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Multi-Component Smoking Cessation Treatment including Mobile Contingency Management for Smoking Cessation in Homeless Veteran Smokers

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Abstract

Introduction—Smoking rates are 80% among persons who are homeless, and these smokers have decreased odds of quitting smoking. Little is known about relapse rates among homeless smokers, but the dearth of research indicates that more information regarding quit rates in this population is needed. Furthermore, innovative methods are needed to treat smoking cessation among homeless smokers. Web-based contingency management (CM) approaches have been found helpful in reducing smoking among other difficult-to-treat smoker populations but have been generally limited by the need for computers or frequent clinic based carbon monoxide (CO) monitoring. This pilot study builds on a web-based CM approach by evaluating a smart phone based application for CM named mobile CM (mCM).

Methods—Following a one-week training period, 20 homeless veteran smokers participated in a multi-component smoking cessation intervention including 4 weeks of mCM. All smokers received 4 smoking cessation counseling sessions, nicotine replacement and bupropion (if medically eligible). Participants could earn up to \$815 (\$480 for mCM, \$100 for CO readings showing abstinence at posttreatment and follow up, and \$35 for equipment return). Mean compensation for the mCM component was \$286 of a possible \$480.

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Results—Video transmission compliance was high during the one-week training (97%) and the four-week treatment period (87%). Bioverified 7-day point prevalence abstinence was 50% at four weeks. Follow up bioverified single assessment point prevalence abstinence was 65% at three months and 60% at six months.

Conclusions—mCM may be a useful adjunctive smoking cessation treatment component for reducing smoking among homeless smokers.

Keywords

homeless; veteran; smoking cessation; mobile contingency management

Introduction

Studies have indicated that smoking rates are significantly higher among homeless individuals^{1, 2} (80%). Research conducted by Arnsten and colleagues³ in a sample of 98 homeless smokers found that 67% suffered from current smoking-related symptoms and 46% reported current smoking-related health problems. However, there is evidence that homeless smokers are interested in quitting. Okuyemi and colleagues⁴ reported that nearly 76% of the homeless smokers had plans to quit smoking within the next 6 months. Unfortunately, available evidence suggests that homeless smokers have been unsuccessful in reducing or quitting smoking. In a study following 754 chronically homeless adults, despite 48% of the smokers reporting they were trying to limit their smoking and 75% reporting they had discussed smoking cessation with a health care professional, there were no significant reductions in smoking status at the one year follow up². There are few studies evaluating smoking cessation among homeless smokers, as they are often excluded from smoking cessation clinical trials⁵.

Rates of smoking are generally higher among individuals with multiple psychiatric disorders⁶, and persons who are homeless are more likely to have multiple psychiatric disorders⁷. Homeless veterans are four times as likely to have a diagnosis of nicotine dependence compared to veterans who are not homeless⁸, independent of their increased risk for other substance-use disorders. Tsai and colleagues⁸ have reported that there “has been little development of smoking prevention and cessation programs for homeless people, let alone homeless veterans, and more research is needed in this area.”

Contingency management (CM) may be a useful treatment component to increase quit rates among homeless smokers. CM has shown efficacy for reducing smoking in other difficult-to-treat populations, including pregnant women⁹, drug dependent individuals^{10, 11}, adolescents¹², individuals with low motivation to quit^{13, 14}, and individuals with other psychiatric comorbidity¹⁵⁻¹⁷. Widespread implementation of CM has been limited by the burdensome need to verify abstinence 2-4 times daily with a carbon monoxide (CO) monitor¹⁸. This is not feasible for clinics that are often open during a portion of the day on weekdays only, and it is especially challenging for homeless smokers who are less likely to have reliable transportation.

Because of this barrier, researchers have examined alternative strategies for abstinence verification. For example, several studies have shown that internet-based verification of smoking cessation is a useful, effective, and less burdensome CM strategy¹⁹⁻²². 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 website 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 website. Similar methods have been used in several studies to date²⁰⁻²².

In order to further mobilize verification for CO necessary for CM, we developed a smart-phone application that allows the participant to follow similar procedures, thus making mobile CM (mCM) even more portable, potentially more feasible and less expensive. A preliminary study utilizing this approach in a sample of smokers with PTSD demonstrated a four-week quit rate (verified with CO) of 82% for the mCM condition and 45% for yoked controls whose monetary reinforcement was not contingent on smoking abstinence²³. Three-month self-report quit rates were 50% in the mCM and 18% in yoked controls. This study was limited by a non-bioverified follow up and a relatively short (3-month) follow up. The current study was designed to evaluate the feasibility of mCM within a smoking cessation intervention among homeless veteran smokers.

Methods

Following IRB approval of the study, 25 homeless smokers were screened for study inclusion. Homelessness was defined according to VA federal guidelines²⁴. Participants were included if they: 1) were currently homeless or homeless more than twice in the past year period; 2) smoked at least 10 cigarettes daily for at least one year and had a CO at the baseline session of at least 10 ppm; 3) were eligible for VA care; and 4) were between the ages of 18–70. Potential participants were excluded if they: 1) were pregnant; 2) scored less than 80 on the Kaufman Brief Intelligence Test; 3) used other forms of nicotine; 4) were medically unstable; 5) produced a positive drug screen; or 6) had uncontrolled diabetes, seizure disorder, or eating disorder. Five individuals were excluded (one for current substance abuse or dependence; one for being an ineligible veteran; three for CO being too low).

Following informed consent and screening, participants were asked to complete a total of 7 laboratory visits, 1 brief telephone session, and 5 weeks of CO monitoring. *Session 1* was a screening appointment, which included administration of the Fagerström Test for Nicotine Dependence²⁵, as well as the Structured Clinical Interview for the DSM-IV-TR²⁶. In *Session 2*, participants completed the first of four counseling sessions for smoking cessation. The four 20-minute counseling sessions were based on standard cognitive-behavioral therapy (CBT) techniques shown to be efficacious for smoking cessation, were consistent with the Public Health Service Clinical Practice Guidelines, and were based on the manual used in a large scale PTSD smoking cessation trial²⁷. Also in this session, participants began bupropion SR 150 mg on days 1-3 with an increase to 300 mg on days 4-45. Session 2 occurred 1-3 weeks following session 1 and was dependent on response from the

individual's physician to be prescribed study medications. In *Session 3*, which occurred one week after session 2, participants completed the second of four CBT treatments and set a quit date. Participants were provided with a mobile phone equipped with a video camera and a CO monitor for use in the mCM intervention. Participants were trained to use the equipment to video record themselves taking a CO reading and displaying the results, and then upload the videos to a secured website that was only accessible by the research team members. At this session, participants began one practice week of CO monitoring.

In *Session 4, the quit date*, which occurred one week after session 3, participants completed the third of four CBT treatments, began NRT, and began abstinence CO monitoring. Participants monitored CO in their breath twice per day, with at least eight hours between each monitoring activity. Participants were compensated for each CO reading that indicated abstinence (i.e., < 6 ppm), 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 to fixed and yoked control reinforcement) has been shown to produce higher smoking cessation rates²⁸. Standard NRT was administered to all participants (21 mg for the first two weeks of the quit attempt, 14 mg for next two weeks and 7 mg for last two weeks). Any participant who was identified during the pre-quit treatment phase (*via* CO readings > 30) received 42 mg patches to use on their quit day, and they continued the 42 mg dose for the first week of the post-quit 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, i.e., rescue method and instructed to use it as needed to reduce cravings during the post-quit period. *Session 5*, which occurred two weeks after session 4, was a telephone session in which participants completed the final CBT for smoking cessation with a relapse prevention focus. In this session, the study coordinator checked about any problems with monitoring, patch use, and/or bupropion use. In *Session 6*, which occurred 2 weeks after session 5, CO monitoring ceased and study equipment was returned.

Session 7, which occurred 6 weeks after quit date, was an in-laboratory session during which abstinence was bioverified by a CO reading. *Session 8* was a 3-month follow up visit in which participants returned to the laboratory and provided information about smoking behavior since Session 7. Abstinence was bioverified by a CO reading.

Participants could earn up to \$815 (\$480 for mCM, \$100 for verified abstinence at the three follow up visits, and \$35 for equipment return), and were paid by mailed check at the end of session 6 (1-week training, 4-week mCM intervention) and again after each follow up session, sessions 7, 8, and 9. The mean total compensation for mCM was \$286.

All participants were prescribed the nicotine patch and a NRT rescue method and 55% were prescribed bupropion. Six participants (30%) were not prescribed bupropion due to concurrent hepatitis C (a contraindication to bupropion use), a rate consistent with reported the hepatitis C rate among homeless individuals²⁹ (27%).

Results

Participant characteristics are described in Table 2. The sample was comprised mostly of males, and more than half of the sample met criteria for comorbid lifetime posttraumatic stress disorder (PTSD), major depressive disorder (MDD), and alcohol and/or substance dependence. Other comorbid psychiatric disorders included schizophrenia (20%), bipolar disorder (15%), dysthymia (5%), social phobia (5%), obsessive compulsive disorder (5%), eating disorder (5%), and panic disorder (5%). Rates of psychiatric comorbidity were similar to previously reported rates except for PTSD and MDD. PTSD rates were higher (60%) in the study participants than previously reported in the general homeless population (7%). Depression rates were also higher in the study group (50%) than previously reported rates among homeless veterans² (24%). No participants were married at study enrollment, consistent with previously reported marital rates among homeless smokers².

Adherence to the timing and procedures for videos during the initial baseline week (median = 93%) and treatment phase (median = 92%) was excellent. Self-reported adherence was 57% with NRT and 73% among those prescribed bupropion. Based on a CO of < 6 ppm for each assessment across seven days²⁷, the quit rate at four weeks was 50 ($n=20$). As indicated by single bioverified assessments at each follow up, abstinence was maintained in 65% at three months and 60% at six months. These percentages included those who enrolled but did not complete the program ($n = 5$) or who were lost to follow up ($n = 2$) – these seven participants were counted as smoking at the post treatment and follow up assessments.

Discussion

Feasibility of mCM as part of a multi-component smoking cessation intervention among veteran homeless smokers was high, as measured by compliance and participant retention (65% at 6-month follow up). In previous studies using web-based CM (with a computer), compliance rates have ranged from good²¹ (67%) to excellent³⁰ (98%), and the rate observed with this sample was excellent (92%). The compliance rates were similar to a previous study utilizing this approach with PTSD smokers²³ (93%). Bioverified abstinence rates were 55% at 4 weeks, 65% at 3-month follow up and 60% at 6-month follow up. Psychiatric comorbidity in the cohort was high, which is consistent with a previously reported rate⁸, and suggests that the intervention is useful in homeless smokers with a range of psychiatric problems.

This pilot study is limited by the small sample size and the lack of a comparison condition (e.g., yoked controls). Results are limited to homeless veterans enrolled in the VHA healthcare system. Despite the limitations, these pilot results suggest that mCM is feasible, and may contribute to increases in initial and long term quit rates as part of a multi-component smoking cessation intervention for smokers who are homeless. mCM may provide a portable method and sufficient incentive to assist these smokers through cravings, particularly early in the quit period. Given the demonstrated feasibility and observed quit rates associated with this pilot study, a larger randomized clinical trial utilizing a comparison group of mCM with one year bioverified follow up for smoking cessation among homeless smokers is warranted.

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Table 1

Potential Compensation for Monitoring and Abstinence

Week	Day	1st CO	2nd CO	Bonus	Weekly Totals
3	1-7	\$1.00	\$1.00		Up to \$14.00
4	1	\$1.00	\$1.25		
	2	\$1.50	\$1.75		
	3	\$2.00	\$2.25		
	4	\$2.50	\$2.75		
	5	\$3.00	\$3.25	\$5.00	
	6	\$3.50	\$3.75		
	7	\$4.00	\$4.25		Up to \$41.75
5	1	\$4.50	\$4.75		
	2	\$5.00	\$5.25		
	3	\$5.50	\$5.75	\$5.00	
	4	\$6.00	\$6.25		
	5	\$6.50	\$6.75		
	6	\$7.00	\$7.25		
	7	\$7.50	\$7.75		Up to \$90.75
6	1	\$8.00	\$8.25	\$5.00	
	2	\$8.50	\$8.75		
	3	\$9.00	\$9.25		
	4	\$9.50	\$9.75		
	5	\$10.00	\$10.25		
	6	\$10.50	\$10.75	\$5.00	
	7	\$11.00	\$11.25		Up to \$144.75
7	1	\$11.50	\$11.75		
	2	\$12.00	\$12.25		
	3	\$12.50	\$12.75		
	4	\$13.00	\$13.25	\$5.00	
	5	\$13.50	\$13.75		

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Week	Day	1st CO	2nd CO	Bonus	Weekly Totals
	6	\$14.00	\$14.25		
	7	\$14.50	\$14.75		Up to \$188.75

Table 2
Sample Characteristics

	Contingency Management (<i>n</i> = 20)
	<i>M (SD)</i>
Age	54.7 (7.0)
Years of Education	12.6 (1.8)
CAPS score	47.2 (34.6)
Fagerström score	3.6 (1.1)
	<i>N (%)</i>
Male	18 (90%)
Minority	16 (80%)
Married	0 (0%)
Veteran	20 (100%)
Homeless	20 (100%)
Employed	2 (10%)
Lifetime Disorders	
No disorders	2 (10%)
Posttraumatic Stress Disorder	12 (60%)
Major Depressive Disorder	10 (50%)
Panic Disorder	1 (5%)
OCD	1 (5%)
GAD	1 (5%)
Social Phobia	1 (5%)
Schizophrenia	4 (20%)
Bipolar Disorder	3 (15%)
Dysthymia	1 (5%)
Eating Disorder	1 (5%)
Alcohol Abuse	2 (10%)
Alcohol Dependence	12 (60%)
Drug Abuse	5 (25%)
Drug Dependence	12 (60%)
Prescribed bupropion	11 (55%)
Bupropion compliance	73%
Prescribed NRT Patch	20 (100%)
Baseline CO Reading	20.9 (10.0)
NRT Patch compliance	57%
NRT Rescue	
Gum	4 (20%)
Lozenge	14 (70%)
Gum+Lozenge	2 (10%)