Effects of cannabis use on cigarette smoking cessation in LGBTQ+ individuals

Raina D. Pang[ab], Lucy A. Schuler[a], John R. Blosnich[c], Jon-Patrick Allem[d], Matthew G. Kirkpatrick[ab]

[a]Department of Population and Public Health Sciences, University of Southern California, 1845 N. Soto Street, Los Angeles, CA 90032

[b]Department of Psychology, University of Southern California, SGM 50, 3620 McClintock Ave, Los Angeles, CA 90089

[c]Suzanne Dworak-Peck School of Social Work, University of Southern California, 669 W 34th St., Los Angeles, CA 90089

[d]Department of Health Behavior, Society, and Policy, Rutgers School of Public Health, 683 Hoes Ln W, Piscataway, NJ 08854

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Correspondence concerning this article should be addressed to Raina D. Pang, 1845 N. Soto Street, Los Angeles, CA 90032, Tel: 1-323-442-7251; Email: rpang@usc.edu.

Abstract

Objective: Sexual and gender minority (SGM) individuals are more likely to use tobacco and cannabis and have lower cigarette cessation. This study examined cannabis use associations with daily cigarettes smoked in SGM individuals before and during a quit attempt.
Method: Participants included dual smoking same sex/gender couples from California that were willing to make a quit attempt (individual n = 205, 68.3% female sex). Participants reported baseline past 30-day cannabis use and number of cigarettes smoked and cannabis use (yes/no) during 35 nightly surveys. Individuals with current cannabis use reported baseline cannabis use and/or nightly survey cannabis use. Multilevel linear models predicted number of cigarettes smoked by cannabis use.
Results: Number of cigarettes decreased from before to during a quit attempt, but this decrease was smaller in individuals with current cannabis use compared to no current cannabis use ($p<.001$). In individuals with current cannabis use, number of cigarettes smoked was greater on days with cannabis use ($p<.001$). Furthermore, cannabis use that day increased overall number of cigarettes in those with relatively high overall cannabis use but only during a quit attempt in those with relatively low cannabis use (within-subject cannabis use × between-subject cannabis use × quit attempt interaction; $p<.001$).
Conclusions: SGM individuals with cannabis and cigarette use may have a harder time quitting smoking than those who do not use cannabis. For those with cannabis use, guidance on not using cannabis during a quit attempt may improve cigarette cessation outcomes.

Public Health Significance Statement: This study found that sexual and gender minority individuals with current cannabis use smoked more cigarettes during a cigarette quit attempt. In those with current cannabis use, overall higher frequency of cannabis use and days with cannabis use increased the number of cigarettes smoked during a quit attempt.

Keywords: tobacco, cannabis, sexual and gender minority, smoking cessation, daily diary, smoking

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Sexual and gender minority (SGM) individuals have a higher prevalence of cigarette smoking and lower smoking cessation rates than their heterosexual peers (Blosnich et al., 2013; Cornelius et al., 2023; Tan, 2022). One factor that may be relevant to smoking cessation for SGM individuals is cannabis co-use (i.e., regular use of both substances, whether that use is concurrent or not). Prior research has found that sexual minority individuals (i.e., gay, lesbian, bisexual) are more likely to use cannabis than their heterosexual peers (Goldbach et al., 2017; Liautaud et al., 2021) and that sexual minority individuals are more likely to co-use tobacco products and cannabis (vs. tobacco alone; Mattingly et al., 2022; Nguyen et al., 2021). Additionally, gender minority individuals (i.e., transgender, nonbinary, genderqueer) have the highest tobacco and cannabis use prevalence among the California SGM population (Tan, 2022). These disparities between SGM and heterosexual/gender-conforming individuals are attributed to a variety of factors, including social norms around smoking and complex and interacting experiences of minority stressors (e.g., discrimination, family rejection) that can instill or amplify substance use (Lee et al., 2020; McQuoid et al., 2023; Wheldon & Wiseman, 2021). As cigarette and cannabis co-use is prevalent in sexual minority and gender minority populations, a better understanding of how cannabis use impacts cigarette smoking during a cigarette quit attempt in SGM individuals is warranted to develop and test interventions.

The use of cannabis in adults who smoke cigarettes has increased over the past two decades, and people who smoke are more than ten times as likely to use cannabis daily compared to people who do not smoke (Goodwin et al., 2018; Schauer et al., 2015). Yet, no prior study has investigated whether between (i.e., an individual's overall amount of cannabis use) and within (i.e., use of cannabis that day compared to not using cannabis) subject cannabis use associates

with the number of cigarettes smoked before and during a cigarette quit attempt in SGM individuals.

Longitudinal studies in nationally representative datasets have demonstrated that cannabis use is associated with increased odds of both initiation of cigarette smoking in adults as well as cigarette lapses and relapse during a smoking cessation attempt (Shariati et al., 2017; Weinberger, Delnevo, et al., 2020; Weinberger, Pacek, et al., 2020; Weinberger et al., 2018). These studies suggest that individuals who co-use cannabis with cigarettes may have a harder time quitting cigarettes compared to those who do not use cannabis. However, these studies have not looked at day-by-day smoking behavior (e.g., number of cigarettes smoked per day) both before *and* during a quit attempt by cannabis use status.

The effects of acute cannabis use have also been investigated in relation to cigarette smoking. Laboratory-based research has shown that among individuals who co-use cannabis and tobacco, acute cannabis abstinence increased cigarette smoking (Haney et al., 2019) and acute simultaneous abstinence from both cigarettes and cannabis (vs. one substance alone) significantly increased overall withdrawal symptoms, compared with abstinence from either substance alone (Vandrey et al., 2008). These studies suggest that cannabis abstinence during a cigarette quit attempt might *decrease* the likelihood of cigarette abstinence. On the other hand, daily diary studies showed that higher daily levels of cannabis use (e.g., intoxication, intensity) was associated with increased cigarette smoking (Hughes et al., 2014; Nguyen et al., 2023), potentially due to acute cannabis intoxication acting as a cue-induced trigger for cigarette smoking. While these studies suggest that acute cannabis use and abstinence may influence cigarette smoking, these studies were conducted in individuals who were not engaged in a cigarette quit attempt. Thus, it is important to investigate how naturalistic cannabis use impacts

cigarette smoking before and during a cigarette quit attempt. This information is essential to provide guidance related to cannabis use during a cigarette quit attempt in order to enhance cessation outcomes.

This is a secondary analysis of data from an Ecological Momentary Assessment (EMA) study in SGM couples 18 years and older who smoke cigarettes. Aim 1 of the study was to investigate whether SGM individuals with current cannabis use (i.e., past 30-day cannabis use at baseline and/or any cannabis use during EMA) smoked more cigarettes before and during a quit attempt compared to individuals without current cannabis use. This study hypothesized that SGM individuals with current cannabis use would smoke more cigarettes during a quit attempt, compared to those without current cannabis use. Aim 2 of this study was to investigate between-subject (i.e., overall frequency of day cannabis use during EMA) and within-subject (i.e., use or no use of cannabis that day) cannabis use on cigarettes smoked in the subset of individuals with current cannabis use. This study hypothesized that individuals with overall more daily cannabis use (i.e., between-subject cannabis use) would smoke more cigarettes. This study also hypothesized that days when cannabis use occurs (i.e., within-subject cannabis use) would be associated with more cigarette use on that day. This study also explored whether there is an interaction of between-subject cannabis use and within-subject cannabis use. The results of this study will inform the literature to whether SGM individuals with current cannabis use have a harder time quitting smoking cigarettes, and how acute cannabis use influences cigarette use during a smoking cessation attempt.

Method

Participants

These data come from a larger study investigating cigarette smoking cessation in SGM

couples in California. To be eligible for the parent study, both members of the couple had to report smoking at least 1 cigarette/day for the past year, be in a same-sex or same-gender romantic relationship for at least six months with no intentions of separating in the next 35 days, be motivated to quit smoking (i.e., respond "yes" to "Do you want to quit or have you been thinking about quitting smoking cigarettes?"), be willing to make a practice quit attempt (i.e., respond "yes" to "Would you be willing to make a 'practice' quit attempt for the purpose of a study?"), be at least 18 years old, live in California, and have the ability to complete study tasks, including completing videoconference/phone interviews and having a smart device compatible with the LifeData app (e.g., iOS or Android), used for EMA data collection (https://www.lifedatacorp.com/). Sample size for the parent study was based on Level-2 prompts/ observations using a conservative 20% non-compliance rate (i.e., ~105 EMA prompts/participant). With a planned sample size of 200 participants, it was determined this study would have sufficient observations to determine small within-subject effects for smoking.

Procedure

Recruitment for the parent study occurred from March 2021 to January 2023. Participants were screened for eligibility based on an online survey filled out by one partner with information about the couple and then both partners provided informed consent during a phone call with study staff. Once consented, both partners completed an online survey assessing baseline measures before attending the first of two phone/videoconference interviews. During the first interview, study staff assessed smoking history and motivation to quit cigarette smoking with each member of the couple separately. Participants were instructed to download the LifeData app and were briefed on the EMA schedule. The quit date was set for approximately a week after starting EMA, allowing us to capture approximately 7 days before the quit attempt and 28 days

during the quit attempt. During EMA, participants received five surveys per day: one in the morning (response window from 5:00 am – 11:00 am), three throughout the day (1-hour response window each, at 11:00 am, 3:00 pm, and 7:00 pm), and one at night (response window from 8:30 pm – 11:59 pm). To capture experiences from the entire day, the study team instructed participants to complete their morning survey right when they woke up, and the night survey right before they went to sleep.

This study is a secondary analysis, which restricted the analysis to the data from the night survey. This decision was appropriate because cannabis use was assessed exclusively during the night. Participants were paid once a week depending on their survey completion rates, with the opportunity to earn up to $350. All procedures were approved by the University of Southern California Institutional Review Board.

Measures

Baseline Measures

REDCap electronic data capture tools hosted at the University of Southern California (Harris et al., 2009) was used to administer baseline measures. Author-constructed personal history questionnaire assessed basic demographics (e.g., age) including sex ("What sex were you assigned at birth, on your original birth certificate?" with options "Male" and "Female") and gender identity ("What is your current gender identity? [check all that apply]" with response options "Male," "Female," "Trans male/trans man," “Trans female/trans woman," "Genderqueer/ gender non-conforming," and "Different identity [please specify]"). Cigarette dependence was measured using the Fagerström Test for Cigarette Dependence (FTCD; Fagerström, 2003, 2012). Motivation to quit cigarette smoking was also measured using the Contemplation Ladder, where participants rated themselves on a visual analog scale from 0 (“no thoughts of quitting”) to 10

("taking action [cutting down, enrolling in programs]")(Biener & Abrams, 1991).

To measure baseline cannabis use, participants were asked if they used any of the following in the past 30 days, with the response options of "marijuana/cannabis/THC," "caffeinated beverages," and "none of the above." Participants who selected "marijuana/cannabis/THC" were coded as having past 30-day cannabis use at baseline. Participants who did not select "marijuana/cannabis/THC" were coded as having no past 30-day cannabis use at baseline.

Night Survey Measures

During the night survey, participants were asked "How many cigarettes did you smoke today" and were given response options of 0-40. Number of cigarettes smoked served as our primary outcome.

During the night survey, participants were asked "Today, have you had any of the following substances? Check all that apply. If you did not use any substances below, select none". Responses included "caffeine," "marijuana/cannabis/THC," "e-cigarettes/JUUL/other vaping device," "non-cigarette tobacco product," "alcohol," or "none." Participants with at least one day of cannabis use were coded as having cannabis use during EMA night surveys and participants with 0 days of reported cannabis use were coded as not having any cannabis use during EMA night surveys. For our aim 1 primary predictor of current cannabis group, we coded current cannabis as any participant who indicated past 30-day cannabis use in the baseline measures and/or at least one day of cannabis use during night surveys and no current cannabis group as any participant who reported no past 30-day cannabis use at baseline and 0 days of cannabis during night surveys. Within-subject cannabis use was coded as day cannabis use (i.e., "marijuana/cannabis/THC" was selected) or no day cannabis use (i.e.,

"marijuana/cannabis/THC" not selected). Between-subject cannabis use was calculated as the person mean of cannabis use across all days of the study (i.e., number of days used cannabis) and was grand mean centered.

Data Analysis

Preliminary analyses assessed night survey compliance (i.e., percentage of night surveys responded to over the 35 days) and correlations of compliance with key variables. Preliminary analyses also included reporting demographic statistics, and substance use reported at the night survey in the full sample and by current cannabis group. To investigate potential differences by current cannabis group, this study compared sample descriptives using independent samples t-tests for continuous variables and chi-square tests for categorical variables.

Aim 1 was conducted using all days in the full sample (n=205). Number of cigarettes was predicted from current cannabis group (binary: no current cannabis group vs. current cannabis group) and quit attempt (binary within-person: before attempt vs. during quit attempt). Model 2 included a current cannabis group (binary: no current cannabis group vs. current cannabis group) × quit attempt (binary within-person: before attempt vs. during quit attempt) interaction. Significant interactions were followed up with pairwise comparisons using estimated marginal means.

Aim 2 was investigated in the current cannabis use group (n=115). Number of cigarettes was predicted from within-subject cannabis use (binary within-person: day cannabis use vs. no day cannabis use), between-subject cannabis use (i.e., person mean of cannabis use across all days of the study and was grand mean centered), and quit attempt (binary within-person: before attempt vs. during quit attempt). Model 2 included two-way interactions of within-subject cannabis use × between-subject cannabis use, within-subject cannabis use × quit attempt, and

between-subject cannabis use × quit attempt. Model 3 included a three-way interaction of within-subject cannabis use × between-subject cannabis use × quit attempt. Significant three-way interactions were stratified by a median split on between-subject cannabis use and pairwise comparisons using estimated marginal means. All models controlled for cigarette dependence, age, sex, daily use of other tobacco products (i.e., non-cigarette/e-cigarette tobacco), and day (binary: weekday [Mon-Thurs] vs. weekend [Fri-Sun]), with baseline responses nested within dyad and daily responses nested within individual and dyad (i.e., random effects specified random intercepts and slopes for each couple).

Analyses were conducted in SPSS (Version 29). As in prior work (Phillips et al., 2022; Rubin et al., 2020; Scholz et al., 2016), number of cigarettes was treated as a continuous variable and primary analyses were run using a Linear Mixed Model. Missing data were handled under missing at random assumptions.

Transparency and Openness

This study reported on how sample size was reported, data exclusion criteria, manipulations, and measures in the study, and followed the Journal Article Reporting Standards (Appelbaum et al., 2018). All data, analysis code, and research materials are available upon request to the corresponding author. This analysis was not pre-registered, and results should be considered exploratory.

Results

Preliminary Results

A total of 208 participants completed baseline study measures included in this analysis. Of those, three participants did not complete any of the night survey measures and were excluded from analyses. The final analytic sample was 205 individuals (no current cannabis group n=90;

current cannabis group n=115) and 6,555 night prompts sent out. A total of 5,407 (82.5%) of night surveys sent out were responded to and participants completed an average of 26.3 (SD=9.6) night surveys. Compliance with night surveys was insignificantly correlated with cigarette dependence, current cannabis use, sex assigned at birth, age, and current cannabis group (ps>.05).

Out of the 205 individuals included in analyses, three individuals were missing partner data, totaling 202 individuals (101 couples) with data from both members of the couple. Out of the 202 individuals (101 couples) with data from both members, 84 individuals (42 couples) had both partners with current cannabis use, 56 individuals (28 couples) had one partner with current cannabis use, and 62 individuals (31 couples) had both partners with no current cannabis use. Of the 115 individuals included in the current cannabis use group, there were 25 individuals with discrepancies in baseline reporting and use during EMA. Fourteen individuals reported using cannabis at baseline only, and 11 individuals reported using cannabis at least one day during EMA with no baseline cannabis use.

Study descriptives for the full sample and by current cannabis group are reported in Table 1. There were significant differences between the current cannabis groups for sex and cannabis use reported at the night survey (Table 1).

Primary Results

Aim 1

Aim 1 tested whether SGM individuals with current cannabis use (compared to those without current cannabis use) would smoke more cigarettes during a cigarette quit attempt. There was not a main effect of current cannabis group on number of cigarettes smoked (Table 2; Aim 1 model 1). There was a significant current cannabis group × quit attempt interaction such that

those with no current cannabis use had a larger decrease in number of cigarettes smoked from before to during the quit attempt (Table 2; Aim 1 model 2). Pairwise comparisons demonstrate that both groups smoked significantly less during the quit attempt, but the mean difference in number of cigarettes from before to during the quit attempt was larger in the no current cannabis use group (mean [SE] difference=-6.60[.14], p<.001; Figure 1) compared to the current cannabis use group (mean [SE] difference=-4.18[.13], p<.001; Figure 1).

Aim 2

Aim 2 investigated the effects of within-subject and between-subject cannabis use on cigarettes smoked among those with current cannabis use. There was a main effect of within-subject cannabis use with significantly fewer cigarettes smoked on days with no cannabis use compared to days with cannabis use (Table 2; Aim 2 model 1). There was a significant two-way interaction of between-subject cannabis use × quit attempt such that increasing overall cannabis use associated with smaller decrease in the number of cigarettes smoked from before quit attempt to during the quit attempt (Table 2; Aim 2 model 2). There was also a significant three-way interaction of within-subject cannabis use × between-subject cannabis use × quit attempt (Table 2; Aim 2 model 3, Figure 2). Models stratified by between-subject cannabis use (median split) demonstrated that day cannabis use increased number of cigarettes smoked in those with relatively high overall cannabis use (before quit attempt: mean [SE] difference=1.49 [.48]; p=.002; during quit attempt: mean [SE] difference=-.53 [.22]; p=.01). In those with relatively low overall cannabis use, day cannabis use significantly increased number of cigarettes smoked during the quit attempt (mean [SE] difference=.72 [.29]; p=.01), but there was no difference before the quit attempt (mean [SE] difference=-.17 [.43]; p=.70).

Models stratified by between-subject cannabis use (median split) demonstrated that in

those with relatively low overall cannabis use, the decrease in number of cigarettes smoked from before to during the quit attempt was smaller on days with cannabis use (mean [SE] difference=-3.66 [.47]; p<.001) compared to days with no cannabis use (mean [SE] difference= -4.55 [.20]; p<.001). In individuals with high overall cannabis use, the decrease in number of cigarettes smoked from before to during the quit attempt was larger when comparing days with cannabis use (mean [SE] difference=-3.99 [.18]; p<.001) to days with no cannabis use (mean [SE] difference=-3.03 [.49]; p<.001).

Conclusions

This EMA study investigated whether SGM individuals with current cannabis use smoked more cigarettes compared to SGM individuals without current cannabis use. In individuals with current cannabis use, this study also investigated whether days where cannabis use occurred, and overall frequency of cannabis use associated with number of cigarettes smoked before and during a quit attempt.

Several prior longitudinal studies have demonstrated that individuals who use cannabis may have less success during a cigarette cessation attempt (Shariati et al., 2017; Weinberger, Delnevo, et al., 2020; Weinberger, Pacek, et al., 2020; Weinberger et al., 2018). This study expanded upon these earlier findings by investigating cannabis and cigarette use in a diverse SGM sample. In support of the hypotheses, this study found that those with current cannabis use – compared to no current cannabis use – reported smaller decreases in number of cigarettes smoked from before to during a quit attempt. Similarly, among those with current cannabis use this study found that increasing overall frequency of cannabis use was associated with a smaller decrease in number of cigarettes smoked from before to during a quit attempt. Investigations like this study are important because SGM populations have higher rates of cannabis and cigarette

co-use (Mattingly et al., 2022; Nguyen et al., 2021) and are underrepresented in smoking cessation research (Weinberger et al., 2021). The findings from this study suggested that SGM with current cannabis use and overall higher frequency of cannabis use may have reduced success in quitting cigarettes early in a cigarette quit attempt and may need additional support to successfully quit smoking cigarettes.

This study also investigated the associations of within-subject cannabis use on number of cigarettes smoked before and during a quit attempt in those with current cannabis use. In support of the hypotheses, this study found that days with cannabis use was associated with greater number of cigarettes smoked. This is consistent with prior studies on acute cannabis use on cigarette use – in samples not attempting to quit smoking cigarettes, – showing that cannabis use was associated with smoking more cigarettes (Hughes et al., 2014; Nguyen et al., 2023). This study found interactions of day cannabis use, overall frequency of cannabis use, and quit attempt. In other words, individuals with relatively low cannabis use smoked more cigarettes on days with cannabis use compared to no cannabis use during a quit attempt. By contrast, individuals with relatively greater overall cannabis use smoked more cigarettes on days with cannabis use compared to no cannabis use both before and during the quit attempt. These findings suggest that day-to-day cannabis use increases cigarette smoking.

The results of this study need to be interpreted in the context of its limitations. First, the parent study focused on tobacco use, containing few cannabis measures. For example, day cannabis use was measured as binary (use vs. no use) during the night survey. This means this study was only able to describe that cannabis and cigarette use occurred that day and was unable to account for whether cannabis use and cigarette use were simultaneous (Chu et al., 2023; Kendall et al., 2022; Nguyen et al., 2023; Ruglass et al., 2020). This study also could not account

for the route of administration and dose level of cannabis use, which can affect the intensity and time course of intoxication (Lemyre et al., 2019; Nguyen et al., 2023). Additionally, this study utilized measures of tobacco and cannabis use reported during the night survey and it is possible that participants smoked more cigarettes or used cannabis following completion of the survey. However, this study was able to capture whether tobacco and cannabis use occurred in the same period (i.e., the past day), as both were measured at the same survey. At baseline, only participants who reported past 30-day cannabis use were asked additional questions about their cannabis use (e.g., frequency, route of use) and this study did not assess any recent changes in cannabis use, or intentions for cannabis use (or cannabis cessation) over the course of the study, including in night surveys during the cigarette cessation attempt. Given our limited assessment of cannabis use, this study cannot determine why some participants reported discrepancies between past 30-day cannabis use at baseline and EMA cannabis use. This study was conducted throughout the COVID-19 pandemic from March 2021 to January 2023. The pandemic has impacted both tobacco and cannabis use (Nguyen et al., 2022) and tobacco quit attempts decreased during the pandemic (Bandi et al., 2022). Therefore, both cannabis use and cigarette cessation behaviors seen in this study may not extend to other time periods.

This study investigated cannabis use on cigarette smoking before and during a cigarette quit attempt in SGM individuals. Importantly, this study found that SGM individuals with current cannabis use (compared to no current cannabis use) smoked more cigarettes during a quit attempt. Among those with current cannabis use, more frequent cannabis use was associated with smaller declines in number of cigarettes smoked from before to during the quit attempt. These findings suggest that SGM with cannabis use and more frequent cannabis use may have a harder time quitting smoking cigarettes and may need additional support during a quit attempt. While

this study cannot determine the reason for cannabis use as a barrier to smoking cessation in SGM individuals, there are several potential reasons this may occur. For example, research in SGM populations highlight socioecological factors (e.g., depression symptoms, minority stress, tobacco norms) as contributors of tobacco use and cigarette cessation outcomes (McQuoid et al., 2023; Wheldon & Wiseman, 2021). It is possible that co-use of cannabis and cigarettes may signify socioecological differences (e.g., greater depression symptoms, more frequent discrimination, greater coping motives; Buckner et al., 2023; Foster et al., 2016; Mattingly et al., 2023; McKelvey et al., 2021; Romm et al., 2022), which may serve as a barrier to smoking cessation. Interestingly one case study demonstrated a unique role of cannabis and cigarette use in coping with SGM related stress (McQuoid et al., 2021). It will be important for future studies to investigate whether SGM individuals with cannabis and cigarette co-use differ from their SGM peers with cigarette use only in sociodemographic, environmental, or other contextual factors. Our findings show that cannabis use increased number of cigarettes smoked during a quit attempt. This finding suggests that guidance about cannabis use may be beneficial to provide for SGM individuals who co-use cannabis and cigarettes and are making a cigarette quit attempt (Beckham et al., 2018). Additionally, cannabis legalization is becoming increasingly common across the United States. As cannabis legalization may increase cannabis use and cannabis and cigarette co-use (Weinberger, Wyka, & Goodwin, 2022; Weinberger, Wyka, Kim, et al., 2022), it will be important for future research to examine any potential spillover effects of cannabis legalization on cigarette cessation in SGM individuals (Philbin et al., 2022).

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