Mobile Contingency Management as an Adjunctive Smoking Cessation Treatment for Smokers With Posttraumatic Stress Disorder

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Received December 20, 2012; accepted April 5, 2013

ABSTRACT

Introduction: Smokers with posttraumatic stress disorder (PTSD) smoke at higher prevalence rates and are more likely to relapse early in a quit attempt. Innovative methods are needed to enhance quit rates, particularly in the early quit period. Web-based contingency-management (CM) approaches have been found helpful in reducing smoking among other difficult-to-treat smoker populations but are limited by the need for computers. This pilot study builds on the web-based CM approach by evaluating a smartphone-based application for CM named mobile CM (mCM).

Methods: Following a 2-week training period, 22 smokers with PTSD were randomized to a 4-week mCM condition or a yoked (i.e., noncontingent 4-week mCM condition). All smokers received 2 smoking cessation counseling sessions, nicotine replacement, and bupropion. Participants could earn up to $690 ($530 for mCM, $25.00 for assessments and office visits [up to 5], and $35.00 for equipment return). The average earned was $314.00.

Results: Compliance was high during the 2-week training period (i.e., transmission of videos) (93%) and the 4-week treatment period (92%). Compliance rates did not differ by group assignment. Four-week quit rates (verified with CO) were 82% for the mCM and 45% for the yoked controls. Three-month self-report quit rates were 50% in the mCM and 18% in the yoked controls.

Conclusions: mCM may be a useful adjunctive smoking cessation treatment component for reducing smoking among smokers with PTSD, particularly early in a smoking quit attempt.

INTRODUCTION

Compared with persons without mental illness, those with posttraumatic stress disorder (PTSD) have higher smoking rates (45% vs. 23%; Lasser et al. 2000). Despite clear evidence that persons with PTSD, like other smokers, want to quit smoking (Kirby et al., 2008), individuals with PTSD have decreased odds of successfully quitting smoking (Hapke et al., 2005). Compared with smokers without PTSD, individuals with PTSD have been shown to have a shorter time to first smoking lapse (Beckham et al., 2012). Even the most promising clinical trial in smoking cessation among PTSD smokers (McFall et al., 2010) yielded only an 8% bioverified abstinence rate at 1 year which is significantly lower than rates found in the general population with similar intensive interventions (average of 23% abstinence; Fiore et al. 2000). These data suggest that there is a need for innovative and intensive behavioral treatments to be developed for use with PTSD smokers.

Contingency management (CM) may be a useful treatment component to increase quit rates among PTSD smokers. CM has shown efficacy for reducing smoking in other difficult-to-treat populations, including pregnant women (Heil et al., 2008), drug-dependent individuals (Dunn, Sigmon, Thomas, Heil, & Higgins, 2008; Shoptaw et al., 2002), adolescents (Krishnan-Sarin et al., 2006), individuals with low motivation to quit (Lamb, Morrall, Galbicka, Kirby, & Iguchi, 2005; Lamb et al., 2007), and individuals with other psychiatric comorbidity (Kollins, Mc Clernon, & Van Voorhees, 2010; Roll, Higgins, Steingard, & McGinley, 1998; Tidey, O’Neill, & Higgins, 2002). Widespread implementation of CM has been limited by the need to verify abstinence 2–4 times daily with a carbon monoxide (CO) monitor, which is burdensome (Ledgerwood, 2008).

doi:10.1093/ntt/nnt060
Advance Access publication May 3, 2013
Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco 2013.
Because of this barrier, researchers have begun to examine alternative strategies for abstinence verification. Several studies have shown that Internet-based verification of smoking cessation is a useful, effective, and less burdensome CM strategy (Dallery, Meredith, & Glenn, 2008; Reynolds, Dallery, Shroff, Patak, & Leraas, 2008; Stoops et al., 2009).

Typical Internet-based verification of smoking cessation involves use of an Internet-ready computer, a web-ready camera, and a portable CO breath monitor. During the abstinence phases, participants log on to a secure Web site 2–3 times per day, and using the web camera, film themselves taking a CO reading, and show the CO results on the web camera. Participants then stop the recording and load the recording onto the secured Web site. Similar methods have been used in several studies to date (Dallery et al., 2008; Reynolds et al., 2008; Stoops et al., 2009). In order to further mobilize verification for CO necessary for CM, we developed a smartphone application that allows the participant to follow similar procedures, thus making mobile CM (mCM) even more portable, potentially more feasible and less expensive.

The study was designed to address two aims: (a) evaluate the feasibility of mCM for use in smoking cessation among smokers with PTSD, and (b) examine the efficacy of a progressive reinforcement schedule of mCM versus yoked control mCM (i.e., noncontingent reinforcement) in increasing abstinence rates among smokers with PTSD.

METHODS

Following IRB approval of the protocol, 24 smokers with PTSD were screened as study eligible (2 withdrew prior to randomization) and 22 were randomized to receive either mCM or to a yoked condition (where payments were based noncontingently on a matched, active mCM participant). Smokers completed the Fagerström Tobacco and Nicotine Dependence scale to assist in describing smoking status (Heatherton, Kozlowski, Frecker, & Fagerström, 1991). Smokers were provided with two smoking cessation counseling sessions (including controlled breathing training, short relaxation strategies, examination of smoking triggers, and preparation for the quit day) based on the NCI Freshstart program (Lando, McCovern, & Barrios, 1990), prescribed precessation nicotine replacement therapy (NRT) and were switched to low-nicotine cigarettes 2 weeks prior to their quit day. Bupropion was prescribed 1 week prior to their quit day. Postcessation NRT and choice of acute administration NRT (nicotine gum, nicotine inhaler, or nicotine nasal spray) were prescribed for use beginning on the quit day. Participants were trained to perform CO monitoring with a device provided by the study. They were provided with a mobile phone equipped with a video camera and used this equipment at home. Participants recorded videos of themselves taking a CO reading and displaying the results, and then uploaded the videos to a secured Web site that was only accessible by the research team members. For participants in the active CM condition, compensation was based on providing CO readings that were ≤8 ppm. Given that we wanted to identify smoking with a high level of certainty, we used a higher recommended cutoff (8 ppm; Javors, Hatch, & Lamb, 2005). Participants in the yoked control CM condition were matched to another participant of the same gender and similar cigarette use, and received compensation based on the yoked active participant’s reimbursement; that is, they were paid for uploaded videos noncontingent on their own abstinence.

Participants were instructed to submit two CO samples within a 24-hr period separated by 8 hr.

Participants were included if they: (a) met diagnostic criteria for PTSD based on the Clinician Administered PTSD Scale (Weathers et al., 2004) and (b) smoked at least 10 cigarettes daily for at least 1 year; and excluded if they: (a) were pregnant; (b) met DSM-IV criteria for lifetime schizophrenia, schizophreniform disorder, schizoaffective disorder, delusional disorder, current manic syndrome, lifetime but not current PTSD, current psychotic symptoms, or current substance abuse/dependence; (c) used other forms of nicotine; or (d) were medically unstable. Axis I diagnoses other than PTSD were evaluated with the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders (SCID; First, Spitzer, Gibbon, & Williams, 1994). Thirty-one individuals were screened and seven screened out (four for current substance abuse or dependence, one for current mania, and one for being medically unstable).

Following informed consent and screening, participants were asked to complete a total of five laboratory visits, six brief telephone sessions, and seven weeks of CO monitoring. “Session 1” was a screening appointment. In “Session 2,” participants completed the first of two cognitive behavioral therapy (CBT) treatments for smoking cessation, began NRT (up to 42 mg patch), and switched cigarette brands to a brand with low nicotine (Session 2 occurred 1–3 weeks following Session 1 dependent on response from the individual’s physician to be prescribed study medications). In “Session 3,” which occurred 1 week after Session 2, participants began bupropion SR 150 mg on days 1–3 with an increase to 300 mg on Days 4–45, completed the second CBT treatment for smoking cessation, set a quit date, were trained in the use of the monitoring equipment, and began 1 week of CO monitoring. “Sessions 4 through 9” were brief telephone sessions in which the study coordinator contacted the participant to check about any problems with monitoring, patch use, and/or bupropion use. Beginning on the quit day established by the participant (i.e., date of Session 4), participants monitored CO in their breath twice per day. Participants in the active condition were compensated for each CO reading that indicated abstinence and the reinforcement schedule was progressive with a reset contingency (see reinforcement schedule in Table 1). The reset was to $1 and increased 25 cents with each subsequent abstinence reading. A progressive reinforcement schedule was chosen because progressive reinforcement (compared with fixed and yoked control reinforcement) has been shown to produce higher smoking cessation rates (Roll, 2005). Standard NRT was administered to all participants (21 mg for the first 2 weeks, 14 mg for next 2 weeks, and 7 mg for last 2 weeks). Any participant who was identified (via CO readings >30) to receive a 42 mg patch during the prequit treatment phase continued the 42 mg dose for the first week of the postquit period and reduced to 21 mg at the second week. This occurred for only one smoker in the yoked group. On the quit date, participants chose one form of acute administration NRT, that is, rescue method and instructed to use it pro re na (PRN; according to circumstances) to reduce cravings during the postquit period. “Session 10,” the final session of the study, was an in-laboratory session. During this session, participants stopped NRT and returned all laboratory equipment. “Session 11” was a 3-month follow-up visit in which participants returned to the
Mobile Contingency for PTSD Smokers

Table 1. Potential Compensation for Monitoring and Abstinence

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>First CO</th>
<th>Second CO</th>
<th>Bonus</th>
<th>Weekly totals</th>
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<td>Up to $14.00</td>
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<td>$1.25</td>
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<td>$2.75</td>
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<td>$14.75</td>
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<td>1–7</td>
<td></td>
<td></td>
<td></td>
<td>Up to $25.00</td>
</tr>
</tbody>
</table>

Weathers et al., 2004

Second CO

$8.50  $8.25  Bonus

Weekly totals

$5.25  $5.00  $6.25

1–7  $4.25  $5.00  $5.00  $4.50  $14.00  $4.75  $5.00  $11.00  $2.50  $11.50

Up to $14.00

Up to $188.75

$5.75  $8.75  $9.50  $14.50  $5.00  $1.00  $14.25  $10.50  $3.00

1–7  $2.75  $13.25  $7.25  $4.00

Up to $144.75

- $3.75  $7.75  $2.25

First CO

$10.00  $1.50

Up to $25.00

$10.25  $13.50

1

$6.50  $3.50  $10.75  $7.50

Up to $90.75

$1.25  $2.00  $12.75  $8.00

$3.25  $5.00  $11.75  $9.75

$12.50  $13.00  $13.75  $14.00

Yoked control

$350 for mCM, $25.00 for assessments, and office visits (up to 5, and $35.00 for equipment return) and were paid by mailed check at the end of Week 7 (1 week training, 4 week mCM intervention, and 2-week mCM monitoring follow-up). The average earned for mCM was $314.00.

RESULTS

Participant characteristics are described in Table 2. The sample consisted of over half males, over half veterans, almost half were homeless, and at least half in each group endorsed lifetime major depressive disorder and/or alcohol or drug dependence. Self-reported NRT usage and bupropion varied little by group. Clinician-Administered PTSD Scale (CAPS) scores were in the severe PTSD range (Weathers et al., 2004). Compliance during the initial baseline week (median = 93%) and treatment phase (median = 92%) was excellent and did not vary by group.

Laboratory and provided information about smoking behavior since Session 10. CO was evaluated twice daily during the 4-week treatment period and for two additional non-contingent weeks. Prolonged abstinence was defined as CO ≤ 8 ppm (Jarvis, Tunstall-Pedoe, Feyerbrand, Vesey, & Saloojee, 1987) for all readings in the last 7 days of the 4-week treatment period (McFall et al., 2010). Participants could earn up to $690 ($530 for mCM, $25.00 for assessments, and office visits [up to 5], and $35.00 for equipment return) and were paid by mailed check at the end of Week 7 (1 week training, 4 week mCM intervention, and 2-week mCM monitoring follow-up). The average earned for mCM was $314.00.

CONCLUSIONS

Feasibility of mCM for smoking cessation among smokers with PTSD was high, as measured by compliance and participant retention. In previous studies using web-based CM (with a computer), compliance rates have ranged from good (67%; Stoops et al., 2009) to excellent (98%; Dallery, Glenn, & Raiff, 2007), so the rate observed with this sample was excellent (93%). Increased bioverified abstinence rates were observed.
with 4 weeks mCM compared with yoked mCM and self-report abstinence remained relatively high at a 3-month follow-up. As psychiatric comorbidity (including major depressive disorder), veteran status and homelessness are all represented in smokers with PTSD (Tsai, Edens, & Rosenheck, 2011), results are likely generalizable to smokers with PTSD with the caveat that the results are certainly limited by sample size in generalizing to the larger population of smokers with PTSD. This pilot study is limited by the small sample size, a short follow-up period, a nonblinded, 3-month abstinence evaluation, and failure to ask participants if they were receiving any PTSD treatment. Despite the limitations, these pilot results suggest that mCM is feasible, leads to increases in initial quit rates, and may help to contribute to longer quit rates as part of a multicomponent smoking cessation intervention.

FUNDING

This work was supported primarily by the National Institutes of Health (Grant 2K24 DA016388), and the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development Clinical Science.

DECLARATION OF INTERESTS

None declared.

ACKNOWLEDGMENTS

We would like to thank the participants who volunteered to participate in this study. The views expressed in this presentation are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs or the National Institutes of Health.

REFERENCES


