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Sociodemographic and Cessation-related Differences between Tobacco-Marijuana Co-users and Single Product Users in a College Student Population

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Abstract

Sociodemographic and Cessation-related Differences between Tobacco-Marijuana Co-users and Single Product Users in a College Student Population
By Matthew Nicholas Masters

Prevalence of tobacco-marijuana co-use has increased nationally. Many studies of tobacco and marijuana exist, but there is significantly less research available on the co-users of both substances, particularly regarding differences in correlates of cessation behaviors. This study is a secondary data analysis of the Project DECOY cohort of college students in Georgia and aims to address this research gap.

Among participants reporting any cigarette or marijuana use in the past 4 months, we conducted analyses to examine correlates (sociodemographics, mental health, substance use related factors) of 1) substance use group membership (cigarette-only, marijuana-only, and co-use), 2) readiness to quit each substance in the next month comparing single product users versus co-users, and 3) having made an attempt to quit each substance in the past four months comparing single product users versus co-users.

Results showed that alternative tobacco product use was associated with being a co-user. Most notably, e-cigarette and little cigar and cigarillo (LCC) use was associated with higher odds of being a co-user rather than cigarette-only user or marijuana-only user. E-cigarette use was associated with increased readiness to quit cigarettes and increased odds of a cigarette quit attempt. LCC use was associated with increased readiness to quit cigarettes and increased odds of a marijuana quit attempt. Technical and HBCU school students had increased odds of being ready to quit marijuana, while public and technical schools had increased odds of having a marijuana quit attempt. Interestingly, higher depression score was associated with increased odds of readiness to quit marijuana and marijuana quit attempts.

Associations between alternative tobacco products and cessation behavior are supported by previous research, but the association between increased depression score and marijuana quit attempts and readiness to quit marijuana is unexpected and should be further investigated. The use of alternative tobacco products such as e-cigarettes and LCCs in quitting should inform policy and intervention makers on college campuses, particularly considering the influence of school type on cessation behaviors. The results of this study can be used to better inform prevention and cessation efforts in the changing landscape of substance use.

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INTRODUCTION

Tobacco use is the leading cause of preventable death in the United States [1], and cigarette smoking is known to cause various types of cancer, cardiovascular issues, and numerous other negative health outcomes [2]. Many studies have focused on prevention of tobacco use initiation in adolescents, with the aim to reduce dependence on nicotine as adolescents transition into young adulthood [3]. Among young adults and college students, numerous institutional policies such as smoke-free campuses have been shown to be effective at reducing smoking prevalence [4], and while progress has been made, cigarette usage remains prevalent among college students. As many as twenty-nine percent of students report ever-use, and fourteen percent report 30-day use of cigarettes; many current smokers also use alcohol and other drugs with known negative health effects [5].

Marijuana is the most commonly used federally illicit drug in the United States [6]. While marijuana remains illegal on a federal level, many states and municipalities have begun to legalize or decriminalize marijuana use. An increasing number of jurisdictions, including the state of Georgia, have recently legalized marijuana possession for specific medical conditions [7]. Moreover, a majority of Americans now believe that marijuana use should be legalized [8], indicating that additional states may soon follow suit and relax marijuana legislation and enforcement. Despite the increasing access to legal marijuana nationwide, the health effects of marijuana use are still not well understood, particularly among youth and young adults [9-11]. As access to marijuana increases, it becomes more important to better understand the impacts of marijuana use and the interplay between marijuana and other drugs.

While many studies of tobacco and marijuana exist, there is significantly less research available on the co-users of both substances. One study of 3,021 adolescents and young adults found an association between early cigarette use initiation and later abuse of alcohol and tobacco,

although early marijuana adoption did not show the same association [12]. Other studies have shown similar connections between cigarette use and future marijuana and drug use, lending plausibility to certain drug use pathways [13].

Not only have studies shown that there may be substance use pathways and connections between tobacco, marijuana, and alcohol, but also that the rates of co-use appear to be increasing in youth [14, 15]. Rates of co-use in young adults are as high as fifty three among cigarette smokers [16]. Rates of co-use are only expected to increase as legalization continues. This increase in cigarette and marijuana co-use in adolescents and young adults, in addition to research showing that earlier substance use adoption is associated with increased odds of substance abuse later in life, highlights the importance of evidence-based interventions aimed at promoting marijuana and cigarette cessation. To better inform tobacco and marijuana use and co-use cessation efforts, this study aims to support and expand the body of research regarding demographic and motivational predictors of quitting behaviors among cigarette smokers and marijuana users.

LITERATURE REVIEW

Rates of Co-use

The rates of marijuana and tobacco co-use is increasing in the United States, particularly after the legalization of marijuana in numerous states [17]. This study by Wang et al., using 2013 National Survey on Drug Use and Health data, showed that 5.1% of the sample reported past 30-day cigarette and marijuana co-use, and that the proportion of co-users was higher in states that had previously legalized marijuana. Data from nationally representative samples, such as the publicly available SAMHSA (Substance Abuse and Mental Health Services Administration), show that approximately thirty-four percent of cigarette smokers also reported past-month cannabis use [15]. Some studies have shown an even greater prevalence of marijuana and cigarette co-use; an anonymous online survey of 1,808 adults aged 18-25 who had smoked cigarettes in the past 30 days showed that fifty-three percent of respondents that had smoked cigarettes also used marijuana in the past month [16]. An analysis by Ramo et al. showed that, depending on your definition of cigarette smokers and marijuana smokers (i.e., ever-smoking counts as a "smoker" versus daily smoking counting as a "smoker"), tobacco use increases the risk of marijuana use by two to six-fold [18]. Recent studies have shown that over seventy percent of marijuana smokers also smoke cigarettes [19].

While co-use data of college students, excluding results from Project DECOY, is not readily available, SAMHSA provides survey statistics estimating the prevalence of single-substance use in Georgia from 2015. In 2015, SAMHSA estimated that 207,000 adolescents aged 18-25 smoked marijuana in the past month, compared to 297,000 that smoked cigarettes in the past month [20]. This is approximately 18.6% and 26.6% of Georgians aged 18-25.

Relationship of Marijuana and Tobacco use to Morbidity and Other Risk Behaviors

In addition to increasing co-use in recent years, increasing intensity and frequency of other tobacco product use among co-users is also potentially a public health concern. A study of cigarette and marijuana co-users at the University of Florida found that nearly two-thirds of co-users smoked both substances within the same hour, and approximately a third used tobacco to prolong the effects of marijuana [21]. Use of LCCs, cigarettes, and other tobacco with marijuana may have an additive effect upon an individual's health, leading to more severe negative health outcomes [22]. While tobacco is a known cause of many cancers and diseases, studies have also shown links between marijuana use and certain cancers [23], and the additive effects of co-use may potentially affect these links.

In addition to increased frequency of tobacco use among co-users, the increasing prevalence of marijuana use among college students and young adults is also associated with an increase in the risk for motor vehicle crashes [24]. Co-use has also been shown to be related to lower likelihood of condom use [25]. Other studies have shown higher rates of risky sexual behaviors among high-risk adolescents [26]. Another study found similar findings related to risky sexual behaviors, namely that late-onset marijuana users and binge drinkers had more sex partners and were less likely to have used a condom than those who did not use marijuana or binge drink [27]. A review of four Harvard School of Public Health Alcohol Study Surveys showed that more than ninety-eight percent of those surveyed that used marijuana also used other illicit drugs [28].

Other risk behavior associated with co-use of marijuana and cigarettes is the use of alternative tobacco products. The prevalence of alternative tobacco use has risen in recent years, and the perceptions of the perceived harm, addictiveness, and social unacceptability of such products has changed [29]. Additionally, many people utilize alternative tobacco products as a tool for quitting the

use of cigarettes [30, 31], although there is less research on the interaction of these alternative tobacco products and marijuana cessation.

Connections to Depression

There have been a number of studies that have shown a positive relationship between increased depressive symptoms and both tobacco and marijuana prevalence and intensity [32]. Studies on tobacco use and depression show a strong and consistent connection. In a 2004 study of college students at a mid-western university, students with a lifetime history of treatment for depression disorders were seven times more likely to be a tobacco user [33]. Analysis of national data has also shown consistent connections between tobacco use and depression [34].

There have been a number of studies that have found significant associations between marijuana and tobacco co-use and depression. In a recent study of college students, marijuana use was identified as a significant correlate of depression score among those that also smoked cigarettes [35]. Multiple studies have shown a link between marijuana use and psychotic or affective mental outcomes[36], particularly among younger adolescents. A 2003 study using results from the Child and Adolescent Survey of Mental Health found that marijuana and tobacco co-use was related to greater likelihood of depression diagnosis and psychiatric diagnosis in childhood [32].

Paucity of Research on Co-use and the Correlates of Cessation

Studies have shown that tobacco cessation behavior is heavily influenced by the use of other tobacco products, particularly alternative tobacco products and alcohol. A 13-year follow up study of adults in Baltimore found that those that smoked marijuana at baseline were almost twice as likely to still be using tobacco at follow-up, even after adjusting for race, educational attainment, and marital status [37]. While there have been a few studies that show that, relative to marijuana-only users, co-users of marijuana and tobacco products have increased likelihood of cannabis use disorders, psychosocial problems, and poorer cannabis cessation outcomes [38], these studies did

not find that tobacco use worsened tobacco cessation outcomes. There are very few studies that look at the demographic, psychosocial, and cessation related correlates of marijuana-only use, particularly in comparison to tobacco cessation. With the increasing rates of co-use nationwide, additional studies should aim to determine factors associated with marijuana cessation, paying special attention to the interplay of demographics, polytobacco use, alcohol use, depression, and cessation factors such as confidence and importance of quitting.

Study Aims

Given the aforementioned findings and the gaps in the current literature, research is need to better understand the differences in psychosocial and substance use profiles between cigarette-only, marijuana-only, and cigarette-marijuana co-users among young adults, as well as differences in quitting behaviors and intentions in order to inform cessation efforts. Because of this need, this study proposed secondary analyses of a cohort of 721 young adult college student current (past 4-month) cigarette and/or marijuana users to address the following three aims:

(1) Identify sociodemographic, mental health, and substance use factors associated with cigarette-only use, marijuana-only use, and cigarette-marijuana co-use.

(2) Identify sociodemographic, mental health, and substance use factors associated with readiness to quit cigarettes or marijuana in the next 30 days among cigarette-only, marijuana-only, and cigarette-marijuana co-users.

(3) Identify sociodemographic, mental health, and substance use factors that are associated with having made at least one attempt at cessation of cigarettes or marijuana in the last 30 days among cigarette-only, marijuana-only, and cigarette-marijuana co-users.

METHODS

Participants and Procedures

Project DECOY (Documenting Experiences with Cigarettes and Other Tobacco in Young Adults) is a sequential mixed-methods longitudinal cohort study of 3,418 college students attending seven colleges and universities in Georgia [39]. Two public universities, two private universities, two technical or community colleges, and one historically black college were selected for enrollment. Detailed descriptions of the recruitment, sampling, and retention procedures can be found elsewhere [40], although I will describe them briefly in this section. Every four months, a survey link was sent to participants that completed the baseline survey (n=3418). Incentives of increasing value ($30 for the first two waves, $40 for the second two, and $50 for the final two) were provided to promote retention throughout the two-year study period [40]. The study was approved by the Emory University IRB, ICF International Institutional Review Boards, and the review boards of all participating colleges.

The registrar's office of each college or university provided contact information for students that met the eligibility criteria for the study: aged 18-25 years and speak English. One public and two private universities had 3,000 students randomly selected from those that were eligible; the remaining colleges and universities had eligible student bodies that were smaller than 3,000, and therefore all eligible students were contacted for enrollment. Recruitment efforts included emails, posting of fliers, and posting on campus websites [40]. An overall response rate of 22.9% was observed during recruitment, and all sampling quotas were met within seven days [39]. The baseline sample was largely representative of each school's demographic profile, although respondents were disproportionately female [40]. The analysis in this paper is based upon responses to Wave 4 (i.e., the fourth survey).

For inclusion in this analysis, students who reported either marijuana use or cigarette use in the last four months were selected from the wave four sample. This resulted in a sample of 721 students whose demographic and substance use is presented in Table 1.

Measures

Sociodemographics

Age- Age was calculated as age at baseline plus one year, as this wave was administered twelve months after the baseline survey.

Sex- Sex was determined by self-report as either male or female at baseline. One respondent that used only cigarettes and one respondent that used only marijuana identified as "other" and were excluded.

Sexual orientation- Sexual orientation was determined by self-report, and dichotomized into heterosexual and not heterosexual.

Race/ethnicity- Race was determined by self-report as white, African American or black, Asian, American Indian or Alaskan Native, Native Hawaiian or Pacific Islander, more than one race, or "other." A second question asked if participants identified as Hispanic. Hispanics that identified as also white were categorized as Hispanic, and other selections such as bi-racial, more than one race, or "other" were categorized as "other." This resulted in five racial/ethnic groups: White, Black, Hispanic, Asian, and Other.

School type- Four types of school were categorized in Project DECOY: private universities, public universities, technical colleges, and a historically black college or university (HBCU).

Mental Health

Depression score- Depression score was calculated using the Patient Health Questionnaire-9 (PHQ-9) questionnaire, with a range of 0-27, with higher scores being associated with more depressive symptoms. The scale is thoroughly validated [alpha=0.85][41].

Substance Use

Days of use, cigarettes- Every participant was asked a set of required substance use questions, and cigarette use in the past four months (intended to cover usage between waves) was required to complete the survey. The question asks "During the past 4 months, on how many days did you smoke cigarettes?" Participants selected a value from a drop-down menu between zero (no use) and 120 (use every day).

Days of use, marijuana- All participants were also asked "In the past 4 months, on how many days did you use marijuana?" Participants were allowed to refuse to answer and continue to complete the survey. They could select refuse or a value from zero (no use) to 120 (use every day) from a drop-down menu.

Other substance use- Use of little cigars/cigarillos (LCCs), smokeless tobacco (chew, snus, dip, etc.), e-cigarette, and hookah were described in binary form based upon any use reported in the previous four months. 30-day alcohol use, and past 30-day binge drinking were reported as yes/no variables. Binge drinking was defined as drinking 5 or more drinks in a session for a male or 4 or more drinks for a female.

Cessation-Related Factors

Importance of quitting cigarettes- All respondents that smoked at least one cigarette in the past four months were asked "on a scale of 0 to 10, how important is it that you quit using cigarettes (or

not smoke if you don't currently), with 0 being not at all important and 10 being absolutely important?"

Importance of quitting marijuana- Similar to the previous question, all participants that had used marijuana in the past four months were asked to rate the importance of quitting marijuana use on a scale of 0 to 10.

Confidence in quitting cigarettes- All respondents that smoked cigarettes on at least one occasion in the last four months were asked "On a scale from 0 to 10, how confident are you that you could quit using cigarettes if you wanted to (or not smoke if you don't currently), with 0 being not at all confident and 10 being absolutely confident?"

Confidence in quitting marijuana- Similar to the previous question, all students that reported using marijuana on at least one occasion during the past four months were asked to rate their confidence in quitting marijuana on a scale from 0 to 10.

Outcomes

Readiness to quit cigarettes- All participants that smoked cigarettes during the previous four months were asked "Are you seriously thinking about quitting the use of cigarettes? Those that responded "Yes, within the next 30 days" were coded as being ready to quit. Those that were serious about quitting in less than six months, more than six months, or who were not considering quitting were coded as not ready to quit.

Readiness to quit marijuana- All participants that used marijuana during the previous four months were asked "Are you seriously thinking about quitting the use of marijuana? Those that responded "Yes, within the next 30 days" were coded as being ready to quit. Those that were serious about quitting in less than six months, more than six months, or who were not considering quitting were coded as not ready to quit.

Quit attempts, cigarettes- All respondents that used cigarettes in the past four months are asked "how many times did you quit smoking for one day or longer because you were trying to quit cigarettes for good?" All those that tried to quit for good at least once in the past four months were coded as having a quit attempt. The four-month variables were used to ensure that all respondents that had attempted to quit since the last wave was administered would be included in the analysis.

Quit attempts, marijuana- All respondents that used marijuana in the past four months are asked "During the past 4 months, how many times did you stop using marijuana for one day or longer because you were trying to quit using marijuana for good?" All those that tried to quit for good at least once in the past four months were coded as having a quit attempt.

Data Analysis

All data cleaning and analysis was done using SAS 9.4. Chi-square tests were conducted using the frequency procedure, while p-values for continuous variables were calculated using two-sample t-tests. In all two-sample t-tests, a folded F test was performed to determine the equality of variances. Demographic characteristics of the sample, including bivariate analysis of each usage group (i.e., cigarette-only, marijuana-only, and co-users) are provided in Table 1 and Table 2. Multinomial logistic regression was conducted to assess associations of usage group membership (i.e., cigarette-only or marijuana only vs co-use as the reference group). The multinomial logistic regression of group membership associations can be found in Table 3. Additional bivariate tests were conducted to assess differences between users of marijuana and users of cigarettes with regard to their perceived importance of quitting and confidence in quitting. These bivariate analysis can be found in Table 4 and Table 6.

Wald Chi-square p-values are given for all multinomial logistic regressions. Two binary logistic regressions were conducted for both marijuana and cigarette smokers to determine what

factors influenced an individual's readiness to quit and presence of a quit attempt in the last four months. These binary logistic regressions were combined by substance type (cigarettes or marijuana) into two tables, Table 5 and Table 7.

Lastly, two correlations were run to assess the relationship between frequency of marijuana and cigarette use and depression score. The results of these correlations are provided at the end of the results section.

RESULTS

Table 1. Participant Characteristics

Sample Descriptors (N=721)	
Sociodemographics	
Age (SD)	21.60 (1.96)
Gender (%)	
Female	409 (56.73)
Male	312 (43.27)
Sexual orientation (%)	
Heterosexual	629 (87.24)
Other	91 (12.76)
Race/ethnicity (%)	
White	407 (56.45)
Black	174 (24.13)
Hispanic	29 (4.02)
Asian	48 (6.66)
Other	63 (8.74)
Type of school (%)	
Private	283 (39.25)
Public	197 (27.32)
Technical college	144 (19.97)
HBCU	97 (13.45)
Mental Health	
Depression score	6.44 (5.89)
Marijuana and cigarette use (%)	
Used marijuana in past 4 mo.	483 (66.99)
Used cigarettes in past 4 mo.	390 (54.09)
Used only marijuana in past 4 mo.	331 (45.91)
Used only cigarettes in past 4 mo.	238 (33.01)
Used marijuana and cigarettes in past 4 mo.	152 (21.08)
Other substance use (%)	
Used little cigars/cigarillos in past 4 mo.	185 (25.66)
Used smokeless tobacco in past 4 mo.	47 (6.52)
Used E-cigarettes in past 4 mo.	83 (11.51)
Used hookah in past 4 mo.	130 (18.03)
Past 30-day alcohol use	620 (86.11)
Past 30-day binge drinking	449 (62.27)

Participant Characteristics

Of the 721 students included in this analysis, 66.99% had smoked marijuana in the previous four months, and 54.09% had smoked cigarettes during that same period. 238 (33.01%) used only cigarettes in the past four months, 331 (45.91%) used only marijuana in the past four months, and 152 (21.08%) used both marijuana and cigarettes during the past four months. The average age of this sample was 21.60 (SD = 1.96), and the sample was 56.73% female. The vast majority of cigarette or marijuana users self-reported as heterosexual or straight (87.24%). The sample was predominantly white (56.45%), with blacks (24.13%) the second most represented, followed by other (8.74%), Asian (6.66%), and Hispanic (4.02%). Private school students comprised 39.25% of those with cigarette or marijuana use, public schools had 27.32%, technical schools 19.97%, and HBCUs 13.45%. The demographic makeup of the sample used in this study was not statistically significantly different than the make-up of all wave four respondents or to the baseline sample.

Table 2. Bivariate Analyses Regarding Use Group Membership

	Co-use N=152	Cigarette-only use N=238	Co-use vs. cigarette-only use, p-value	Marijuana-only use N=331	Co-use vs. marijuana-only use, p-value
Sociodemographics					
Age (SD)	21.43 (1.94)	21.94 (2.05)	0.015	21.43 (1.88)	0.965
Gender (%)					
Female	81 (53.29)	124 (52.10)	0.819	204 (61.63)	0.083
Male	71 (46.71)	114 (47.90)		127 (38.37)	
Sexual orientation (%)					
Heterosexual	127 (83.55)	208 (87.39)	0.288	294 (88.82)	0.108
Other	25 (16.45)	30 (12.61)		37 (11.18)	
Race/ethnicity (%)					
White	97 (63.82)	152 (63.87)	0.723	158 (47.73)	0.003
Black	27 (17.76)	36 (15.13)		111 (33.53)	
Hispanic	4 (2.63)	8 (3.36)		17 (5.14)	
Asian	9 (5.92)	22 (9.24)		17 (5.14)	
Other	15 (9.87)	20 (8.40)		28 (8.46)	
Type of school (%)					
Private	68 (44.74)	72 (30.25)	0.001	143 (43.20)	0.011
Public	35 (23.03)	69 (28.99)		93 (28.10)	
Technical college	30 (19.74)	81 (34.03)		33 (9.97)	
HBCU	19 (12.50)	16 (6.72)		62 (18.73)	
Depression (SD)	7.03 (6.02)	6.50 (6.12)	0.405	6.12 (5.66)	0.115
Frequency of Use					
Days used cigarettes, past 4 months (SD)	32.46 (43.19)	35.71 (45.33)	0.489	--	--
Days used marijuana, past 4 months (SD)	40.77 (43.90)	--	--	21.88 (36.02)	<0.001
Other Substance Use (%)					
Little cigars/cigarillos	56 (36.84)	50 (21.02)	0.001	79 (23.87)	0.003

Smokeless tobacco	14 (9.21)	22 (9.24)	0.991	11 (3.32)	0.007
E-cigarettes	38 (25.00)	28 (11.76)	0.001	17 (5.14)	<0.001
Hookah	42 (27.63)	31 (13.03)	<0.001	57 (17.22)	0.009
Past 30-day alcohol use	142 (94.04)	187 (78.57)	<0.001	291 (87.92)	0.039
Past 30-day binge drinking	111 (73.03)	139 (58.40)	0.003	199 (60.12)	0.006
Quit-Related Factors					
Cigarettes					
Importance of quitting (SD)	6.10 (3.84)	6.53 (3.90)	0.281	--	--
Confidence in quitting (SD)	8.24 (2.76)	8.28 (2.79)	0.895	--	--
Readiness to quit, next 30 days (%)	29 (19.08)	36 (15.13)	0.307	--	--
Quit attempts, past 4 months (%)	57 (37.50)	98 (41.18)	0.469	--	--
Marijuana					
Importance of quitting (SD)	3.30 (3.24)	--	--	4.19 (3.64)	0.01
Confidence in quitting (SD)	9.13 (2.93)	--	--	9.94 (2.37)	0.003
Readiness to quit, next 30 days (%)	15 (9.87)	--	--	77 (23.26)	0.001
Quit attempts, past 4 months (%)	33 (21.71)	--	--	72 (21.75)	0.992

Bivariate Comparisons Regarding Use Group Membership

Bivariate analyses show that cigarette-only users were on average approximately six months older than co-users ($p=0.015$), but there was no significant age difference between marijuana-only users and co-users. Marijuana-only users were more likely to be female than cigarette-only users (sixty-two percent of marijuana-only users were female compared to fifty-two percent of cigarette-only users, $p=0.023$), although there was no statistically significant difference in gender distribution when comparing co-users and single-substance users. Sexual orientation was not associated with substance use category. Racial composition of the usage groups was found to be statistically different between co-users and marijuana-only ($p=0.003$) and marijuana-only and cigarette-only use ($p<0.001$). School type was found to be significant across all three substance use comparisons.

There was a significant difference in the frequency of marijuana use between marijuana-only users and co-users, as co-users used marijuana an average of 40.8 days in the last four months, while those that only used marijuana did so for only and average of 21.9 days ($p<0.001$). The number of days cigarettes were used in the previous four months was not significantly different when comparing co-users and cigarette-only users ($p=0.489$).

The use of most other tobacco products and alcohol was associated with usage category. The proportions of students those reporting use of LCCs, e-cigarettes, hookah, alcohol, and alcohol binge drinking were all significantly different among usage categories, such that co-users had higher prevalence of use compared to either of the single substance users. Smokeless tobacco did not show statistically significant differences in proportions between both cigarette-only users versus co-users, but was more common among co-users than marijuana-only users.

Depression was not associated with membership in any substance use category. Additionally, importance of quitting cigarettes, confidence in quitting cigarettes, readiness to quit cigarettes, and

having attempted to quit cigarettes in the last four months were not associated with being a co-user versus cigarette-only user. There were, however, significant associations between psychosocial factors relating to marijuana use and substance use category membership. Marijuana-only users, compared to co-users, were found to have significantly higher confidence in quitting ($p=0.003$), higher importance of quitting ($p=0.010$), and a greater proportion of participants ready to quit using marijuana ($p=0.001$). Marijuana quit attempts were not significantly different between usage category.

Table 3. Multinomial Logistic Regression Indicating Correlates of Being a Cigarette-only User or a Marijuana-only User Versus a Co-user

Variable	Cigarette Use Only vs Co-use					Marijuana Use Only vs Co-use			
--	Odds Ratio	95%Lower	95%Upper	p-value		Odds Ratio	95%Lower	95%Upper	p-value
Gender (ref female)									
Male	1.120	0.673	1.864	0.664		0.948	0.585	1.535	0.828
Race (ref White)									
Black	1.764	0.755	4.123	0.190		4.646	2.103	10.263	<0.001
Hispanic	3.763	0.878	16.120	0.074		4.405	1.129	17.187	0.033
Asian	2.356	0.899	6.178	0.081		0.975	0.371	2.567	0.960
Other	0.866	0.400	1.876	0.715		0.953	0.465	1.953	0.895
Sexual Orientation (ref heterosexual)									
LGBTQ	0.695	0.366	1.320	0.266		0.579	0.313	1.071	0.082
School Type (ref private)									
Public	2.091	1.169	3.740	0.013		1.207	0.702	2.074	0.496
Technical	2.847	1.502	5.396	0.001		0.440	0.224	0.863	0.017
HBCU	0.645	0.217	1.917	0.430		0.528	0.206	1.356	0.185
Age (centered at age 18)									
1 Year	1.094	0.973	1.231	0.132		0.991	0.884	1.110	0.870
Depression Score									
1 unit change	0.983	0.946	1.021	0.366		0.985	0.950	1.021	0.419
Substance Use (ref no use)									
Little cigars/cigarillos (past 4mo)	0.447	0.255	0.783	0.005		0.383	0.223	0.657	0.001
Smokeless Tobacco (past 4mo)	2.193	0.906	5.311	0.082		0.834	0.312	2.231	0.718
Electronic Cigarettes (past 4mo)	0.470	0.248	0.891	0.021		0.203	0.102	0.404	<0.001
Hookah (past 4mo)	0.613	0.329	1.140	0.122		0.748	0.427	1.310	0.310
Alcohol in the past 30 days	0.246	0.098	0.619	0.003		0.613	0.245	1.536	0.296
Binge drinking in the past 30 days	0.817	0.467	1.429	0.478		0.647	0.383	1.094	0.104

Multivariate Analyses Regarding Use Group Membership

Multinomial logistic regression of group membership showed that students at public schools were more likely to be cigarette-only users than those at private universities OR 2.09, 95% CI [1.17, 3.74] and students at technical colleges were also more likely to use only cigarettes than to be co-users, OR 2.85, 95% CI [1.50, 5.40]. Technical school students, in comparison to their private school peers, were also more likely to be co-users than marijuana-only, OR 0.44, 95% CI [0.22, 0.86].

Use of other substances was frequently associated with higher odds of being a co-user rather than cigarette-only. The odds of being a cigarette-only user for those that also used little cigars and/or cigarillos was 0.48 times that of those that co-use, 95% CI [0.26, 0.78]. Electronic cigarette usage was also associated with cigarette-only usage compared to co-use, OR 0.47, 95% CI [0.24, 0.89]. Those who consumed alcohol in the past 30 days were also more likely to be co-users than cigarette-only users, OR 0.25, 95% CI [0.10, 0.62].

When comparing the likelihood of being a marijuana-only user vs a co-user, different predictors were found to be significant. Black students were more likely to only use marijuana, OR 4.65, 95% CI [2.10, 10.26], and Hispanics were also more likely to be marijuana-only users, OR 4.40, 95% CI [1.13, 17.19]. Similarly, attending a technical school was associated with higher odds that participants were cigarette-only rather than a co-user OR 2.85, 95% CI [1.50, 5.40], attendance at a technical school made it less likely that you were a marijuana-only user, OR 0.44, 95% CI [0.22, 0.86]. Public school students were more likely to be cigarette-only smokers than co-users, compared to private school students OR 2.09, 95% CI [1.17, 3.74]. Little cigar/cigarillo use and electronic cigarette use was associated with higher odds of an individual being a co-user rather than a single-substance user, OR 0.45, 95% CI [0.26, 0.78] for cigarette-only use compared to co-use, and OR 0.38, 95% CI [0.22, 0.66] for marijuana-only compared to co-use.

Table 4. Bivariate Analyses Regarding Readiness to Quit and Quit Attempts Among Cigarette Smokers

Cigarette Users (N=390)							
	Ready to Quit	Not Ready to Quit			Attempted to Quit	No Quit Attempts	p-value
Sociodemographics							
Age (SD)	21.51 (2.13)	20.59 (1.96)	<0.001		20.82 (1.98)	20.69 (2.04)	0.548
Gender (%)							
Female	41 (63.08)	164 (50.46)			86 (55.48)	119 (50.64)	
Male	24 (36.92)	161 (49.54)	0.063		69 (44.52)	116 (49.36)	0.348
Sexual orientation (%)							
Heterosexual	58 (89.23)	277 (85.23)			130 (83.87)	205 (87.23)	
Other	7 (10.77)	48 (14.77)	0.398		25 (16.13)	30 (12.77)	0.350
Race/ethnicity (%)							
White	38 (58.46)	211 (64.92)			93 (60.00)	156 (66.38)	
Black	17 (26.15)	46 (14.15)			26 (16.77)	37 (15.74)	
Hispanic	1 (1.54)	11 (3.38)			5 (3.23)	7 (2.98)	
Asian	2 (3.08)	29 (8.92)			15 (9.68)	16 (6.81)	
Other	7 (10.77)	28 (8.62)	0.078		16 (10.32)	19 (8.09)	0.706
Type of school (%)							
Private	18 (27.69)	122 (37.54)			49 (31.61)	91 (38.72)	
Public	15 (23.08)	89 (27.38)			46 (29.68)	58 (24.68)	
Technical college	24 (36.92)	87 (26.77)			48 (30.97)	63 (26.81)	
HBCU	8 (12.31)	27 (8.31)	0.190		12 (7.74)	23 (9.79)	0.363
Mental Health							
Depression (SD)	6.19 (6.13)	6.81 (6.13)	0.455		6.97 (6.30)	6.53 (5.94)	0.493
Frequency of Use							
Days used cigarettes, past 4 mo. (SD)	47.12 (45.42)	31.91 (43.92)	0.012		35.30 (42.81)	33.88 (45.62)	0.758
Other Substance Use (%)							
Little cigars/cigarillos	25 (38.46)	81 (24.92)	0.025		49 (31.61)	57 (24.26)	0.110

Smokeless tobacco	6 (9.23)	30 (9.23)	0.999		15 (9.68)	21 (8.94)	0.805
E-cigarettes	15 (23.08)	51 (15.69)	0.147		35 (22.58)	31 (13.19)	0.016
Hookah	7 (10.77)	66 (20.31)	0.072		31 (20.00)	42 (17.87)	0.598
Past 30-day alcohol use	56 (86.15)	273 (84.26)	0.700		133 (85.81)	196 (83.76)	0.584
Past 30-day binge drinking	39 (60.00)	311 (64.92)	0.450		101 (65.16)	149 (63.40)	0.723
Co-use with marijuana	29 (44.62)	123 (37.85)	0.307		57 (36.77)	95 (40.43)	0.469
Quit-Related Factors							
Importance of quitting (SD)	8.80 (2.26)	5.88 (3.95)	<0.001		7.61 (3.31)	5.54 (4.01)	<0.001
Confidence in quitting (SD)	8.40 (2.40)	8.24 (2.85)	0.672		8.18 (2.50)	8.32 (2.95)	0.608

Bivariate Analyses Regarding Readiness to Quit and Quit Attempts Among Cigarette Smokers

Respondents that were ready to quit smoking cigarettes were, on average, slightly less than a year older than those that were not ready to quit. Age was not, however, significantly different between those that had attempted to quit cigarettes in the past four months and those that did not.

Interestingly, those that reported being ready to quit cigarettes within the next 30 days had a higher frequency of use than those that were not ready to quit smoking. The average number of days smoked in the past four months for those ready to quit was over forty-seven days, while those that were not ready to quit only smoked an average of approximately thirty-two days in the previous four months. No significant difference was seen when comparing the number of days a respondent smoked cigarettes between those who had a quit attempt and those that did not.

LCC users were more likely to be ready to quit cigarettes, with approximately thirty-nine percent of those ready to quit cigarettes having used LCCs in the previous four months. Cigarette users that also reported electronic cigarette use were more likely to have had a cigarette quit attempt, comprising 22.6% of those with a quit attempt but only 13.2% of those without cigarette quit attempts.

The importance of quitting cigarettes was higher among both those that were seriously thinking of quitting and those that had attempted to quit, with an average importance of 8.8 out of ten for those that were ready to quit compared to 5.88 among those that weren't. The importance of quitting among those with quit attempts was, on average, a 7.61 out of ten compared to an average of 5.54 among those that had not attempted to quit cigarettes

Table 5. Binary Logistic Regression Analyses Regarding Readiness to Quit and Quit Attempts Among Cigarette Smokers

Cigarette Users (N=390)									
Variable	Readiness to Quit					Quit Attempts			
--	Odds Ratio	95%Lower	95%Upper	p-value		Odds Ratio	95%Lower	95%Upper	p-value
Gender (ref female)									
Male	0.650	0.330	1.282	0.214		0.729	0.444	1.195	0.210
Race (ref White)									
Black	2.410	0.895	6.490	0.082		1.290	0.581	2.860	0.532
Hispanic	0.567	0.063	5.074	0.612		0.972	0.260	3.624	0.966
Asian	0.757	0.154	3.729	0.732		2.095	0.851	5.161	0.108
Other	1.548	0.574	4.177	0.388		1.580	0.751	3.326	0.228
Sexual Orientation (ref heterosexual)									
LGBTQ	0.504	0.199	1.275	0.148		1.461	0.779	2.738	0.237
School Type (ref private)									
Public	0.847	0.368	1.949	0.696		1.577	0.884	2.813	0.123
Technical	0.829	0.355	1.939	0.666		1.346	0.719	2.521	0.353
HBCU	0.563	0.145	2.185	0.407		0.811	0.274	2.397	0.705
Age (centered at age 18)									
1 Year	1.306	1.119	1.523	0.001		1.026	0.916	1.150	0.656
Depression Score									
1 unit change	0.988	0.938	1.041	0.653		1.005	0.969	1.042	0.783
Substance Use (ref no use)									
Little cigars/cigarillos (past 4mo)	2.379	1.151	4.917	0.019		1.520	0.874	2.646	0.138
Smokeless Tobacco (past 4mo)	1.088	0.362	3.268	0.880		1.046	0.466	2.349	0.914
Electronic Cigarettes (past 4mo)	2.448	1.094	5.480	0.029		2.053	1.098	3.841	0.024
Hookah (past 4mo)	0.245	0.091	0.662	0.006		0.839	0.446	1.579	0.587
Alcohol in the past 30 days	0.870	0.316	2.396	0.787		1.181	0.554	2.518	0.667
Binge drinking in the past 30 days	1.063	0.501	2.252	0.874		1.108	0.630	1.950	0.721

Substance Use Group									
Cigarette-only vs Co-use	0.700	0.366	1.340	0.282		1.343	0.826	2.181	0.234
Days of Cigarette use	1.006	0.999	1.013	0.083		1.000	0.995	1.005	0.955

Multivariate Analyses Regarding Readiness to Quit and Quit Attempts Among Cigarette Smokers

The only significant association for having attempted to quit cigarette use in the past four months was the use of electronic cigarettes, where those who had used an electronic cigarette were more likely to have attempted to quit smoking standard cigarettes, OR 2.05, 95% CI [1.09, 3.84]. Electronic cigarette use was also observed to be associated with greater odds of being ready to quit using cigarettes, OR 2.45, 95% CI [1.09, 5.48].

Older participants indicated a higher readiness to quit smoking cigarettes, OR 1.31, 95% CI [1.12, 1.52]. Age was not, however, significantly associated with readiness to quit marijuana when comparing marijuana-only users and co-users. Use of little cigars/cigarillos was associated with greater odds of being ready to quit cigarettes, OR 2.38, 95% CI [1.15, 4.92], but this was not found to be the case in marijuana users Smoking hookah was found to be associated with reduced odds of being ready to quit use of cigarettes, OR 0.25, 95% CI [0.09, 0.66].

Table 6. Bivariate Analyses of Readiness to Quit and Quit Attempts Among Marijuana Users

Marijuana Users (N=483)							
	Ready to Quit	Not Ready to Quit	p-value		Attempted to Quit	No Quit Attempts	p-value
Sociodemographics							
Age (SD)	20.26 (1.82)	20.47 (1.91)	0.346		20.52 (1.73)	20.40 (1.94)	0.561
Gender (%)							
Female	58 (63.04)	227 (58.06)			70 (66.67)	215 (56.88)	
Male	34 (36.96)	164 (41.94)	0.382		35 (33.33)	163 (43.12)	0.071
Sexual orientation (%)							
Heterosexual	85 (92.39)	336 (85.93)			91 (86.67)	330 (87.30)	
Other	7 (7.61)	55 (14.07)	0.096		14 (13.33)	48 (12.70)	0.863
Race/ethnicity (%)							
White	38 (41.30)	217 (55.50)			38 (36.19)	217 (57.41)	
Black	38 (41.30)	100 (25.58)			50 (47.62)	88 (23.28)	
Hispanic	4 (4.35)	17 (4.35)			5 (4.76)	16 (4.23)	
Asian	3 (3.26)	23 (5.88)			1 (0.95)	25 (6.61)	
Other	9 (9.78)	34 (8.70)	0.035		11 (2.28)	32 (8.47)	<0.001
Type of school (%)							
Private	28 (30.43)	183 (46.80)			24 (22.86)	187 (49.47)	
Public	24 (26.09)	104 (26.60)			32 (30.48)	96 (25.40)	
Technical college	15 (16.30)	48 (12.28)			22 (20.95)	41 (10.85)	
HBCU	25 (27.17)	56 (14.32)	0.005		27 (25.71)	54 (14.29)	<0.001
Mental Health							
Depression (SD)	8.27 (6.73)	5.99 (5.47)	0.004		8.55 (6.88)	5.83 (5.31)	<0.001
Frequency of Use							
Days used marijuana, past 4 mo. (SD)	20.78 (35.43)	29.48 (40.40)	0.058		24.59 (35.12)	28.72 (24.60)	0.345
Other Substance Use (%)							
Little cigars/cigarillos	29 (31.52)	106 (27.11)	0.396		49 (46.67)	86 (22.75)	<0.001

Smokeless tobacco	6 (6.52)	19 (4.86)	0.517	8 (7.62)	17 (4.50)	0.201
E-cigarettes	7 (7.61)	48 (12.28)	0.205	14 (13.33)	41 (10.85)	0.478
Hookah	17 (18.48)	82 (20.97)	0.594	29 (27.62)	70 (18.52)	0.041
Past 30-day alcohol use	79 (85.87)	354 (90.77)	0.162	93 (88.57)	340 (90.19)	0.628
Past 30-day binge drinking	60 (65.22)	250 (63.94)	0.818	64 (60.95)	246 (65.08)	0.435
Co-use with cigarettes	15 (16.30)	137 (35.04)	0.001	33 (31.43)	119 (31.48)	0.992
Quit-Related Factors						
Importance of quitting (SD)	6.98 (3.44)	1.95 (2.81)	<0.001	5.16 (3.63)	2.29 (3.26)	<0.001
Confidence in quitting (SD)	8.68 (2.64)	8.68 (2.58)	0.988	7.88 (3.17)	8.90 (2.35)	0.002

Bivariate Analyses Regarding Readiness to Quit and Quit Attempts Among Cigarette Smokers

The chi-square test for independence between racial identification and both readiness to quit using marijuana in the next 30 days and having a quit attempt showed that there were statistical differences between groups. White students and black student showed opposite trends in readiness to quit, with white students comprising a greater proportion of those not ready to quit and black students comprising a greater proportion that were ready to quit. The largest number of respondents that reported having made a quit attempt were black.

School type was also significantly different between both those ready to quit and those that weren't, as well as those who had attempted to quit and those who hadn't. Approximately half of those that reported that they had not attempted to quit were private school students, while they only constituted 23 percent of those that had attempted to quit.

LCC users comprised forty-six percent of those that had attempted to quit the use of marijuana, but only twenty-three percent of those that hadn't. Approximately one third of all LCC users had attempted to quit marijuana in the previous four months. Hookah users also showed significant difference between those with quit attempts and those without: twenty-eight percent of those that had attempted to quit were hookah users while only nineteen percent of those that did not have a quit attempt were hookah users.

Co-users and marijuana-only users were significantly different in terms of readiness to quit. Sixteen percent of all those ready to quit were co-users while co-users represented over thirty-five percent of those that were not ready to quit the use of marijuana. The importance of quitting was much higher for both those ready to quit (6.98 vs 3.44) and those with a quit attempt (5.16 vs 3.26).

Depression was associated with both readiness to quit and quit attempts of marijuana. The average depression score among those ready to quit marijuana was 8.68, compared to 5.99 among those that weren't ready to quit. Additionally, the average depression score for those with a quit attempts was 8.55 compared to an average of 5.83 among those that did not have a quit attempt.

Table 7. Multivariate Analyses Regarding Readiness to Quit and Quit Attempts Among Marijuana Users

Marijuana Users (N=483)									
Variable	Readiness to Quit					Quit Attempts			
--	Odds Ratio	95%Lower	95%Upper	p-value		Odds Ratio	95%Lower	95%Upper	p-value
Gender (ref female)									
Male	1.493	0.824	2.707	0.187		1.281	0.717	2.289	0.403
Race (ref White)									
Black	1.375	0.641	2.947	0.413		3.081	1.527	6.219	0.002
Hispanic	1.350	0.392	4.648	0.635		2.113	0.641	6.959	0.219
Asian	0.549	0.113	2.674	0.458		0.397	0.048	3.255	0.389
Other	1.848	0.776	4.402	0.166		2.568	1.112	5.930	0.027
Sexual Orientation (ref heterosexual)									
LGBTQ	0.553	0.231	1.321	0.182		1.177	0.574	2.415	0.656
School Type (ref private)									
Public	1.396	0.725	2.686	0.318		1.976	1.035	3.772	0.039
Technical	2.614	1.110	6.157	0.028		3.156	1.420	7.017	0.005
HBCU	2.778	1.104	6.987	0.030		1.419	0.595	3.384	0.429
Age (centered at age 18)									
1 Year	0.938	0.814	1.081	0.378		1.038	0.906	1.190	0.588
Depression Score									
1 unit change	1.084	1.040	1.131	<0.001		1.093	1.049	1.138	<0.001
Substance Use (ref no use)									
Little cigars/cigarillos (past 4mo)	0.909	0.475	1.741	0.775		1.951	1.091	3.489	0.024
Smokeless Tobacco (past 4mo)	2.654	0.836	8.423	0.098		1.952	0.626	6.081	0.249
Electronic Cigarettes (past 4mo)	0.486	0.155	1.530	0.218		1.130	0.466	2.741	0.787
Hookah (past 4mo)	1.105	0.546	2.238	0.781		1.359	0.721	2.559	0.343
Alcohol in the past 30 days	0.816	0.330	2.016	0.660		1.278	0.529	3.092	0.586
Binge drinking in the past 30 days	1.261	0.688	2.313	0.454		0.737	0.420	1.293	0.288

Substance Use Group									
Marijuana-only vs Co-use	3.107	1.519	6.356	0.002		1.136	0.625	2.065	0.675
Days of Marijuana use	0.996	0.988	1.003	0.255		0.995	0.988	1.001	0.125

Multivariate Analyses Regarding Readiness to Quit and Quit Attempts Among Marijuana Users

A one unit increase in depression score was associated with an 8.4% higher likelihood of readiness to quit marijuana, OR 1.08, 95% CI [1.04, 1.13] and 9 percent greater odds of having made a quit attempt, OR 1.09, 95% CI [1.05, 1.14]. Black/African American students had higher odds of attempting to quit marijuana use than white students, OR 3.08, 95% CI [1.53, 6.22]. Those categorized into the "other" racial group also showed an association with higher odds of having attempted to quit marijuana, OR 2.57, 95% CI [1.11, 5.93].

When analyzing school type, students enrolled in technical colleges were more likely to be ready to quit their use of marijuana, OR 2.61, 95% CI [1.11, 6.16]. Technical school students also had higher odds of having attempted to quit marijuana in the past four months, OR 3.16, 95% CI [1.42, 7.02] than those students attending a private school. Similarly, those attending a public school were more likely to report marijuana quit attempts, OR 1.98, 95% CI [1.04, 3.77]. Students attending the HBCU sampled in this study were more likely to be ready to quit their use of marijuana, OR 2.78, 95% CI [1.10, 6.99] than private school students.

Using only marijuana, compared to using both marijuana and cigarettes was, however, associated with greater odds of being ready to quit marijuana use, OR 3.11, 95% CI [1.52, 6.36]. When analyzing differences between readiness to quit cigarettes among co-users versus cigarette-only users, no significant differences were found. Use of little cigars and cigarillos raised the odds of having at least one marijuana quit attempt, OR 1.95, 95% CI [1.09, 3.49].

Correlation Analysis of Depression and Frequency of Use

Due to the findings in this study regarding the association between increased depression score and both readiness to quit marijuana and marijuana quit attempts, correlations were conducted to assess the associations between cigarette and marijuana use frequency and level of depressive symptoms. Days of cigarette smoking in the past four months was correlated with depression score [ϱ= 0.07, p=0.05], but days of marijuana use in the past four months was not correlated with depression score [rho-0.01, p=0.81]. It does not appear that the association between marijuana use and increased readiness to quit or quit attempts is directly linked to the frequency of marijuana use.

DISCUSSION

The analysis found within this study supports much of the research cited in the literature review and in the overall body of research on marijuana and tobacco use, co-use, and cessation. Other significant findings, however, are surprising and may require additional research to better contextualize. In the following section, findings from the major demographic, substance, or psychosocial category will be discussed in the context of relevant literature.

Depression

When determining readiness to quit marijuana, higher depression score was associated with higher odds of being ready to quit, and depression scores were on average two points higher among those that were ready to quit marijuana. This connection between higher depressive symptoms and readiness to quit marijuana is unusual, as many studies show an association between marijuana use and increased depressive symptoms [33, 35] and other psychotic or affective mental health outcomes [36].

Similarly to readiness to quit marijuana, depression score showed associations with marijuana quit attempts. Depression score among those with a quit attempt was almost three points higher than among those without a quit attempt on the PHQ-9 questionnaire. Each additional point on the 27-point scale increased the odds of having a marijuana quit attempts by approximately 9%-- a finding that contradicts research that shows depression is associated with increased marijuana dependency, although some studies have shown that adults with a recent major depressive episode had greater odds of quit attempts but a lower quit ratio [42]. The connection between higher depression score and both readiness to quit marijuana and quit attempts is unusual considering research that shows amotivational behavior among marijuana users [43].

Depression score was not significantly different between marijuana-only, cigarette-only, and co-use groups, and the inclusion of four-month frequency of marijuana use in the regression models makes it unlikely that these findings are related to how often depressed students smoke marijuana. Because of the cross-sectional nature of this study, no cause and effect hypothesis should be drawn from these findings, but rather these findings should motivate additional research on the associations between depression, readiness to quit marijuana, and marijuana quit attempts.

Sociodemographics

The only significant finding related to gender or sexual orientation was that the proportion of marijuana-only users that are females is significantly higher than the proportion of cigarette and marijuana co-users that are female. Other studies of college students have shown that males are generally more likely to report drug use [20, 44], and that overall rates of cigarette smoking are lower among females in Georgia [45].

Race and ethnicity were major determinants of usage group, readiness to quit, and quit attempts for both marijuana and cigarettes. When looking at group membership, blacks comprised a much larger proportion of marijuana-only users than either cigarette-only users or co-users, and odds of marijuana-only membership were over four times higher than for whites. When examining racial correlates of cessation behavior, differences were not found for readiness to quit or quit attempts among cigarette users, and the only effect of race was seen in the nearly three-fold greater odds of having a marijuana quit attempt by blacks. Rates of marijuana use are generally higher among African Americans [20], and social acceptability and increasing popularity of blunts are increasing, particularly among African Americans [46, 47].

Different types of schools were found to be significantly associated with the outcomes in this study. Technical and public school students were more likely to be cigarette-only users than co-

users. Technical and public school students also had greater odds of being ready to quit marijuana. Compared to private school students, technical school students also had higher odds of having had a marijuana quit attempt. School type was not found to be associated with any cigarette cessation variables, indicating that the landscape of substance use and the priority of cigarette smoking cessation are different depending on the type of school attended. These findings may be due to factors that were not accounted for in this study that influence the type of school attended, and researchers should be careful extrapolating these results without additional support. Nonetheless, understanding the influence of school type could help create more effective cessation interventions on college campuses.

Frequency of Use

Frequency of use is an important factor in cessation efforts, largely because it affects nicotine dependence and can lead to habitual substance use behaviors [48, 49]. Additionally, frequent marijuana use has been associated with greater dependence on nicotine [50]. Findings in this study largely support those associations, as co-users smoked marijuana nearly twice as often as those that reported being marijuana-only users. Among those that said they were seriously thinking of quitting cigarette smoking in the next 30 days, the average number of days in which they smoked during the past four months was significantly higher than among those that were not seriously thinking of quitting. Interestingly, frequency of cigarette use was not found to be significantly different among those with quit attempts and those without. These findings may support research that shows that frequent cigarette users are serious about quitting but are addicted enough that quit attempts are unsuccessful [48].

Other Substance Use

The prevalence of alternative tobacco use has risen in recent years, and the perceptions of the perceived harm, addictiveness, and social unacceptability of such products has changed [29, 51]. Because of this increase in the use of alternative tobacco products, it is important to understand the effects of alternative tobacco use on cigarette and marijuana cessation behaviors. Some alternative tobacco products are known to be used as aids in cigarette cessation [30, 31], but the effects of alternative tobacco product use on marijuana cessation is less well understood.

Significantly more cigarettes smokers that had attempted to quit in the past four months were e-cigarette users. The odds of being ready to quit cigarettes were nearly twice as high for e-cigarette users, and e-cigarette users also had twice the odds of having a quit attempt compared to those that did not use e-cigarettes. E-cigarette use did not appear to have any association with marijuana cessation behavior, indicating that e-cigarette use is generally only used as a cessation aid for cigarettes and not marijuana.

Little cigar and cigarillo (LCC) smokers were more likely to be co-users than either cigarette-only or marijuana-only users, which is likely a result of the use of blunts in smoking marijuana [47]. Interestingly, the odds of being ready to quit cigarettes was almost twice as high among LCC users, but co-use with marijuana was not found to be associated with readiness to quit. This could be due to the use of LCCs as a quitting aid similarly to e-cigarettes in this sample. LCC use were more likely to have attempted to quit marijuana during the past four months than those that did not use LCCs, but there was no association between LCC use and readiness to quit. The role of LCCs as quitting aids for both marijuana and cigarettes should be explored further.

Alcohol use in the past 30 days and binge drinking during that same time-period were not associated with any quitting behaviors, although it was found to be associated with tobacco and marijuana use group membership. Alcohol use and alcohol-related behaviors like binge drinking

have been linked to increased substance use and abuse among college students and adolescents [52]. Additionally, alcohol use is associated with increased sensation-seeking behaviors that may lead to tobacco and marijuana use [53]. Data from this analysis largely supports this connection between alcohol and sensation seeking behavior, as ninety-four percent of co-users in this study used alcohol in the past 30 days, compared to seventy-nine and eighty-eight percent among cigarette-only users and marijuana-only users, respectively.

Confidence and Importance of Quitting

Confidence in quitting and the importance of quitting are often important aspects in a person's decision to attempt to quit, although high confidence and/or importance are not necessarily highly correlated [54]. Generally, higher confidence in quitting and importance of quitting is related to more successful quitting when a quit attempt is made [55, 56]. The expectation that those who are ready to quit or have made quit attempts would have greater confidence in quitting and importance of quitting was observed in this sample. The importance of quitting marijuana among those that were ready to quit was nearly three times as high on average as the importance of quitting among those that were not ready to quit using marijuana. While rated lower than importance, confidence in quitting marijuana was also substantially higher among those that had marijuana quit attempts compared to those that did not. Importance of quitting cigarettes, as expected, was also higher among those with quit attempts or those who were ready to quit the use of cigarettes, although no significant differences were found when looking at confidence in quitting. Confidence in quitting cigarettes is generally lower than that of marijuana and other drugs [57], and this lower confidence in quitting cigarettes compared marijuana can be seen in the lower average confidence rating for cigarettes among co-users within this sample.

Strengths and Limitations

The number of substance users dropped significantly from baseline to wave two and onwards, partially as a result of differential attrition and also possibly due to participants realizing that answering "no" to substance use questions skipped follow-up questions and shortened the survey. This results in a rather conservative sample of users present in this study, which affords us a high degree of confidence that the sample truly consists of marijuana users and cigarette smokers, and that their responses are likely to be genuine about their usage frequency of other tobacco products and alcohol.

As previous studies on the Project DECOY cohort have described, the baseline cohort was disproportionately female. This greater proportion of females than males may reduce the cell counts in certain categories that are highly correlated with gender and limit power in analyses. However, the sample size is quite large, and confidence intervals for regressions were narrow

Self-report is a problem with many studies in behavior science, and Project DECOY relies on self-report for many of its measures, including substance use and quit attempts. Participants were asked how many times they used each given substance in the previous four months, with answers ranging from 0-120, and any use was dichotomized into a yes/no variable. While this will help with the large amount of variance such an estimate would have, for very infrequent users it is still entirely possible that usage was missed or over reported. In this same regard, there is the possibility that responses were affected by social desirability bias, even though the survey was administered anonymously online.

CONCLUSION

This study identifies factors associated with co-use, cigarette-only use, and marijuana-only use, as well as the psychosocial factors related to quitting within those groups. There is a paucity of research done on co-use of marijuana and cigarettes in college students, and this study has both validated findings from existing tobacco and marijuana research in other demographic groups. Findings from this study have also identified areas that require further research and analysis. The connection between e-cigarettes and tobacco cessation appears to be present when other variables are controlled for, which other studies have shown may be due to use of e-cigarettes as a tool for quitting. The association between older students and higher readiness to quit cigarettes is worth exploring, and in light of the experimentation behavior that we hypothesize is taking place within this cohort, following the "aging out" of substance use could be an avenue for future research on tobacco and marijuana use in young adults. While research into the long-term health effects of e-cigarettes and tobacco vaping products is not particularly well understood and is ongoing, public health practitioners should utilize these findings to exploration of the effectiveness of e-cigarette use in promoting cigarette smoking cessation, a well-known negative health behavior with a significant public health burden.

With additional state and local efforts to legalize or decriminalize marijuana, and the expected increase in the availability of marijuana products, findings of this study should be used to better formulate policies and cessation efforts targeting the use of both marijuana and tobacco among college students. Alternative tobacco product use other than e-cigarettes appear to be associated with higher odds of co-use of marijuana and cigarettes, which most likely describes experimentation behavior and has been seen in studies of younger children as well as adults. Because

of this, school administrators should consider revising their smoke-free policies to include marijuana and alternative tobacco products.

The finding that co-users were significantly less likely to be ready to quit emphasizes the importance of preventing co-use in college populations, and in conjunction with increasing prevalence and availability of marijuana in the United States, efforts in colleges and universities should have an increased focus on preventing marijuana-use initiation.

The positive relationship between higher depression score and greater readiness to quit marijuana and quit attempts is also worth researching among this population, particularly with the increasing burden of depression on college aged young adults. Correlation analysis of frequency of marijuana use and depression score showed that it is unlikely the relationships found between marijuana cessation behavior and depression were due to infrequent users. The findings may direct the depression treatment providers of college students to utilize the opportunity to promote and support marijuana cessation in their patients. Long-term longitudinal analysis of quit attempts and readiness to quit among those exhibiting high depression symptoms could provide insight into how depression affects marijuana cessation success.

While future research into the unexpected findings of this study should be conducted on similar cohorts for validation, additional long-term, longitudinal studies of co-user and single-substance behavior would shed light on aspects such as the effectiveness of quit attempts within each group as well as the importance of perceived readiness to quit and the importance of quitting.

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