Published in final edited form as:
Cancer Epidemiol Biomarkers Prev. 2011 July ; 20(7): 1555–1557. doi:10.1158/1055-9965.EPI-11-0390.

The Efficacy of Computer-Delivered Treatment for Smoking Cessation

Lorraine R. Reitzel, Ph.D.[1], **Jennifer B. McClure, Ph.D.**[2], **Ludmila Cofta-Woerpel, Ph.D.**[3], **Carlos A. Mazas, Ph.D.**[1], **Yumei Cao, M.S.**[1], **Paul M. Cinciripini, Ph.D.**[3], **Jennifer Irvin Vidrine, Ph.D.**[1], **Yisheng Li, Ph.D.**[4], and **David W. Wetter, Ph.D.**[1]

[1]The University of Texas MD Anderson Cancer Center, Department of Health Disparities Research

[2]Group Health Research Institute, Seattle, Washington

[3]The University of Texas MD Anderson Cancer Center, Behavioral Sciences Department

[4]The University of Texas MD Anderson Cancer Center, Department of Biostatistics

Abstract

Background—The current study evaluated the efficacy of an individualized, hand-held Computer-Delivered Treatment (CDT) versus Standard Treatment (ST) for the maintenance of smoking abstinence following a quit attempt.

Methods—Participants were 303 adult daily smokers randomized to CDT or ST, plus pharmacotherapy. Abstinence though one year was examined using logistic random intercept models, a type of generalized linear mixed model regression.

Results—Results did not support the efficacy of the CDT program through one year post-quit in analyses adjusted for time and study site [OR = .84, 95% CI = .55–1.30], or after further adjusting for race/ethnicity, age, gender, education, marital status, and the number of cigarettes smoked per day before quitting [OR = .89, 95% CI = .57–1.39].

Conclusions—CDT did not increase short- or long-term abstinence rates over ST in this study.

Impact Statement—Findings differ from some in the literature and suggest the need for continued research on the use of CDT for smoking cessation.

Smoking is the most preventable cause of premature morbidity and mortality in the U.S. (1) and the health benefits of quitting are substantial. Unfortunately, of the 34% of adult smokers who make a serious quit attempt each year, only 7.5% are successful (2). One promising approach to increasing cessation rates may be the use of computer-delivered treatment (CDT) provided via a small, mobile computer or smartphone. CDT might be particularly efficacious because it could be individualized based on smoking preferences and empirical data, and would allow the provision of treatment in-the-moment when high-risk situations arose. The current study examined the efficacy of an individualized CDT program for smoking cessation used as an adjuvant to a standard cessation treatment (ST). We hypothesized that CDT would increase abstinence rates through 1 year post-quit relative to ST.

Corresponding Author: Lorraine R. Reitzel, Ph.D. Department of Health Disparities Research - Unit 1440 P. O. Box 301402 University of Texas MD Anderson Cancer Center Houston, Texas 77230-1402 Phone: 713-792-0253; Fax: 713-792-1152.

Method

Study Design

This study was a two group randomized controlled trial of a palmtop computer-delivered, individualized smoking cessation intervention for adult smokers (*N*=303). Smokers were randomized into CDT (*n*=152) or ST (*n*=151).

Participants

Participants were recruited from Seattle, WA (*n*=139), and Houston, TX (*n*=164). Enrollment spanned 1999 to 2003. Data collection completed in 2004. Inclusion criteria were: aged 18–70 years; ≥10 cigarettes per day for the past year; expired breath carbon monoxide level of ≥10 ppm; and the ability to speak/read/write in English. Exclusion criteria were: regular use of tobacco products other than cigarettes; active substance abuse disorder; current psychiatric disorder; current use of bupropion; or contraindications for nicotine replacement therapy (NRT).

Procedure

Participants provided written informed consent, completed baseline measures, and were assigned a quit date. All were asked to complete assessments on a palmtop computer during the week prior to quitting. Assessments queried high risk situations for smoking and efficacy and outcome expectancies for context-specific coping strategies. All participants received ST, which consisted of a self-help manual, information regarding how to access the Committed Quitters Program, and six weeks of the NRT patch. Participants randomly assigned to the CDT group also utilized individualized CDT through 1 month post-quit.

CDT intervention consisted of 3 components: *Treatment Information* about smoking (e.g., risks of smoking, benefits of quitting) and specific tips on quitting (e.g., managing negative emotions, what to do if a slip occurs); *Motivational Messages* to encourage quitting; and *Managing My Urge*, a list of situational- and affectively-relevant coping strategies that could be accessed at the moment of an urge. Coping strategies were personalized to each person's preferences and experiences based on the pre-treatment assessment and rating period. Participants were instructed to access the CDT program components to get assistance managing urges or whenever they needed additional information/guidance.

Measures

Socio-demographic and tobacco-related characteristics were measured at baseline and included self-reported race/ethnicity, age, gender, education, marital status, and the number of cigarettes smoked per day before quitting (smoking rate).

Smoking abstinence was assessed at Week 1, and Months 1, 6, and 12 after the target quit date. Abstinence was defined as a self-report of no smoking during the previous 7 days and an expired air carbon monoxide level of <10 ppm. Participants with missing data were classified as smokers per intent-to-treat procedures.

Data Analyses

All analyses were performed using Statistical Analysis Software (version 9.1). Preliminary analyses compared the ST and CDT groups on socio-demographic characteristics and smoking rate. Primary analyses examined the efficacy of CDT on abstinence over time using logistic random intercept models. Model 1 controlled for study site and time, and Model 2 further adjusted for race/ethnicity, age, gender, education, marital status, and smoking rate.

Results

Preliminary Analyses

There were no significant differences between the CDT and ST groups on any of the socio-demographic characteristics or smoking rate (Table 1).

Primary Analyses

Abstinence rates for CDT versus ST at Week 1, and Months 1, 6, and 12 were: 52.6% vs. 55%, 41.4% vs. 47%, 14.5% vs. 14.6%, and 11.2% vs. 13.9%, respectively. There were no significant differences in abstinence by treatment group in Models 1 or 2 (Table 2).

Discussion

Recent reviews of electronic portable devices suggest the efficacy of these modalities in affecting behavior change across a variety of behavioral areas, including smoking cessation (3, 4). Contrary to expectations CDT was not more efficacious for smoking cessation than ST in this trial. Several possible explanations must be considered. It is possible that the intervention delivery device, format, or content was not appealing to participants. It is important to note that hand-held computers were not common at the time and were unfamiliar to most. Exposure to the pre-treatment assessment required to individualize treatment may have diminished group differences, as may have use of NRT. Additionally, the intervention may not have been intensive enough. While we report null findings, CDTs that are integrated with more commonly used and carried electronic devices (e.g., smartphones), that offer greater treatment personalization, or are used for longer duration may be more effective.

Acknowledgments

This manuscript was supported by grants from the National Institute of Drug Abuse (R29DA11194 to DWW) and the National Institutes of Health through The University of Texas MD Anderson's Cancer Center Support Grant (CA016672). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Drug Abuse or the National Institutes of Health.

References

1. Ries, LG.; Eisner, MP.; Kosary, CL.; Hankey, BF.; Miller, BA.; Clegg, L., et al., editors. SEER Cancer Statistics Review, 1975–2001. National Cancer Institute; Bethesda, MD: 2004. Available from: http://seer.cancer.gov/csr/1975_2001/
2. CDC. Centers for Disease Control and Prevention. Smoking cessation during previous year among adults - United States 1990 &1991. MMWR. 1993; 42:504–7. [PubMed: 8515740]
3. Heron KE, Smyth JM. Ecological momentary interventions: Incorporating mobile technology into psychosocial and health behaviour treatments. Br J Health Psychol. 2010; 15:1–39. [PubMed: 19646331]
4. Whittaker R, Borland R, Bullen C, Lin RB, McRobbie H, Rodgers A. Mobile phone-based interventions for smoking cessation. Cochrane Database Syst Rev. Oct 7.2009 4:CD006611. [PubMed: 19821377]

Table 1

Participant Characteristics by Treatment Group

	ST *n* = 151	CDT *n* = 152	Total Sample *N* =303	
	n(%)	**n(%)**	**n(%)**	***p* value**
Socio-Demographics				
Age, years (M±SD)	41.2(±10.2)	41.7(±10.1)	41.4(±10.1)	0.6668
Race/Ethnicity				0.4415
White	117(77.5)	112(73.7)	229(75.6)	
Other*	34(22.5)	40(26.3)	74(24.4)	
Gender				0.3295
Male	74(49.0)	83(54.6)	157(0.52)	
Female	77(51.0)	69(45.4)	146(0.48)	
Marital Status				0.6881
Married	57(37.8)	54(35.5)	111(36.6)	
Not Married	94(62.3)	98(64.5)	192(63.4)	
Education				0.8697
≤ High School/GED	38(25.3)	42(27.6)	80(26.5)	
Tech/Voc/Some college	102(68.0)	99(65.1)	201(66.6)	
≥ College degree	10(6.7)	11(7.2)	21(6.9)	
Study Site				0.8664
Seattle	70(46.4)	69(45.4)	139(45.9)	
Houston	81(53.6)	83(54.6)	164(54.1)	
Smoking Rate				
Cigarettes per day (M±SD)	22.7(±10.8)	22.3(±10.0)	22.5(±10.4)	0.7267

Note:

*Due to limited sample sizes among the non-White participants, African Americans (*n* = 38), Latinos (*n*=15), Asian/Pacific islanders (*n* = 13) and Other Races (*n* = 8) were grouped as “Other Race/Ethnicity” for the purpose of these analyses. ST = Standard Treatment. CDT = Computer-Delivered Treatment.

Table 2

Relationship Between Treatment Group and 7-day Point-Prevalence Abstinence Over Time

Model 1	Odds Ratio	95% CI
Treatment Group		
ST*	-	-
CDT	0.842	0.547 – 1.297

Model 2	Odds Ratio	95% CI
Treatment Group		
ST*	-	-
CDT	0.891	0.571 – 1.391
Age, years	1.001	0.978 – 1.025
Race/Ethnicity		
White*	-	-
Other	0.841	0.489 – 1.446
Gender		
Male*	-	-
Female	0.872	0.551 – 1.380
Marital Status		
Married	1.082	0.674 – 1.737
Not Married*	-	-
Education		
≤ High School/GED*	-	-
Tech/Voc/Some college	1.073	0.633 – 1.818
≥ College degree	2.069	0.816 5.247
Cigarettes per day	0.970	0.946 – 0.994

Note:

* Reference group for calculating/testing the Odds Ratio. Both Model 1 and Model 2 were additionally adjusted for study site and time. ST = Standard Treatment. CDT = Computer-Delivered Treatment. With a planned sample size of 150 per group, the study had 80% power to detect an abstinence difference of 25% versus 40% between the ST and CDT groups at 12 months using a two-sided chi-squared test at a significance level of 0.05 (with intraclass correlation =1). This represented a worst case scenario, as the present analysis was longitudinal in nature and incorporated 4 follow-up time points (Week 1, and Months 1, 6, and 12 post-target quit date).