Mobile contingency management as an adjunctive treatment for co-morbid cannabis use disorder and cigarette smoking

Jean C. Beckham[a,c,*], Kelsie A. Adkisson[a,b], Jeffrey Hertzberg[a,b], Nathan A. Kimbrel[a,c], Alan J. Budney[d], Robert S. Stephens[e], Scott D. Moore[a,c], Patrick S. Calhoun[a,c,f]

[a] Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC 27705, USA
[b] Durham Veterans Affairs Medical Center, Durham, NC, 27705, USA
[c] Veterans Affairs Mid-Atlantic Region Mental Illness Research, Education, and Clinical Center, Durham, NC 27705, USA
[d] Geisel School of Medicine at Dartmouth, Center for Technology and Behavioral Health, Lebanon, NH 03766, USA
[e] Virginia Polytechnic Institute and State University, Department of Psychology, Blacksburg, VA 24061, USA
[f] Veterans Affairs Center for Health Services Research in Primary Care, Durham, NC, 27705, USA

HIGHLIGHTS

- Little is known about treating cessation for cannabis and tobacco use simultaneously.
- Participants completed Abstinence Reinforcement Therapy (ART) for both substances.
- ART for both cannabis and tobacco and home monitoring with saliva strips is feasible.
- Future research should examine the efficacy and cost-effectiveness of this approach.

ARTICLE INFO

ABSTRACT

Introduction: Cannabis is the most widely used illicit drug in the U.S. with 19.8 million current users. Population-based data indicate that almost all cannabis users (90%) have a lifetime history of tobacco smoking and the majority (74%) currently smoke tobacco. Among cannabis users, smoking tobacco is associated with increased frequency of cannabis use, increased morbidity, and poorer cannabis cessation outcomes. There is a lack of research, however, focused on addressing cessation of both substances simultaneously. The purpose of the current pilot study was to evaluate the feasibility and acceptability of a multi-component tobacco/cannabis abstinence treatment.
Methods: Five participants completed Abstinence Reinforcement Therapy, an intervention that included five sessions of cognitive-behavioral telephone counseling for tobacco/cannabis, pharmacotherapy for smoking cessation, and five weeks of mobile contingency management to remain abstinent from tobacco and cannabis.
Results: Feasibility of recruitment, retention and treatment completion was high. Satisfaction with the treatment was also high.
Conclusion: Results support the feasibility and acceptability of this approach with dual cannabis and tobacco users and suggest that further research examining the efficacy of this approach is warranted.

1. Introduction

Cannabis is the most widely used illicit drug in the U.S. with 19.8 million current users (Substance Abuse Mental Health Services Administration, 2014). Population-based data indicate that almost all cannabis users (90%) have a lifetime history of tobacco smoking (Agrawal, Budney, & Lynskey, 2012) and the majority (68–79%) currently smoke tobacco (Richter, Ahluwalia, Mosier, Nazir, & Ahluwalia, 2002; Richter et al., 2004; Schauer, Berg, Kegler, Donovan, & Windle, 2016). Among adult smokers, as many as 22% use marijuana. While cannabis use alone is associated with significant adverse health effects (Hall & Degenhardt, 2009; Hall, Degenhardt, & Lynskey, 2001), tobacco smoking is the number one preventable cause of illness and death in the U.S. (Centers for Disease Control and Prevention, 2010; Lejuez et al., 2002). This is especially true for illicit drug users, for whom the tobacco-related mortality rate is twice that of the general population

(Hurt et al., 1996). Among cannabis users, smoking tobacco is associated with increased frequency of cannabis use (Richter et al., 2004), increased morbidity (Peters, Budney, & Carroll, 2012; Taylor et al., 2002), and poorer cannabis cessation outcomes (de Dios, Vaughan, Stanton, & Niaura, 2009; Gray et al., 2011; Moore & Budney, 2001). Treatment among dual users is complicated as the cessation of one substance is often associated with increased utilization of the other (Akre, Michaud, Berchtold, & Suris, 2010; Allsop et al., 2014; Copersino et al., 2006). There is limited research, however, focused on addressing cessation of both substances simultaneously (Agrawal et al., 2012; Becker, Haug, Sullivan, & Schaub, 2014; Hill et al., 2013; Lee et al., 2014, 2015; Peters et al., 2012). Preliminary studies suggest that interventions focused on dual cessation are feasible and desirable by co-smokers (Becker et al., 2013, 2014; Hill et al., 2013; Lee et al., 2014, 2015).

Intensive behavioral therapies, including contingency management (CM) approaches, have demonstrated short-term efficacy for the treatment of cannabis use disorder (CUD; (Carroll et al., 2006; Kadden, Litt, Kabela-Cormier, & Petry, 2007) and tobacco smoking (Carpenter et al., 2015; Davis et al., 2015; Hertzberg et al., 2013). Implementation of CM approaches for tobacco smoking and illicit drug use has been limited by the need to verify abstinence via repeated clinic visits (often multiple times daily in the case of tobacco smoking and more than once weekly for cannabis).

The standard in the field for detection of cannabis use has been urinalysis examining excretion of the cannabis metabolite 11-nor-Δ9-tetrahydrocannabinolic acid (THC-COOH) via immunoassay completed in a clinic setting (Budney et al., 2015). There are several drawbacks to this approach for CM. While multiple factors affect detection times for cannabis use via urine screening (e.g., frequency of use, dosage, individual metabolism), THC-COOH levels are typically elevated in regular cannabis users (e.g., background levels ≥ 1000 ng/ml). As a result, a washout period (1–2 weeks or longer) is needed between cessation of use and submission of negative urine samples to verify daily abstinence. Thus, this washout period requires at least 1–2 weeks of sustained abstinence before CM procedures can typically be started. As a result, implementation of CM for CUD has been discouraged in health care settings because this lag-time between cessation of use and submission of negative samples makes CM for CUD more complicated to administer (Petry, DePhilippis, Rash, Drapkin, & McKay, 2014). Following a washout period, the detection window for single use of cannabis is typically 3–4 days (based on a 50 ng/ml cutoff level) or up to 7 days (based on a 20 ng/ml cutoff for cannabinoids) using urinalysis (Huestis, Mitchell, & Cone, 1996). As a result, most previous CM approaches for CUD have required clinic-based monitoring at least twice a week to verify abstinence. Consequently, detection of cannabis use via traditional urinalysis methods makes it impossible to contingently reinforce reductions in *daily* cannabis use.

In contrast to traditional urine- or blood-based drug testing approaches) saliva (i.e., oral fluid; OF) is a relatively new biological matrix for forensic and clinical drug testing. Saliva testing is non-invasive and has the benefits of directly observable sample collection methods (reducing potential for sample adulteration), lower biohazard risk during collection, ease of multiple sample collections, and stronger correlation with blood-based drug-testing results than urine concentrations (Lee & Huestis, 2014). In contrast to urinalysis, which detects cannabis metabolites, the majority of current OF devices directly measure Δ9-tetrahydrocannabinol (THC). The reliability/validity of OF drug testing has improved significantly over the past decade (Lee et al., 2012; Lee & Huestis, 2014; Niedbala et al., 2001) and there is currently one FDA-approved saliva testing method (Oratect® Oral Fluid Drug Screen Device) that can be used to detect all forms of THC use (e.g., inhaled and ingested; 40 ng/ml) in the past 12–14 h. The accuracy of Oratect has been evaluated in comparison to GC/MS methods with 100% agreement for positive samples and 95% agreement for negative samples (Confirm Biosciences, 2012), but has not been compared to

urinalysis. Importantly, cigarette smoke and multiple food/beverage and hygiene products (mouthwash) have been demonstrated to not interfere with the test (Branan Medical Corporation, 2015). To date, no studies have examined the feasibility of using OF testing methods for CM to treat CUD.

Dallery and colleagues developed web-based and internet based contingency management approaches to overcome the need for clinic monitoring for smoking cessation (Dallery et al., 2017; Dallery, Meredith, & Glenn, 2008; Dallery & Raiff, 2011). Building upon their work, we utilized a mobile health (mHealth) application to increase the feasibility and reach of contingency management for tobacco smoking (Carpenter et al., 2015; Hertzberg et al., 2013). Our group has now developed Abstinence Reinforcement Therapy (ART), a multi-component cannabis and tobacco smoking cessation tele-health intervention that combines 1) intensive behavioral therapy through a mobile contingency management (mCM) app and the use of oral fluid strips to assess recent cannabis use; 2) a cognitive behavioral treatment (CBT) intervention for both substances (informed with expert consultation from two cannabis CBT treatment experts – AJB and RSS), and 3) nicotine replacement therapy. The purpose of the current pilot study was to evaluate the acceptability and feasibility of the study procedures and whether the procedures led to short or long term abstinence from cannabis or tobacco.

2. Materials and methods

2.1. Recruitment and enrollment

Participants were recruited from substance use disorder (SUD), mental health, and primary care clinics in the Duke University Health System. Craigslist ads and flyers were also posted in community settings. This study was approved by the Duke University IRB and no procedures were administered prior to consent. An NIH certificate of confidentiality was obtained so that information obtained from the saliva strips could not be accessed outside the study protocol.

2.2. Screening procedures

Prior to study entry, potential participants completed screening procedures as part of the baseline assessment, including informed consent, the psychosis and substance misuse modules of the structured clinical diagnostic interview for DSM-5 (SCID-5; First, Williams, Karg, & Spitzer, 2015), self-report measures, demographic data, and tobacco and cannabis history. Urine and saliva samples were collected to assess for cannabis use and other illicit drugs. A breath sample was used to assess CO level. Urine pregnancy tests were completed for women of childbearing potential. Sexually active women consented to use appropriate contraception during the study and to notify study staff if they become pregnant due to harmful effects of cannabis and nicotine on fetuses. If no contact from the primary health care physician could be obtained, the participants' health information was evaluated by the study physician, who provided medical clearance for pharmacotherapy use and participation.

2.3. Inclusion/exclusion criteria

Inclusion criteria included: (a) currently met criteria for cannabis use disorder (American Psychiatric Association, 2013) (b) 40 or more days of cannabis use in the past 90 days, (b) currently smoked 7 cigarettes in the past 7 days, and smoking for at least the past year; (c) 18–70 years of age; (d) could speak and write fluent conversational English and (e) were willing to make an attempt to quit both cannabis and tobacco smoking. Participants were excluded if they: (a) expected to have a significant change in their psychiatric medication regimen during the study; (b) were currently receiving non-study CUD or smoking treatment; (c) met criteria for serious mental illness (e.g.,