al., 2016; Westmaas et al., 2021). Still, co-use of cigarettes/cannabis is associated with higher toxicant levels (e.g., acrylonitrile, acrylamide) indicative of cardiovascular disease risk compared to use of cannabis alone, though there are mixed reports on whether such toxicant levels may be similar (Lorenz et al., 2021) or higher (Smith et al., 2020) for cigarette/cannabis co-users compared to cigarette smokers who do not use cannabis.

People with HIV (PWH) smoke cigarettes at higher rates (Asfar et al., 2021; Mdodo et al., 2015) and have lower cigarette quit rates (Mdodo et al., 2015) than the general population. PWH who smoke may also be less adherent to antiretroviral therapy compared to those who do not smoke (Cioe et al., 2017; but also see Nguyen et al., 2016). Still, PWH who smoke cigarettes and are maintained on antiretroviral therapy are up to 13 times more likely to die from cigarette-related disease (e.g., lung cancer) than from HIV infection (Wolitski, 2017), highlighting the importance of developing effective smoking cessation interventions for PWH. One factor that may hinder successful cigarette smoking cessation among PWH is cannabis use. Current cannabis use prevalence among a nationally representative U.S. sample of PWH from 2005-2015 was 34.9% (Pacek et al., 2018), which is nearly double that seen in the general U.S. population. Among this same sample of PWH, only 34.1% of those who did not use cannabis reported cigarette smoking whereas 68.0% and 56.4% of those reporting non-daily or daily cannabis use, respectively, also currently smoked cigarettes (Pacek et al., 2018).

Despite such high rates of cigarette/cannabis co-use among PWH and the potential impact of co-use on cigarette quit success, little work on the associations between cigarette/cannabis co-use and smoking cessation has been done among PWH. In one study, cannabis use was associated with fewer attempts to quit smoking cigarettes among PWH (Barré et al., 2021). However, it is unknown whether cannabis use influences cessation success among PWH. The purpose of the current secondary data analysis was to evaluate associations between cannabis use frequency and cigarette abstinence among PWH enrolled in a cigarette cessation trial who were motivated to quit.

2. Material and methods

All aspects of this study were approved by the Institutional Review Boards at Montefiore Medical Center and the Johns Hopkins University School of Medicine.

2.1. Participants

Between July 2016 and March 2020, PWH who smoke cigarettes (N=506) were enrolled in a smoking cessation trial (NCT02781090) comparing Positively Smoke Free on the Web plus online community (PSFW+) and the American Heart Association Getting Healthy online program (AHA) at two clinical sites: 1) Montefiore Medical Center's Center for Positive Living in the Bronx, New York; and 2) Johns Hopkins Bartlett Clinic for Infectious Diseases in Baltimore, Maryland. Inclusion criteria were: 1) a laboratory-confirmed HIV infection; 2) current cigarette smoking (defined as responding "yes" to "Have you smoked at least 100 cigarettes in your entire life?" and "Have you smoked cigarettes (even a puff) in the last seven days, including today?"; 3) motivation to quit smoking cigarettes within the next 6 months (Abrams et al., 2007); 4) a device with access to the internet at least weekly; 5) reading ability at or above the 7th grade level (REALM-SF literacy score ≥ 4); 6) no contraindication to nicotine patch use; and 7) not currently pregnant or

breastfeeding.

2.2. Procedure

2.2.1. Intervention

Eligible participants were randomized to PSFW+ or AHA smoking cessation interventions. All participants, regardless of randomization condition, were offered a 12-week supply of nicotine replacement patches in a dose calibrated to their average cigarettes per day. Details regarding the randomization process, intervention conditions, and nicotine patch utilization metrics have been published previously (Shuter et al., 2022). Briefly, PSFW+ included an interactive web intervention with an online health community and 8 lessons designed specifically for PWH who smoke cigarettes. PSFW+ participants could select (and change) their target quit date any time, view lessons on a flexible schedule, and access an online community. AHA included a health-promotion website with 7 online modules targeting health and fitness, one of which is on smoking cessation (<https://www.heart.org/en/healthy-living/healthy-lifestyle/lifes-essential-8>). There was no cannabis-focused content in either intervention condition. Primary outcomes from the trial showed that significantly more PSFW+ participants (14.9%) were cigarette abstinent at 6 months compared to AHA participants (8.8%) (Shuter et al., 2022).

2.2.2. Study visits

Participants were scheduled to attend four in-person visits: enrollment (baseline), 1-month follow-up, 3-month follow-up, and 6-month follow-up. During visits, participants completed audio computer-assisted self-interviews (QDS ACASI software) and provided biochemical measurements specific to tobacco use. Due to the COVID-19 pandemic, in-person visits were suspended from April-July 2020. During that time, visits were completed via telephone without biochemical measurements.

2.3. Measures

2.3.1. Cannabis use

Past 30-day (P30D) cannabis use (yes/no) and frequency of P30D cannabis use (none (coded 0)/once per month (coded 1)/2-3 times per month (coded 2)/1-2 times per week (coded 3)/3-6 times per week (coded 4)/daily (coded 5)) were assessed at all four visits. A four-category change-in-cannabis-use-frequency variable was created based on responses to these questions. N=176 PWH were categorized as "no use", which was defined as responding "no" to any P30D cannabis use during all four visits. For the N=198 PWH who reported P30D cannabis use during at least one visit, participants were categorized by subtracting the P30D cannabis use frequency code at baseline from the code at 6 months (increase (>0), decrease (<0), or no change (=0)).

2.3.2. Past 7-day cigarette abstinence

Past 7-day cigarette abstinence was assessed at the 6-month follow-up and was determined via the question, "Have you smoked a cigarette, even a single puff, in the past seven days?" along with having an expired-air carbon monoxide (CO) (piCO+TM Smokerlyzer, CoVita) level of <10ppm (Hughes et al., 2003). For the few participants who reported cigarette abstinence but had a CO of ≥ 10 ppm, which can occur with cannabis use, a salivary swab (Orasure Technologies, Bethlehem, PA) for cotinine was collected to verify abstinence. In the primary outcomes paper for the parent RCT (Shuter et al., 2022), all models were also run on seven-day point-prevalence abstinence using a lower cut-point of CO <6ppm. Although power was reduced, results showed similar trends and effect sizes, which can be found in Supplemental Tables 2 and 3 of Shuter et al. (2022).

2.3.3. Covariates

At baseline, sociodemographic characteristics included age; sex;

race; ethnicity; and housing stability. These factors were categorized as shown in Table 1. Age was a continuous variable. Additional participant characteristics also were assessed during baseline: nicotine dependence via the Modified Fagerström Tolerance Questionnaire; P30D use of other illicit drug(s) including heroin, any other un-prescribed opiate(s), cocaine, any other drug(s) (e.g., amphetamines, MDMA), un-prescribed sedatives/tranquilizers/sleeping pills, and/or any other un-prescribed medication(s) (yes/no); P30D use of any other tobacco product(s), including cigars, little cigars/cigarillos, pipes, waterpipe/hookah, e-cigarettes, chewing tobacco/snuff, and/or snus (yes/no); average cigarettes smoked per day; and living with a smoking partner (yes/no). Study site and intervention condition were also included as covariates.

The initial list of covariates was chosen based on our prior analysis, which included forward stepwise model selection by AIC of 18 potential confounders of the association between intervention condition and past 7-day cigarette abstinence at 6 months (Shuter et al., 2022). Each covariate was assessed further in the current study to determine whether it should be included in the final multivariable model. To do so, each covariate was included in a separate multivariable model with the change in cannabis use frequency variable to evaluate its effect on the unadjusted association between change in cannabis use frequency and past 7-day cigarette abstinence. Covariates that changed the change in cannabis use frequency variable's estimate by 5% in either direction were included in the final model as potential confounders (Lee, 2014; Robins et al., 1992). Covariates included in the final multivariable model were study site, intervention condition, race, ethnicity, housing stability, living with a smoking partner, and P30D use of any other tobacco product(s).

Table 1

Bivariate associations between baseline factors and categorical change in past 30-day cannabis use frequency from baseline to the 6-month follow-up among people with HIV who smoke cigarettes.

Baseline Factor	Change in P30D Cannabis Use Frequency from baseline to 6-month follow-up					P value ^a
	n (%) or mean (SD)					
	Increase (n=39)	Decrease (n=78)	No change (n=81)	No use (n=176)	Total (N=374)	
Site						0.016
New York	24 (61.5)	50 (64.1)	44 (54.3)	78 (44.3)	196 (52.4)	
Baltimore	15 (38.5)	28 (35.9)	37 (45.7)	98 (55.7)	178 (47.6)	
Intervention						0.023
PSFW+	17 (43.6)	51 (65.4)	35 (43.2)	86 (48.9)	189 (50.5)	
AHA (Control)	22 (56.4)	27 (34.6)	46 (56.8)	90 (51.1)	185 (49.5)	
Sex						0.078
Male	27 (69.2)	50 (64.1)	49 (60.5)	90 (51.1)	216 (57.8)	
Female	12 (30.8)	28 (35.9)	32 (39.5)	86 (48.9)	158 (42.2)	
Race						0.884
White	6 (15.4)	8 (10.3)	10 (12.3)	22 (12.5)	46 (12.3)	
Black/African American	32 (82.1)	65 (83.3)	69 (85.2)	146 (83.0)	312 (83.4)	
Other	1 (2.6)	5 (6.4)	2 (2.5)	8 (4.5)	16 (4.3)	
Ethnicity						0.713
Not Hispanic/Latino	33 (84.6)	61 (78.2)	65 (80.2)	147 (83.5)	306 (81.8)	
Hispanic/Latino	6 (15.4)	17 (21.8)	16 (19.8)	29 (16.5)	68 (18.2)	
Age	49.4 (11.8)	47.2 (9.3)	48.3 (11.1)	53.2 (8.8)	50.5 (10.1)	<0.001
Nicotine dependence						0.166
Low	6 (15.4)	15 (19.2)	20 (24.7)	28 (15.9)	69 (18.4)	
Low/moderate	12 (30.8)	20 (25.6)	22 (27.2)	50 (28.4)	104 (27.8)	
Moderate	19 (48.7)	37 (47.4)	25 (30.9)	83 (47.2)	164 (43.9)	
High	2 (5.1)	6 (7.7)	14 (17.3)	15 (8.5)	37 (9.9)	
P30D illicit drug use	18 (46.2)	32 (41.0)	32 (39.5)	39 (22.2)	121 (32.4)	0.001
Stable housing	28 (71.8)	61 (78.2)	66 (81.5)	148 (84.1)	303 (81.0)	0.302
Living with a smoking partner	17 (43.6)	34 (43.6)	25 (30.9)	50 (28.4)	126 (33.7)	0.055
Other tobacco product use	13 (33.3)	30 (38.5)	32 (39.5)	34 (19.3)	109 (29.1)	0.001
Average cigarettes per day	11.3 (8.6)	10.4 (6.9)	12.8 (11.7)	11.9 (8.5)	11.7 (8.9)	0.460
6-Month Follow-up						
Past 7-day cigarette abstinence	2 (5.1)	16 (20.5)	9 (11.1)	32 (18.2)	59 (15.8)	0.081

PSFW+ = Positively Smoke Free on the Web plus online community; AHA = American Heart Association Getting Healthy online program; P30D = past 30 day; Bolded values denote statistical significance, p<0.05.

^a P values are from chi-square tests for categorical variables and one-way analysis of variance (ANOVA) for continuous variables.

2.4. Data analysis

Analyses were limited to PWH who responded to questions about P30D cannabis use during all four visits (N=374; 73.9% of parent study sample). Subsample characteristics overall and as a function of categorical change in P30D cannabis use frequency (increase, decrease, no change, no use) between baseline and 6 months were summarized using descriptive statistics. Next, we evaluated bivariate associations between baseline factors and categorical change in P30D cannabis use frequency between baseline and 6 months using chi-square tests for categorical variables and one-way analysis of variance (ANOVA) for continuous variables. Finally, we conducted multivariable logistic regression to determine how change in cannabis use frequency between baseline and 6 months was associated with past 7-day cigarette abstinence at 6 months after controlling for covariates. The full multivariable model was conducted twice. In the first model, participants who reported no P30D cannabis use during all four study visits served as the reference category. In the second model, participants who reported P30D cannabis use during at least one study visit (baseline, 1-month, 3-month, and/or 6-month) and decreased their P30D cannabis use frequency between baseline and 6 months served as the reference category. Analyses were performed using R statistical software version 3.5.1 (<http://www.r-project.org/>) with significance defined as p<0.05.

3. Results

Table 1 shows baseline characteristics for PWH as a function of categorical change in P30D cannabis use frequency from baseline to 6 months (increase, decrease, no change, or no use). Of N=374 PWH who responded to questions about P30D cannabis use during all four visits,

42.2% were female, 83.4% were Black/African American, 81.8% were not Hispanic/Latino, 81.0% had stable housing, and the mean age was 50.5 years (SD=10.1). Nearly half (43.9%) were considered to be moderately nicotine dependent, 33.7% were living with a smoking partner, 29.1% used other tobacco product(s) in the past 30 days, and the mean average cigarettes smoked per day was 11.7 (SD=8.9). Approximately half (n=176; 47.1%) reported no P30D cannabis use during all four visits. Of the n=198 PWH who reported P30D cannabis use during at least one visit, between baseline and 6 months, n=39 (19.7%) increased their frequency of use, n=78 (39.4%) decreased their frequency of use, and n=81 (40.9%) had no change. Participants categorized as having increased their use frequency included n=15 (7.6%) who reported no use at baseline but some level of use at 6 months. Participants who decreased their use frequency included n=48 (24.2%) who reported some level of use at baseline but no use at 6 months.

Table 1 also shows bivariate associations between baseline characteristics and categorical change in P30D cannabis use frequency. Although a notably smaller percentage of participants who increased their cannabis use frequency quit smoking cigarettes at 6 months (5.1%) relative to those who decreased (20.5%), had no change in use frequency (11.1%), or did not use cannabis (18.2%), the unadjusted association between change in P30D cannabis use frequency and past 7-day cigarette abstinence was not statistically significant. Significant bivariate associations were observed for study site, intervention condition, age, P30D use of other illicit drug(s), and P30D use of other tobacco product (s). For study site, more PWH in New York reported increases, decreases, or no change in P30D cannabis use frequency than those in Baltimore, who more often reported no use. In addition, more PWH enrolled in PSFW+ decreased their cannabis use frequency than those in AHA, who more often had increased use or no change. For age, PWH who reported no cannabis use were older than those who reported increases, decreases, or no change in cannabis use frequency. Fewer PWH who reported no cannabis use (vs increased, decreased, or no change in use frequency) also reported P30D use of other illicit drug(s) or other tobacco product(s). Prevalence of P30D other illicit drug use was highest for PWH who increased their P30D cannabis use frequency between baseline and 6 months.

Table 2 shows how many participants fell into each cannabis use frequency category at baseline and 6 months among the n=198 who reported P30D cannabis use during at least one visit. At baseline, daily use was the most common use pattern (29.8% of participants), followed by no use (18.2%), use once per month (14.6%), or use 2-3 times per month (14.6%). At the 6-month visit, no use was the most common use pattern (34.3%), followed by daily use (26.3%), use 1-2 times per week (10.6%), or use 3-6 times per week (10.6%).

Tables 3 and 4 shows the factors that were independently associated with past 7-day cigarette abstinence at 6 months. In Table 3, participants who reported no P30D cannabis use during all four study visits served as the reference category. In Table 4, participants who reported P30D cannabis use during at least one study visit (baseline, 1-month, 3-month, and/or 6-month) and decreased their P30D cannabis use frequency

Table 2

Prevalence of past 30-day (P30D) cannabis use frequencies during baseline and 6-month follow-up visits among N=198 people with HIV who smoke cigarettes and who reported P30D cannabis use during at least one study visit (baseline, 1-month, 3-month, and/or 6-month).

	n (%)	
	Baseline	6 Months
No use	36 (18.2)	68 (34.3)
Once per month	29 (14.6)	20 (10.1)
2-3 times per month	29 (14.6)	16 (8.1)
1-2 times per week	19 (9.6)	21 (10.6)
3-6 times per week	26 (13.1)	21 (10.6)
Daily	59 (29.8)	52 (26.3)

Table 3

Multivariable associations between baseline factors and self-reported past 7-day cigarette abstinence at the 6-month follow-up visit among people with HIV who smoke cigarettes (N=374).

Baseline Factor	aOR	95% CI
Site		
New York (referent)	-	-
Baltimore	0.64	0.33, 1.26
Intervention		
AHA (Control) (referent)	-	-
PSFW+	1.82	0.99, 3.43
Race		
White (referent)	-	-
Black/African American	0.87	0.36, 2.28
Other	0.59	0.11, 2.53
Ethnicity		
Not Hispanic/Latino (referent)	-	-
Hispanic/Latino	2.17	0.92, 5.06
Stable housing	2.86	1.16, 8.65
Living with a smoking partner	0.41	0.19, 0.83
P30D use of other tobacco product(s)	1.19	0.61, 2.25
Change in P30D cannabis use frequency from baseline to follow-up		
No use (referent)	-	-
No change	0.54	0.22, 1.20
Decrease	1.11	0.52, 2.30
Increase	0.25	0.04, 0.93

PSFW+ = Positively Smoke Free on the Web plus online community; AHA = American Heart Association Getting Healthy online program; P30D = past 30 day; aOR = adjusted odds ratio; CI = confidence interval; Bolded values denote statistical significance, p<0.05.

Table 4

Multivariable associations between baseline factors and self-reported past 7-day cigarette abstinence at the 6-month follow-up visit among people with HIV who smoke cigarettes (N=374).

Baseline Factor	aOR	95% CI
Site		
New York (referent)	-	-
Baltimore	0.64	0.33, 1.26
Intervention		
AHA (Control) (referent)	-	-
PSFW+	1.82	0.99, 3.43
Race		
White (referent)	-	-
Black/African American	0.87	0.36, 2.28
Other	0.59	0.11, 2.53
Ethnicity		
Not Hispanic/Latino (referent)	-	-
Hispanic/Latino	2.17	0.92, 5.06
Stable housing	2.86	1.16, 8.65
Living with a smoking partner	0.41	0.19, 0.83
P30D use of other tobacco product(s)	1.19	0.61, 2.25
Change in P30D cannabis use frequency from baseline to follow-up		
Decrease (referent)	-	-
No use	0.90	0.43, 1.91
No change	0.49	0.18, 1.22
Increase	0.22	0.03, 0.90

PSFW+ = Positively Smoke Free on the Web plus online community; AHA = American Heart Association Getting Healthy online program; P30D = past 30 day; aOR = adjusted odds ratio; CI = confidence interval; Bolded values denote statistical significance, p<0.05.

between baseline and 6 months served as the reference category. After controlling for covariates, an increase in cannabis use frequency from baseline was associated with reduced odds of cigarette abstinence at 6

months versus a decrease in use frequency (aOR=0.22, 95% CI=0.03, 0.90) or no use (aOR=0.25, 95% CI=0.04, 0.93). In addition, participants with stable housing were significantly more likely (aOR=2.86, 95% CI=1.16, 8.65) whereas those living with a smoking partner were significantly less likely (aOR=0.41, 95% CI=0.19, 0.83) to report past 7-day cigarette abstinence.

4. Discussion

This is the first study to evaluate associations between cigarettes/cannabis co-use and cigarette abstinence among PWH who were motivated to quit cigarettes during a cigarette cessation trial. Approximately half of the sample reported P30D cannabis use during at least one visit, with more than half reporting weekly use at baseline. Such cigarette/cannabis co-use rates are higher than those reported for the general population (29-35%) (Gravely et al., 2022; Gravely et al., 2020), but comparable to a nationally representative sample of PWH from 2005-2015 (24-30%) (Pacek et al., 2018).

Of those who reported P30D cannabis use during at least one visit, nearly 20% increased their frequency of use between baseline and 6 months, and such increases in use frequency were significantly associated with a lower likelihood of cigarette abstinence at 6 months compared to decreased use or no use. This finding is in line with results from a prior study among a nationally representative samples of adult cigarette smokers in Canada, England, Australia, and the U.S. (Driezen et al., 2022); in Driezen et al. (2022), increasing cannabis use across 12 months was associated with a reduced likelihood of cigarette cessation at 12 months compared to no cannabis use. Such results highlight how understanding dynamic changes in cannabis use over time may better predict which PWH will have more difficulty or success with cigarette cessation.

Based on previous work, we speculate that the increasing use frequency seen for some participants over time may be related to participants' reasons for cannabis use. Prior work suggests that some PWH use cannabis for a variety of therapeutic reasons, including for self-treatment of HIV symptoms, pain management, anxiety, depression, and to reduce stress (Costiniuk et al., 2019; Wardell et al., 2018). Still, some PWH use cannabis strictly for recreational purposes, for pleasure, happiness, or to "feel high" (Costiniuk et al., 2019; Wardell et al., 2018). PWH who use cannabis for therapeutic reasons may use cannabis more frequently than those who use for recreational reasons (Wardell et al., 2018) and such differences in use frequency may have downstream effects on other health-relevant behaviors. Although we did not measure reasons for cannabis use in the present study, it is possible that these factors impacted participants' increased cannabis use frequency and in turn, difficulty quitting cigarettes. Future work is needed that examines reasons for cannabis use as a potential mediator of these associations.

Given that more participants who decreased their cannabis use frequency also reported cigarette abstinence at 6 months, the cigarette cessation intervention imposed during the current study may have affected both use behaviors. Indeed, being enrolled in PSFW+ (vs AHA) was significantly associated with reduced cannabis use in the bivariate analysis, though the intervention effect was no longer apparent after controlling for other factors in the multivariable model. In addition, follow-up analyses indicated no significant interaction between intervention condition and categorical change in cannabis use frequency in their association with past 7-day cigarette abstinence (data not shown), though our data may have been underpowered to detect an effect. At least a few interventions have been developed that explicitly target both tobacco and cannabis use cessation (e.g., Becker et al., 2014; Beckham et al., 2018; McClure et al., 2019). However, more research is needed to determine whether cigarette cessation interventions alone may simultaneously impact cannabis use among people who co-use cigarettes/cannabis.

4.1. Limitations

Participants were predominantly Black/African American, non-Hispanic, recruited from two urban sites in the U.S., and on average, middle-aged. Findings may not generalize to other PWH demographic groups or PWH living in other geographic locations. In addition, participants were recruited in states/localities where medical cannabis was legal, but where recreational cannabis was illegal at the time of data collection. We did not assess reasons for cannabis use and it is possible that at least some participants were prescribed cannabis for an approved medical condition. Future work will need to determine whether similar associations are found among participants living in areas where recreational cannabis is legal. Moreover, participants in the current study were enrolled in a cigarette cessation trial and were exposed to either PSFW+ or AHA (control) intervention conditions; results may be different when participants use alternative methods to assist with quitting cigarettes. In addition, the final months of data collection overlapped with the start of the COVID-19 pandemic, which may have influenced changes in P30D cannabis use frequency and/or cigarette abstinence. Also, the cannabis use questions included were limited to frequency of P30D use and did not include questions surrounding quantity of use. Finally, there was not enough statistical power to assess potential interaction effects between sociodemographic factors and change in cannabis use frequency.

5. Conclusions

Results highlight the association between increased cannabis use over 6 months and reduced odds of 7-day cigarette smoking abstinence among PWH who were motivated to quit. In addition, factors that influence cannabis use and cigarette cessation simultaneously, such as reasons for use, are in need of further study. Given that co-use of tobacco and cannabis may result in greater nicotine dependence (Weinberger et al., 2021) and cardiovascular toxicity (Lorenz et al., 2021; Smith et al., 2020) than use of tobacco or cannabis alone, there is a need for additional research assessing cigarette cessation intervention effects on co-use and the development of integrated treatments that explicitly target both cannabis and tobacco.

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Clinical Trial Registration

The trial was registered at clinicaltrials.gov #NCT02781090.

CRediT authorship contribution statement

Jenny E. Ozga: Formal analysis, Writing – original draft. **Jonathan Shuter:** Conceptualization, Resources, Writing – review & editing, Funding acquisition. **Geetanjali Chander:** Data curation, Writing – review & editing. **Amanda L. Graham:** Data curation, Writing – review & editing. **Ryung S. Kim:** Data curation, Writing – review & editing. **Cassandra A. Stanton:** Conceptualization, Writing – review & editing, Funding acquisition.

Declaration of Competing Interest

Dr. Shuter has received financial payments for the development of educational materials and delivering oral presentations from the Northeast/Caribbean AIDS Education and Training Center and from the ObG Project. All other authors declare that they have no conflicts of interest.

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