



Associations between marijuana use and tobacco cessation outcomes in young adults

Erin A. Vogel^{a,*}, Mark L. Rubinstein^b, Judith J. Prochaska^c, Danielle E. Ramo^a

^a Department of Psychiatry and Weill Institute for Neurosciences, University of California, San Francisco, 350 Parnassus Avenue, Suite 810, San Francisco, CA 94117, USA

^b Division of Adolescent & Young Adult Medicine, University of California, San Francisco, 3333 California Street, Suite 245, San Francisco, CA 94118, USA

^c Stanford Prevention Research Center, Department of Medicine, Stanford University, 1265 Welch Road, Stanford, CA 94305, USA

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ABSTRACT

Marijuana and tobacco co-use is common among young adults, and findings are mixed regarding the association between marijuana use and smoking cessation outcomes. This study examined the longitudinal relationships between marijuana use and smoking cessation outcomes among young adults (aged 18–25 years; $N = 500$) enrolled in a 3-month smoking cessation intervention on Facebook. At baseline and 3, 6, and 12 months, participants reported their marijuana use and their smoking behaviors (seven-day point prevalence abstinence from smoking, cigarettes per day, quit attempts) and readiness to quit. Longitudinal analyses controlled for experimental condition and adjusted for baseline stage of change, baseline average cigarettes per day, sex, alcohol use, and age participants began smoking regularly. Use of marijuana by young adult smokers was associated with a lower likelihood of reduced smoking ($OR = 0.71$, 95% CI [0.51, 0.98], $p = .036$) and a lower likelihood of abstaining from smoking ($OR = 0.56$, 95% CI [0.35, 0.90], $p = .017$) in the past seven days, as assessed over 12 months of follow-up. Use of marijuana was not significantly associated with perceptions of or engagement in the smoking cessation intervention, stage of change for quitting smoking, or tobacco quit attempts (all p 's > 0.08). Study findings indicate that while marijuana use is unrelated to motivation to quit tobacco and engage in cessation interventions, marijuana use is associated with less success in reducing and abstaining from tobacco. Additional support and targeted tobacco cessation strategies to address challenges associated with marijuana co-use may be needed.

1. Introduction

Marijuana and tobacco co-use is common among young adults (Ramo, Liu, & Prochaska, 2012b). On average, young adults perceive marijuana as less harmful to health, less addictive, and more socially acceptable than tobacco (Berg et al., 2015), and are less ready to quit marijuana than cigarettes (Ramo, Delucchi, Liu, Hall, & Prochaska, 2014). While a few studies have found that marijuana users were less likely to quit smoking than non-users (Ford, Vu, & Anthony, 2002; Gourlay, Forbes, Marriner, Pethica, & McNeil, 1994), others have found no significant differences in smoking outcomes between marijuana co-users and non-marijuana users (Hendricks, Delucchi, Humfleet, & Hall, 2012; Humfleet, Muñoz, See, Reus, & Hall, 1999; Metrik, Spillane, Leventhal, & Kahler, 2011).

Previous research focused on general adult populations, collected data in-person, and was conducted before the advent of widespread changes in marijuana legalization and social norms (Ford et al., 2002;

Gourlay et al., 1994; Hendricks et al., 2012; Humfleet et al., 1999; Metrik et al., 2011). It is unclear whether and to what extent marijuana use interferes with smoking cessation and related outcomes among young adults in an era of rapidly shifting laws and attitudes regarding marijuana. It is particularly important to study young adults in this context, because they are less likely to seek smoking cessation treatment (Curry, Sporer, Pugach, Campbell, & Emery, 2005) and are more likely to use marijuana (Center for Behavioral Health Statistics and Quality, 2017) than are older adults. Moreover, due to the stigma around marijuana use and its illegal status in many states, collecting data online may be a useful strategy to improve accuracy of self-reported marijuana use (Ramo & Prochaska, 2012) and to further examine its relationship with smoking cessation. Lastly, marijuana use has become increasingly accepted in society (Schulenberg et al., 2017) and increasingly common among cigarette smokers (Goodwin et al., 2018). Given the widespread availability and acceptability of marijuana among young adults, current tobacco smokers may experience more

* Corresponding author.

E-mail address: erin.vogel@ucsf.edu (E.A. Vogel).

difficulty quitting than those surveyed in previous decades. As such, this study uses data from a randomized controlled trial of the Tobacco Status Project (Ramo et al., 2018), a smoking cessation intervention for young adults delivered on Facebook, to examine differences in smoking outcomes between marijuana users and non-marijuana users.

2. Material and methods

2.1. Participants and procedure

Participants were young adult smokers (aged 18–25 years, $N = 500$) who reported smoking 100+ cigarettes in their lifetime, currently smoking 1+ cigarettes per day 3+ days per week and using Facebook 4+ days per week, and who were English literate. Recruitment consisted of a paid Facebook ad campaign from October 2014 to July 2015 (details reported elsewhere; Ramo, Rodriguez, Chavez, Sommer, & Prochaska, 2014). Clicking on an ad redirected participants to a confidential eligibility survey. Eligible, consented participants were randomly assigned to one of two conditions: 1) the Tobacco Status Project (TSP) intervention, or 2) referral to the National Cancer Institute's Smokefree.gov website (control). Participants in both conditions were included in all analyses except treatment engagement and perceptions (described below). TSP included assignment to a private Facebook group tailored to participants' readiness to quit smoking, daily Facebook contact with study staff, weekly live counseling sessions, and six additional Cognitive Behavioral Therapy counseling sessions for those ready to quit. Study staff posted once a day for 90 days and participants were asked to comment on the posts. Post content varied by readiness to quit smoking and included strategies informed by the Transtheoretical Model and the U.S. Clinical Practice Guidelines for smoking cessation (DiClemente et al., 1991; Fiore et al., 2008). Participants were emailed follow-up surveys at 3, 6, and 12 months after the study began. This research was approved by the University of California, San Francisco Institutional Review Board.

2.2. Measures

2.2.1. Baseline demographics

Age, sex (male or female), race/ethnicity (recoded into White or non-White), employment status (recoded into any employment or unemployed), student status (not a student, part-time student, full-time student), education (recoded into high school degree or less, some college, or college degree or higher), and household income (recoded into less than \$20,000, \$20,001 to \$60,000, \$60,001 to \$100,000, or over \$100,000) were measured at baseline.

2.2.2. Baseline smoking characteristics and alcohol use

Nicotine dependence was assessed using the 6-item Fagerström Test of Cigarette Dependence (FTCD; Fagerström, 2012), scored on a scale of 0 to 10, from low to heavy dependence. Daily smoking at baseline was measured with the item, "On average, how many days in a week do you smoke cigarettes (0–7)?" Responses were recoded into daily smoking (7 days) or non-daily smoking (0–6 days). The Smoking History Questionnaire (Hall et al., 2006) assessed early smoking (i.e., age of initiation, age began smoking regularly, number of prior quit attempts) as well as usual number of cigarettes smoked per day. The Stages of Change Questionnaire (Prochaska & DiClemente, 1983) was used to categorize participants into one of three stages of change (precontemplation, contemplation, preparation) based on their readiness to quit smoking at baseline. Alcohol is another substance commonly used by young adults, and use of alcohol can co-occur with tobacco and/or marijuana (Cohn, Johnson, Rath, & Villanti, 2016; Gubner, Thrul, Kelly, & Ramo, 2018). Hence, we measured alcohol use for possible inclusion as a covariate in the models, using the item, "Have you consumed alcohol in the past 30 days?" (yes/no).

2.2.3. Marijuana use

Current marijuana use was measured at each time point using the Staging Health Risk Assessment (S-HRA, developed by Pro-Change Behavior Systems; South Kingstown, RI), based on the Transtheoretical Model stages of change (DiClemente et al., 1991) and the Healthy People 2020 goals for the United States (The Secretary's Advisory Committee on National Health Promotion and Disease Prevention Objectives for 2020, 2008). The item read: "Marijuana is also called pot, weed, and grass. Are you planning to stop using marijuana?" (I have never used marijuana; I stopped using it > 6 months ago; I stopped using it < 6 months ago; Yes, I am planning to stop using it in the next 30 days; Yes, I am planning to stop using it in the next 6 months; No, I am not planning to stop using it in the next 6 months). Participants were categorized as marijuana users if they indicated recent use on the staging item. All others were categorized as non-marijuana users.

2.2.4. Smoking outcomes

The following outcomes were assessed at 3, 6, and 12 months: 1) seven-day point prevalence abstinence, 2) smoking reduction, 3) presence of a quit attempt since the last assessment, and 4) stage of change for quitting smoking. Self-reported point prevalence abstinence and reduction were assessed with the item, "How many cigarettes have you smoked in the past 7 days?". To measure point prevalence abstinence, responses were coded into abstinent in the past seven days (zero cigarettes) or smoking (at least one cigarette). Reduction was calculated using baseline cigarettes per day, and coded into reduced or not reduced by at least 50% since baseline. Quit attempts were measured with, "Have you tried to quit smoking for at least 24 hours since your last Tobacco Status Project survey?" (no; yes; I have not smoked even 1 cigarette since my last TSP survey, recoded into yes/no). Stage of change was measured using the Stages of Change Questionnaire (Prochaska & DiClemente, 1983), recoded into precontemplation, contemplation, preparation, or action/maintenance. Those in action/maintenance indicated that they had quit smoking. All outcomes were measured at each time point.

2.2.5. Treatment engagement and perceptions

Participants in the intervention group reported their perceptions of the intervention at treatment end (3 months) by rating their agreement (1 = strongly disagree, 4 = strongly agree) with 7 items. Items addressed whether the intervention was easy to understand, gave sound advice, gave participants something to think about, and helped them to be healthier, as well as whether they used the information, thought about the information, and would recommend the intervention (Ramo, Thrul, Chavez, Delucchi, & Prochaska, 2015). Responses were coded as disagreement (1–2) or agreement (3–4). Engagement was measured by the number of Facebook comments an individual posted during the 90-day intervention, including comments on posts and during live counseling sessions (range: 0–168).

2.3. Analyses

First, marijuana users and non-users at baseline were compared on baseline demographic and smoking characteristics. Second, differences in reported smoking outcomes between users and non-users during the follow-up period were analyzed using a series of generalized estimated equations (GEEs) with binary distributions and logit link functions for dichotomous variables (seven-day point prevalence abstinence, reduction, quit attempts) and a multinomial distribution with a logit link function for the ordinal variable (stage of change). Longitudinal analyses controlled for intervention group (treatment or control) and adjusted for baseline stage of change (precontemplation, contemplation, or preparation), baseline average cigarettes per day, sex, alcohol use, and age participants began smoking regularly. The first two covariates were determined a priori and the latter were selected based on the

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