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Simultaneous cannabis and tobacco use and cannabis-related outcomes in young women

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Abstract

Compared to those who reported a lifetime co-occurrence of cannabis and tobacco use, individuals who report *simultaneous* use of cannabis and tobacco are more likely to also report higher rates of substance-related problems and psychopathology. In a sample of young women, we examine (a) *co-occurring* use, or whether regular cigarette smoking is associated with increased cannabis involvement and (b) *simultaneous* use, a special form of co-occurring use where cannabis and cigarettes are typically used on the same occasion to test whether those who use cannabis and tobacco simultaneously are also more likely to report greater cannabis involvement and (c) the extent to which latent genetic and environmental factors contribute to simultaneous use in those with a history of co-occurring cannabis use and regular cigarette smoking. Women (N=3,427) who report regular cigarette smoking are 4.5–9.5 times more likely to report co-occurring cannabis use and other stages of cannabis involvement, including DSM-IV cannabis abuse and dependence. In those women who report co-occurring regular cigarette smoking and lifetime cannabis use (N=1,073), simultaneous use of cannabis and tobacco was associated with increased likelihood of negative cannabis-related outcomes. Simultaneous users were 1.6 times more likely to meet criteria for DSM-IV cannabis abuse, even after controlling for early covariates and for prior stages of cannabis involvement. Simultaneous use was not heritable, and twin similarity was attributable to shared environmental factors (31%). While our study does not determine causality between simultaneous tobacco-cannabis use and cannabis involvement, results indicate that simultaneous use is potentially a marker for more severe psychosocial consequences associated with cannabis use.

Keywords

Simultaneous use; cannabis; tobacco; abuse; dependence; twin

1. Introduction

Epidemiological evidence suggests that tobacco users are at increased risk for subsequent cannabis use (Adler et al., 1981; Kandel et al., 1993; Patton et al., 2006). More recently, research has suggested that cannabis use may confer risk for subsequent escalation of tobacco use and nicotine dependence (Agrawal et al., 2008; Patton et al., 2005; Timberlake et al., 2007; Tullis et al., 2003). These quantitative studies substantiate evidence from qualitative evaluations in which adolescents reported a unique relationship between their cannabis and tobacco use, with each fostering the prolonged use of the other (Amos et al., 2004; Clough et al., 2004; Highet, 2004).

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Several hypotheses have been proposed to explain the relationship between cannabis and tobacco use, including a shared genetic liability (Neale et al., 2006), possibly mediated by receptor cross-tolerance (Viveros et al., 2006); overlapping environmental risk influences (e.g. peer groups) (Highet, 2003); the inclusion of tobacco in blunts (Golub et al., 2005); and finally, the common route of administration for both psychoactive substances (i.e. inhalation).

It is critical to distinguish between the commonly investigated relationship of *co-occurring* use across the lifespan and *simultaneous* use, which indexes co-occurring use on the same occasion (Martin et al., 1992). The group of individuals with co-occurring use can be further distinguished into (i) those who do not typically use tobacco and cannabis on the same occasion and (b) those who typically use them on the same occasion. The latter represents a specific form of co-occurrence, that of *simultaneous* use. We hypothesize that even within a group of individuals with co-occurring use, simultaneous use of tobacco with cannabis will be associated with multiple cannabis related outcomes, including risk for abuse and dependence. Using a sample of young adult women, we examine:

- **a.** *Co-occurring* use: Whether regular cigarette smokers are more likely to also report greater cannabis involvement during their lifetime;
- **b.** *Simultaneous* use: In those with a lifetime history of co-occurring use, to test whether simultaneous use of cannabis and cigarettes is associated with greater negative cannabis-related outcomes;
- **c.** Sources of twin similarity in *simultaneous* use: To investigate the extent to which genetic and environmental influences contribute to concordance in simultaneous use after accounting for exposure to both cannabis and tobacco.

2. Methods and Materials

2.1 Sample

Data for the present study come from 3,427 young adult women (aged 21–31 years) who constituted Wave five of Missouri Adolescent Female Twin Study (MOAFTS). MOAFTS consists of a cohort of female same-sex twin pairs born between July 1st 1975 – June 30th 1985 who were identified from birth records (Heath et al., 1999; Slutske et al., 2004). Twins were eligible to participate if both members of the twin pair had survived past infancy, were not adopted at birth and if their biological mother was a resident of Missouri at the time of their birth. Using a cohort-sequential sampling design, twins and their parents were invited to participate in the baseline interviews with at least one biological parent during 1994–1999, when the twins were 13, 15, 17 or 19 years old. A telephone diagnostic interview was administered, first to the parents, and subsequently to the twins, after obtaining parental permission if the twin was minor (Heath et al., 1999; Knopik et al., 2005). Subsequently, participants were invited to complete/participate in: (a) a mailed questionnaire, (b) a one-year follow-up telephone interview, (c) a two year re-test interview (“Wave three”) limited to a subset of participants, (d) the first full-length follow-up telephone interview (“Wave four”) (Heath et al., 2002), (e) an accompanying mailed questionnaire to (d) and (f) a second full-length follow-up telephone interview (Wave five).

Simultaneous use was only assessed in Wave five and hence we restrict the present study to Wave five only. Telephone interviews were conducted during 2005–2007, approximately 10 years after baseline (about 3 years after Wave four), and included 3,427 women who had participated in Wave four (N=3,349), or wave one (but not wave four, N=22). An additional 56 co-twins were interviewed for the first time during Wave Five.

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2.2 Measures

2.2.1 Co-occurring Use—To study lifetime co-occurrence of cannabis-related outcomes and cigarette smoking, we used a measure of regular cigarette smoking, defined as a lifetime history of either (a) smoking 100+ cigarettes or (b) smoking 2–99 cigarettes but smoking as frequently as once a week. For those women who did not report smoking in the past 2 years, data on regular smoking was accessed from their prior (i.e. Wave four) interview. Co-occurring cannabis use occurred if women reported use of cannabis (or cannabis-related outcomes) at any point during their lifetime.

2.2.2 Simultaneous Use—Cannabis use was endorsed by 49.4% (N=1672) of women at Wave five. Of these cannabis users, 1,073 also reported regular cigarette smoking. Only those women who reported a lifetime history of consuming at least one alcoholic beverage, smoking at least one cigarette, using cannabis at least once and using a drug other than cannabis at least once were queried about whether they typically used alcohol, tobacco and/or other drugs when they used cannabis [*Have you typically used marijuana all by itself, or have you typically used marijuana (while smoking cigarettes) (or) (while drinking alcohol) (or) (while using anything else from list x)*]. Participants were asked to endorse any and all substances used simultaneously. 553 women reported simultaneously using tobacco with cannabis, 446 women reported using alcohol or another drug and 74 women reported no simultaneous use. About 44% of simultaneous cannabis-tobacco users also reported simultaneous use of alcohol and other drugs. These women were primarily simultaneous cannabis-tobacco-alcohol users with only 2 women reporting simultaneous cannabis-tobacco-other illicit drug use.

2.2.3. Cannabis-related outcomes—The following outcomes were assessed:

- **a.** Cannabis use: Defined by self-reported use of cannabis at least once during the lifetime;
- **b.** Current/past month use: Whether the participant had used cannabis in the past month;
- **c.** Daily use: Indicating that the participant used cannabis every day or as often as 5–6 days a week, when using it the most;
- **d.** Frequency of lifetime use: Defined dichotomously (used 40 or more times);
- **e.** Cannabis abuse: Defined dichotomously as a diagnosis of DSM-IV cannabis abuse;
- **f.** Cannabis dependence: Defined dichotomously as a diagnosis of DSM-IV cannabis dependence – this diagnosis was non-hierarchical with respect to cannabis abuse (i.e. an individual could meet criteria for both abuse and/or dependence).

2.2.4 Predictors and early correlates of simultaneous cannabis-tobacco use—The following were controlled for:

- **a.** Zygosity: Whether the participant was a member of an identical twin pair;
- **b.** Ethnicity: Indicator denoting African-American ancestry derived from birth records;
- **c.** Age at interview: Both continuous (range 21–31 years) and dichotomous, reflecting the bottom quartile (younger than 23 years of age at the time of interview);
- **d.** Age at first cannabis use: Both continuous (range 8–28 years) and dichotomous, reflecting the bottom quartile (younger than 16 years of age at the time of first cannabis use);

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e. Conduct disorder: A lifetime history of DSM-IV conduct disorder from prior waves (wave one and four);

f. Peer cannabis use: A dichotomous measure, based on self-report from the respondent, on whether 'all' or 'most' of their current friends used cannabis;

g. High school incompletion: A dichotomous measure indicating that the respondent had not obtained a high school degree or a GED;

h. Tobacco preference: Endorsing tobacco as response to the question 'of all the drugs you have used, which one do you prefer?' Only one preference was allowed.

2.3 Statistical analyses

All analyses were conducted in STATA (Stata Corp, 2003). A sandwich estimator was used to account for familial clustering of twin data.

2.3.1 Co-occurring use—To test whether regular cigarette smoking was associated with increased cannabis involvement, we conducted logistic regression analyses in the full sample. Adjusted odds-ratio were computed by controlling for the early predictors and the correlates described above. In addition to these covariates, for the association between regular smoking and current, daily and frequent cannabis use and cannabis abuse and dependence, we also adjusted for lifetime cannabis use. Finally, to examine whether regular cigarette smoking was associated with a lifetime history of cannabis abuse and dependence after controlling for prior stages of cannabis involvement (daily, current and frequent use), odds-ratios between regular smoking and DSM-IV cannabis abuse and dependence that adjusted for early covariates, lifetime cannabis use as well as daily, current and frequent use were calculated.

2.3.2. Simultaneous use—To examine whether, in those with a lifetime history of co-occurring cannabis use and regular cigarette smoking, there was an even greater likelihood of negative cannabis-related outcomes in those who reported simultaneous cannabis-tobacco use, we subset on 1,073 women who reported both regular cigarette smoking and cannabis use. The outcome was simultaneous use and unadjusted and adjusted (controlling for early covariates) odds-ratios were calculated using the strategy described in 2.3.1. Two final models were tested where the association between simultaneous use and DSM-IV cannabis abuse and dependence was adjusted for all prior stages of cannabis involvement (daily, current and frequent cannabis use) thus affording a test of whether simultaneous cannabis-tobacco use independently increased the likelihood of DSM-IV cannabis use disorders.

2.4. Twin analyses

Utilizing data on monozygotic (MZ) and dizygotic (DZ) twins, we examined the role of additive genetic, shared environmental and non-shared environmental influences on simultaneous use of tobacco with cannabis, in those women who reported a lifetime history of cannabis use and regular cigarette smoking. Thus, we were able to test for genetic, shared and non-shared environmental influences specific to simultaneous cannabis-tobacco use in those who were already regular cigarette smokers and cannabis users.

Models were fitted to raw data in the statistical modeling package Mx using full information maximum likelihood (FIML). Additive genetic influences (A) were assumed to correlate 100% and 50% in MZ and DZ twin pairs respectively while shared environmental factors (C, which make members of a twin pair similar to each other) were correlated 100% in both MZ and DZ pairs. Non-shared environmental influences (E), which include measurement error, were uncorrelated across twins. To allow for the effect of significant correlates of

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simultaneous use identified in the logistic regression analyses, thresholds were adjusted for significant predictors. A chi-square test (difference in −2 loglikelihood of models, which is distributed as chi-square for the given degrees of freedom) of statistical significance was used to test for the influence of A, C and E on simultaneous cannabis-tobacco use.

3. Results

3.1 Co-occurring use: Regular cigarette smoking and cannabis involvement

Women with a history of regular cigarette smoking were 9.0 times more likely to report a lifetime history of cannabis use. As shown in Table 1, regular cigarette smokers were also more likely to be current cannabis users, to report daily and more frequent cannabis use and to meet criteria for DSM-IV cannabis abuse and dependence. Even after accounting for the increased likelihood of current, daily and frequent cannabis use and for the influence of covariates, regular cigarette smokers were twice as likely to meet criteria for DSM-IV cannabis abuse [O.R. 2.09 [95% C.I. 1.15–3.82]] supporting *co-occurrence* of regular cigarette smoking and DSM-IV cannabis abuse. While there was a similar 2-fold increase in the likelihood of meeting criteria for DSM-IV cannabis dependence, the association was not statistically significant [O.R. 2.30 [95% C.I.0.92–5.72]].

3.2 Simultaneous tobacco-cannabis use and cannabis involvement

Within the group of women who reported a lifetime history of cannabis use and regular cigarette smoking (i.e. controlling for *co-occurring* use), simultaneous cannabis-tobacco users were considerably more likely to also report daily and frequent cannabis use and also to meet criteria for DSM-IV cannabis abuse and dependence (Table 2). The association between simultaneous use and cannabis involvement persisted even after controlling for early predictors and covariates, of which only age at first cannabis use [O.R. 1.37 [95% C.I. 1.03–1.82]] and tobacco preference [O.R. 1.86 [95% C.I. 1.43–2.42]] were associated with simultaneous use in a multivariate model.

The effects of simultaneous cannabis and tobacco use (while controlling for *co-occurring* use) on cannabis abuse persisted even after accounting for daily, frequent and current cannabis use. Simultaneous cannabis-tobacco users were 1.60 times more likely to meet criteria for cannabis abuse [95% C.I. 1.03–2.52] than those who reported *co-occurring* use but not *simultaneous* use. This evidence suggests that women who typically use cannabis and cigarettes on the same occasion are also more likely to meet criteria for cannabis use disorders, particularly abuse (the association between simultaneous use and cannabis dependence was not significant after adjustment for daily, frequent and current cannabis use) and that this effect may not be mediated by the effects of simultaneous use on prior stages of cannabis involvement.

3.3 Twin models of simultaneous tobacco-cannabis use

For twin analyses, we only selected twin pairs reporting European American ancestry. Consequently we had 160 MZ and 100 DZ pairs and an additional 191 MZ and 227 DZ twins from incomplete pairs for analyses. Upon fitting a univariate twin model to these data with thresholds adjusted for age at first cannabis use and tobacco preference, additive genetic influences did not significantly influence variation in simultaneous cannabis-tobacco use. Phenotypic variance in simultaneous use was attributable to shared environment (31%, [95% C.I. 12–48%]) and non-shared environmental (69%, [95% C.I. 62–88%]) influences.

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4.0 Discussion

We demonstrate that both *co-occurring* and *simultaneous* cannabis-tobacco use is associated with greater levels of cannabis involvement. More importantly, our analyses suggest that even with a specialized group of co-occurring cannabis-tobacco users – those who use cannabis and cigarettes *simultaneously*, this simultaneous use is associated with higher rates of DSM-IV cannabis abuse. While we cannot, with these cross-sectional data, determine whether simultaneous use leads to increased cannabis involvement or whether heavier cannabis users tend to be simultaneous tobacco-cannabis users, our results suggest that simultaneous users of tobacco and cannabis are an especially vulnerable population.

4.1. Prior research on simultaneous substance use

There are few existing studies of simultaneous substance use (Collins et al., 1998; Earleywine et al., 1997; Martin et al., 1992; Midanik et al., 2007; Ream et al., 2008; Smucker Barnwell et al., 2006; Smucker et al., 2005) and findings from these studies have been equivocal as regards the effect of simultaneous use on later stages of substance use. One study found no long-term effects of simultaneous substance use on health-related outcomes (Earleywine et al., 1997), while recently, Midanik and colleagues reported that simultaneous alcohol-cannabis use was associated with higher rates of social consequences (e.g. legal/accidents), alcohol dependence and depression. Smucker-Barnwell (2005, 2006) have also reported that heavy alcohol use is associated with the transition from cannabis use to cannabis dependence, and that heavy alcohol users may also report heavier cannabis consumption.

One prior study reports elevated levels of cannabis dependence in those using blunts (i.e. wrapping cannabis in inexpensive cigar wrappers) (Golub et al., 2005) and in those chasing cannabis with tobacco (Ream et al., 2008). Ream and colleagues (2008) report that simultaneous cannabis-tobacco users were 1.4–1.5 times more likely to endorse symptoms of cannabis dependence, with this odds-ratio increasing to 4.1 in daily cannabis-tobacco users. Consistent with these findings, we report that even after controlling for a history of regular cigarette smoking, simultaneous use of cannabis and tobacco is correlated with elevated cannabis involvement.

4.2 Mechanisms underlying simultaneous cannabis and tobacco use

When coupled with the high rate of regular cigarette smoking in simultaneous users, our results suggest that in addition to the lifetime co-occurrence of cannabis use and cigarette smoking, those women who typically use these substances on the same occasion are more likely to also have cannabis-related problems.

Pharmacological, physiological and social mechanisms may contribute to the increased rates of cannabis-related problems in simultaneous cannabis-tobacco users, even when compared to those with lifetime co-occurring use. Simultaneous users may be more likely to find cannabis smoking more rewarding and reinforcing – Tullis et al (Tullis et al., 2003), for instance, report that some young adults use tobacco with cannabis to prolong and increase the effects of cannabis. Whether this is due to nicotine-mediated alteration of the rewarding effects of Δ9-tetrahydrocannabinol, as has been demonstrated by animal researchers (Castane et al., 2002; Valjent et al., 2002), or whether it is simply because tobacco users are more accustomed to the sensation of smoking, or both, is not known. However, if tobacco users are more likely to find cannabis use enjoyable, and further, if this simultaneous use increases their rate of cannabis use, then simultaneous users are more likely to develop problems with cannabis, even when compared to those with co-occurring use across the lifetime.

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Our finding that similarity between members of a twin pair for simultaneous cannabis-tobacco use was entirely due to shared environmental influences, and not due to heritable factors likely reflects the importance of social and cultural influences that underlie the practice of simultaneous use. It is possible that similar patterns of socialization (e.g. common peer group characteristics) may account for twin similarity in simultaneous use (Gifford-Smith et al., 2005; Lynskey et al., 1998; Perkonigg et al., 2008; Windle et al., 2004). Collins et al (Collins et al., 1998), for instance, report pro-drug beliefs, deviance, drug offers and drug use intentions to be potent predictors of simultaneous alcohol-cannabis use. Other cultural characteristics, such as blunt-smoking, may also be correlated with simultaneous use, and contribute to estimates of shared environment (Golub et al., 2005; Kelly, 2005).

4.3 Study Limitations

Some limitations of the current study are noteworthy. First, this is a sample of young adult women from the U.S. Midwest and results may not extend to men, other geographic regions or other age cohorts. Second, lifetime use of alcohol, tobacco, cannabis and other illicit drugs was a pre-requisite for being asked the simultaneous use questions. While it is unlikely that any cannabis users would not have previously used alcohol, it is possible that some cannabis users may not have used other illicit drugs, and such individuals were excluded from the section on simultaneous use. Third, retrospective recall bias may have influenced our analyses. Fourth, statistical power may have limited our ability to detect heritable influences on simultaneous tobacco-cannabis use. Finally, and importantly, our study design is not equipped to address whether simultaneous cannabis-tobacco use has a causal impact on cannabis involvement, and our conclusions may not, as such, be viewed as evidence that simultaneous use predicts adverse cannabis-related outcomes.

In conclusion, female simultaneous cannabis and tobacco users may represent a group at increased vulnerability for cannabis-related outcomes. Further research will be required to unequivocally delineate whether simultaneous use is a marker for problematic cannabis and tobacco use or exerts a causal influence on later stages of cannabis involvement.

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References

Adler I, Kandel DB. Cross-cultural perspectives on developmental stages in adolescent drug use. J Stud Alcohol 1981;42:701–715. [PubMed: 6975860]

Agrawal A, Madden P, Bucholz K, Heath A, Lynskey M. Transitions to Regular Smoking and to Nicotine Dependence in Women using Cannabis. Drug Alcohol Depend 2008;95:107–114. [PubMed: 18325694]

Amos A, Wiltshire S, Bostock Y, Haw S, McNeill A. 'You can't go without a fag...you need it for your hash'--a qualitative exploration of smoking, cannabis and young people. Addiction 2004;99:77–81. [PubMed: 14678065]

Castane A, Valjent E, Ledent C, Parmentier M, Maldonado R, Valverde O. Lack of CB1 cannabinoid receptors modifies nicotine behavioural responses, but not nicotine abstinence. Neuropharmacology 2002;43:857–867. [PubMed: 12384171]

Clough AR, d'Abbs P, Cairney S, Gray D, Maruff P, Parker R, O'Reilly B. Emerging patterns of cannabis and other substance use in Aboriginal communities in Arnhem Land, Northern Territory: a study of two communities. Drug Alcohol Rev 2004;23:381–390. [PubMed: 15763742]

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Collins RL, Ellickson PL, Bell RM. Simultaneous polydrug use among teens: prevalence and predictors 24. J Subst Abuse 1998;10:233–253. [PubMed: 10689657]

Earleywine M, Newcomb MD. Concurrent versus simultaneous polydrug use: prevalence, correlates, discriminant validity, and prospective effects on health outcomes. Exp Clin Psychopharmacol 1997;5:353–364. [PubMed: 9386962]

Gifford-Smith M, Dodge KA, Dishion TJ, McCord J. Peer influence in children and adolescents: crossing the bridge from developmental to intervention science. J Abnorm Child Psychol 2005;33:255–265. [PubMed: 15957555]

Golub A, Johnson BD, Dunlap E. The growth in marijuana use among American youths during the 1990s and the extent of blunt smoking. J Ethn Subst Abuse 2005;4:1–21. [PubMed: 16537326]

Heath AC, Howells W, Bucholz KK, Glowinski AL, Nelson EC, Madden PA. Ascertainment of a mid-western US female adolescent twin cohort for alcohol studies: assessment of sample representativeness using birth record data. Twin Res 2002;5:107–112. [PubMed: 11931688]

Highet G. Cannabis and smoking research: interviewing young people in self-selected friendship pairs. Health Educ Res 2003;18:108–118. [PubMed: 12608688]

Highet G. The role of cannabis in supporting young people's cigarette smoking: a qualitative exploration. Health Educ Res 2004;19:635–643. [PubMed: 15199002]

Kandel D, Yamaguchi K. From beer to crack: developmental patterns of drug involvement. Am J Public Health 1993;83:851–855. [PubMed: 8498623]

Kelly BC. Bongs and blunts: notes from a suburban marijuana subculture. J Ethn Subst Abuse 2005;4:81–97. [PubMed: 16537329]

Lynskey MT, Fergusson DM, Horwood LJ. The origins of the correlations between tobacco, alcohol, and cannabis use during adolescence. J Child Psychol Psychiatry 1998;39:995–1005. [PubMed: 9804032]

Martin CS, Clifford PR, Clapper RL. Patterns and predictors of simultaneous and concurrent use of alcohol, tobacco, marijuana, and hallucinogens in first-year college students. J Subst Abuse 1992;4:319–326. [PubMed: 1458048]

Midanik LT, Tam TW, Weisner C. Concurrent and simultaneous drug and alcohol use: results of the 2000 National Alcohol Survey. Drug Alcohol Depend 2007;90:72–80. [PubMed: 17446013]

Neale MC, Harvey E, Maes HH, Sullivan PF, Kendler KS. Extensions to the modeling of initiation and progression: applications to substance use and abuse. Behav Genet 2006;36:507–524. [PubMed: 16770695]

Patton GC, Coffey C, Carlin JB, Sawyer SM, Lynskey M. Reverse gateways? Frequent cannabis use as a predictor of tobacco initiation and nicotine dependence. Addiction 2005;100:1518–1525. [PubMed: 16185213]

Patton GC, Coffey C, Carlin JB, Sawyer SM, Wakefield M. Teen smokers reach their mid twenties. J Adolesc Health 2006;39:214–220. [PubMed: 16857533]

Perkonigg A, Goodwin RD, Fiedler A, Behrendt S, Beesdo K, Lieb R, Wittchen HU. The natural course of cannabis use, abuse and dependence during the first decades of life. Addiction 2008;103:439–449. [PubMed: 18269364]

Ream GL, Benoit E, Johnson BD, Dunlap E. Smoking tobacco along with marijuana increases symptoms of cannabis dependence. Drug Alcohol Depend 2008;95:199–208. [PubMed: 18339491]

Smucker Barnwell SV, Earleywine M, Gordis EB. Confirming alcohol-moderated links between cannabis use and dependence in a national sample. Addict Behav 2006;31:1695–1699. [PubMed: 16414201]

Smucker BS, Earleywine M, Gordis EB. Alcohol consumption moderates the link between cannabis use and cannabis dependence in an internet survey. Psychol Addict Behav 2005;19:212–216. [PubMed: 16011393]

Stata Corp. STATA; College Station, TX: 2003.

Timberlake DS, Haberstick BC, Hopfer CJ, Bricker J, Sakai JT, Lessem JM, Hewitt JK. Progression from marijuana use to daily smoking and nicotine dependence in a national sample of U.S. adolescents. Drug Alcohol Depend 2007;88:272–281. [PubMed: 17174040]

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Tullis LM, Dupont R, Frost-Pineda K, Gold MS. Marijuana and tobacco: a major connection? J Addict Dis 2003;22:51–62. [PubMed: 14621344]

Valjent E, Mitchell JM, Besson MJ, Caboche J, Maldonado R. Behavioural and biochemical evidence for interactions between Delta 9-tetrahydrocannabinol and nicotine. Br J Pharmacol 2002;135:564–578. [PubMed: 11815392]

Viveros MP, Marco EM, File SE. Nicotine and cannabinoids: parallels, contrasts and interactions. Neurosci Biobehav Rev 2006;30:1161–1181. [PubMed: 17049986]

Windle M, Wiesner M. Trajectories of marijuana use from adolescence to young adulthood: predictors and outcomes. Dev Psychopathol 2004;16:1007–1027. [PubMed: 15704825]

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Table 1

Co-occurrence of cannabis-related outcomes and regular cigarette smoking in 3,427 women from the MOAFTS.

	Unadjusted odds-ratio [95% C.I.]	Adjusted odds-ratio [95% C.I.]
Cannabis use	9.03 [7.57–10.76]	9.46 [6.95–12.87]
Current/past month user	5.07 [3.55–7.25]	4.47 [2.91–6.86]
Daily user	9.01 [6.54–12.42]	6.92 [4.67–10.26]
Frequent use: used 40+ times	8.17 [6.41–10.42]	6.90 [5.10–9.32]
DSM-IV abuse	7.59 [4.88–11.81]	5.83 [3.51–9.70]
DSM-IV dependence	8.73 [4.51–16.90]	9.19 [4.32–19.55]

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Table 2

The association between simultaneous cannabis-tobacco use and cannabis related outcomes in 1,073 women reporting co-occurring cannabis use and regular cigarette smoking.

	No Simultaneous cannabis- tobacco use (%)	Simultaneous Cannabis- tobacco use (%)	Unadjusted Odds-ratio [95% C.I.]	Adjusted Odds- ratio [95% C.I.]
Current/past month user	50.9	55.7	1.21 [0.83–1.77]	1.30 [0.88–1.94]
Daily user	48.4	62.5	1.77 [1.31–2.39]	1.80 [1.32–2.46]
Frequent use: used 40+ times	42.1	62.0	1.90 [1.47–2.45]	2.03 [1.54–2.67]
DSM-IV abuse	49.6	66.9	2.05 [1.38–3.05]	2.12 [1.42–3.16][#]
DSM-IV dependence	51.0	60.0	1.44 [0.87–2.40]	1.49 [0.88–2.52]

Note:

[#]O.R. = 1.60 [95% C.I. 1.03–2.52] when controlling also for current, daily and frequent use