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Acceptability of an Internet-based contingency management intervention for smoking cessation: Views of smokers, nonsmokers, and healthcare professionals

Bethany R. Raiff, PhD¹, Brantley P. Jarvis, M.A.², Marissa Turturici, B.S.³, and Jesse Dallery, PhD^{2,4}

¹Rowan University

²University of Florida

³West Virginia University

⁴National Development and Research Institutes, Inc

Abstract

The acceptability of an Internet-based contingency management (CM) intervention for cigarette-smoking was evaluated in two experiments. In Experiment 1, 67 participants completed an Internet-based CM intervention and then answered questions about the intervention. Experiment 2 assessed the acceptability of the intervention among potential treatment users (smokers, $n = 164$), non-smokers ($n = 166$), and healthcare providers ($n = 139$), who had never used the intervention. Participants in Experiment 2 were randomly assigned to either watch a video describing the standard CM intervention (No Deposit Group) or to watch a video about the standard intervention plus a deposit incentive (Deposit Group). Overall, results of both experiments indicated high acceptability across all dimensions of the intervention. Seventy-four percent of participants in Experiment 1, and 92% of those in Experiment 2, said they would use it if they needed to quit. Eighty one percent of healthcare providers reported that they would be very likely to recommend the intervention to patients. Participants in both experiments reported that monitoring their progress and earning vouchers were strengths of the intervention. The No Deposit group rated voucher earnings, cash earnings, and cost-effectiveness of the intervention higher than the Deposit Group. Healthcare professionals did not differ in their ratings across video conditions. Overall, the results suggest that Internet-based CM is acceptable as a method to help people quit smoking.

Keywords

Internet; contingency management; smoking cessation; acceptability; social validity; financial incentives

Address Correspondence to: Bethany R. Raiff, PhD, Primary: raiff@rowan.edu, Alternative: raiffbr@gmail.com, Department of Psychology, Rowan University, 201 Mullica Hill Road, Glassboro, NJ 08028, United States of America, Phone: 856-256-4500, Fax:.

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One evidence-based behavioral intervention for smoking cessation is contingency management (CM; Dallery, Glenn, & Raiff, 2007; Dunn, Saulsgiver, & Sigmon, 2011; Higgins et al., 2004; Stitzer, Rand, Bigelow, & Mead, 1986; Stoops et al., 2009; Tidey, O'Neill, & Higgins, 2002). CM consists of delivering incentives (e.g., money) contingent on objective evidence of smoking abstinence. Despite the potential public health impact of CM, barriers to its widespread adoption and dissemination exist, particularly for smoking cessation (Petry, 2010; Roll, Madden, Rawson, & Petry, 2009). One barrier to CM procedures is that they require biochemical verification of abstinence because participants are more likely to falsify self-reports when incentives are delivered contingent on reporting abstinence (Higgins, Silverman, & Heil, 2007).

There are two ways to obtain biochemical verification of smoking status, cotinine via a urine or saliva sample, or carbon monoxide (CO) via exhaled breath output. Cotinine is a metabolite of nicotine and has a relatively long half-life, so it can be tested less often than CO (Higgins et al., 2004)). However, cotinine cannot be used if individuals take nicotine replacement therapy in conjunction with CM (Benowitz, Jacob, Ahijevych, & Jarvis, 2002; Jatlow, Toll, Leary, Krishnan-Sarin, & O'Malley, 2008), it cannot detect recent abstinence (Higgins et al., 2004), and it can be expensive to analyze and time consuming to collect. In contrast, CO can be used with nicotine replacement, and it can detect recent abstinence. However, the current cost of a CO meter may still present some challenges, and CO has a short half-life so it must be collected at least twice per day. If these samples are collected in person, the procedure would not only be onerous for providers and patients, but would also be geographically restricted. Thus, the feasibility of CO testing in community settings is limited by the frequency of testing, and the time and effort required of health care providers (Ledgerwood, 2008).

To address the challenges associated with CO monitoring, Dallery and colleagues have developed and tested a CM intervention that is delivered entirely over the Internet (Dallery et al., 2007; Dallery & Glenn, 2005; Dallery, Meredith, & Glenn, 2008; Meredith, Grabinski, & Dallery, 2011; Reynolds, Dallery, Shroff, Patak, & Leraas, 2008; Stoops et al., 2009). Participants use a web camera to record and submit videos showing them exhale into a CO monitor. If they are abstinent, they earn vouchers, which are monetary statements of earnings that can be exchanged for goods and services. Because the intervention is conducted over the Internet, many features can be automated, thereby reducing the need for staff training and time, while also maintaining treatment fidelity. Internet-based interventions may also be more accessible and convenient because participants can access the intervention anywhere, at any time, as long as they have an Internet-enabled device with a web camera. Internet-based CM is more effective at helping heavy smokers, rural smokers, and adolescent smokers initiate abstinence than Internet-based control conditions (Dallery et al., 2007; Reynolds et al. 2008; Stoops et al., 2009). Furthermore, participants are compliant with the video-submission process (e.g., in one study, 1092 of the scheduled 1120 videos [97.5%] were submitted; Dallery et al., 2007), which supports the feasibility of implementing an Internet-based CM intervention.

Regardless of the potential efficacy of Internet-based CM for smoking cessation, the intervention will only be adopted and disseminated if treatment-seeking smokers are willing

to use the intervention. The systematic assessment of the opinions of potential end users, as well as those who might implement, recommend, or approve the intervention, is referred to as social validity assessment (Foster & Mash, 1999; Klein & Sorra, 1996; Wolf, 1978). Studying acceptability of an intervention through consumer satisfaction questionnaires is one way to measure social validity of an intervention after its implementation (Foster & Mash, 1999). However, potential treatment seekers and treatment providers can also provide valuable data through experimental analogue studies, in which hypothetical treatment situations are presented to participants, who then report their acceptability ratings in surveys.

General Method

We conducted two experiments to evaluate the social validity of an Internet-based CM intervention for smoking cessation. To our knowledge this is the first study to do so. Experiment 1 was conducted with a group of current and former smokers who had recently participated in a clinical trial evaluating the efficacy of Internet-based CM for smoking cessation (Dallery, Raiff, Grabinski, under review). Experiment 2 was conducted online with a group of non-smokers, smokers, and healthcare professionals who had never used the Internet-based CM intervention.

Experiment 1

Experiment 1 was conducted with two groups of treatment-seeking smokers, as part of a larger clinical trial evaluating the short- and longer-term efficacy of Internet-based CM. Participants were randomly assigned to one of two groups. One group of participants earned monetary vouchers contingent on meeting CO goals (Abstinent Contingent group; AC), whereas the other group earned vouchers independent of meeting CO goals (Non-contingent group; NC). At the end of the study, all participants provided a self-report evaluating various dimensions of the intervention.

Method

Participants—Participants between the ages of 18–60 were recruited through print advertisements in newspapers, bulletin boards, and online ($N = 67$; see Table 1 for participant characteristics). Participants were eligible if they reported smoking at least 10 cigarettes per day for at least 2 years, provided a CO of 10 parts per million (ppm) or higher during the intake interview, and expressed a desire to quit smoking. Participants who reported using illicit drugs, or smoking marijuana more than twice per month, were excluded. Participants were also excluded if they were pregnant (verified by a pregnancy test), had a serious mental illness, had smoking-related illnesses (e.g., COPD), did not have Internet access in their home, or lived with another smoker who smoked inside the house. All study procedures were approved by the University of Florida Institutional Review Board (IRB).

Procedure—Only procedural details relevant to the focus of the current study are discussed here. For a more comprehensive overview of the procedures, refer to the primary outcome manuscript (Dallery et al., under review). After completing the consent process, participants completed a psychosocial history questionnaire, which asked questions about

demographics, medical, and mental health. Participants also completed the six-item Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). Participants then completed a 7-week intervention during which they submitted two video samples per day for four weeks, and two video samples per week for the next three weeks, showing them exhale into the CO meter. Participants recorded the videos with a web camera on their home computer. On the home page of the website all participants could view their progress on a graph that displayed their CO submissions throughout the study, with a horizontal line on the graph indicating the CO level that served as the goal for abstinence. Monetary vouchers were distributed according to group assignment. The AC group received vouchers only if they achieved smoking abstinence, whereas the NC group received vouchers contingent on submitting videos, but regardless of whether abstinence was achieved (instead, their earnings were based on the earnings of their AC-paired counterpart). Participants could request items to be purchased with their earnings at any point during the study. Additionally, trained RAs conducted two in-person, and two telephone-based, counseling sessions with each participant during the 7-week intervention. Counselors followed a semi-structured script based on Public Health Service Guidelines (The Tobacco Use and Dependence Clinical Practice Guideline Panel, 2000) and were trained by a Licensed Psychologist (JD).

Finally, at the end of the 7-week intervention, participants completed an in-person paper-and-pencil Treatment Acceptability Questionnaire (TAQ). Research assistants were present but in a different room while the participant completed the TAQ. The TAQ consisted of two parts. The first part measured participants' satisfaction with the Internet-based CM intervention across a number of dimensions, using a 100 mm Visual Analog Scale (VAS; 1 = lowest satisfaction, 100 = greatest satisfaction). Participants were asked: (a) how easy to use, (b) helpful, (c) convenient, (d) effective, and (e) fair the Internet program was; and (f) how much they liked using the CO monitor, (g) seeing their progress on a graph, (h) earning vouchers, and (i) receiving counseling.

The second part of the TAQ consisted of multiple-choice and free-response questions. First, participants were asked how much they would be willing to pay to use the Internet-based CM intervention. Participants were also asked whether they would use the intervention again if they needed to quit, or if they would prefer to try a different treatment (e.g., nicotine patch). They were asked a multiple-choice question about whether they participated in the study to (a) quit smoking, (b) earn money, or (c) both quit smoking and earn money. Finally, this section ended with free-response questions asking participants what they liked most and least about the intervention.

Data analysis—Comparisons between the AC and NC groups on demographics and smoking characteristics were made using chi-square and independent *t* tests for categorical and continuous variables, respectively. Independent *t* tests were used to compare VAS acceptability scores for the AC and NC groups. All correlations refer to Pearson's *r*. Categories for the free-response questions were generated post-hoc by two of the authors, and each response was categorized independently (interobserver agreement = 77.5%). All tests were considered significant with an alpha set to .05, and tests were performed using SPSS 16.0.

Results and Discussion

Participant demographics and smoking characteristics—Demographic information for AC and NC participants can be seen in Table 1. The majority of smokers were white (76.1%), male (53.7%), and middle-aged ($M = 41.0$ years old, $SD = 12.6$). Participants reported smoking 20.8 ($SD = 9.4$) cigarettes per day, moderate nicotine dependence (mean FTND = 5.3, $SD = 2.3$), and a smoking history of 20.3 years ($SD = 12.3$). For most smokers, the reason for their participation was to quit smoking rather than to earn money (62.1%). There were no significant differences on any demographic or smoking characteristics between the AC and NC groups. However, smokers in the AC group submitted a higher percentage of negative samples ($M = 59.5\%$, $SD = 38.6$) during treatment than smokers in the NC group ($M = 40.8\%$, $SD = 37.5$; $t[65] = 2.00$, $d = 0.49$) [note that this only includes participants who completed the TAQ, not all participants who were enrolled in the larger trial reported by Dallery et al. elsewhere; the median percent of negative samples for the entire trial were reported in this other paper and were 66.7% and 25% for the AC ($N = 39$) and NC ($N = 38$) groups, respectively].

Treatment acceptability—Overall treatment acceptability was high for all participants. The mean acceptability rating across all treatment components was 79.9 ($SD = 13.4$, range = 60.9 – 90.9), and all components except counseling were given a rating of 70 or higher. Participants rated the graph ($M = 85.8$, $SD = 21.5$), CO monitor ($M = 81.9$, $SD = 21.7$), and voucher ($M = 80.8$, $SD = 24.8$) treatment components favorably. The highest average overall VAS acceptability score was given for how easy the intervention was to use ($M = 90.9$, $SD = 8.2$). The AC and NC groups differed significantly on only one of the treatment components, which was “fairness” of the intervention. Participants in the NC group rated the intervention as less fair ($M = 76.4$, $SD = 22.1$) than participants in the AC group ($M = 88.2$, $SD = 14.0$, $t[65] = 2.59$, $d = 0.64$). There were no significant differences in overall VAS scores based on demographics, including gender, and smoking characteristics. The only significant association with overall VAS acceptability scores was the percent of negative samples submitted during treatment, and this was seen only in the AC group. Participants who submitted more negative samples (i.e., were more successful in their quit attempt), rated the treatment higher on average ($r[35] = .48$).

There was no significant difference in the amount of money that smokers would be willing to pay to use the Internet-based CM intervention. Smokers in the AC group reported that they would be willing to pay a mean of \$96.72 ($SD = \137.83) compared to a mean of \$86.58 ($SD = \109.11) for those in the NC group. These amounts were not associated with demographic or smoking variables for either group, including income. Seventy-four percent of smokers in the AC group and 62.5% in the NC group reported that they would use the treatment again. In the AC group, quit success was associated with whether smokers would use the treatment again ($t[32] = 3.85$, $d = 1.61$). Among those who reported that they would use the treatment, 70.5% of the samples were negative, compared to 19.8% among those who would not use the treatment again. No significant differences were observed in the NC group.

Free-response questions—For both the AC and NC groups, the major perceived strength was the ability to monitor one's progress with the graph and CO monitor (mentioned by 61.8% of AC and 54.8% of NC participants). Earning vouchers was also listed as a main strength (12.9% of the NC group), particularly among those in the AC group (26.5%). Although counseling received the lowest VAS score rating of any treatment component, it was listed as a strength for a subset of participants in the AC (8.8%) and NC groups (12.9%). Participants in both groups commented that the CO sampling schedule was too frequent (AC group = 29.4%, NC group = 16.1%), and several reported problems with the CO monitor or in submitting video samples (AC group = 23.5%, NC group = 12.9%). For smokers in the NC group (29.0%), a major perceived weakness was that the vouchers were not delivered contingent on their smoking or that the voucher amounts were too small.

Conclusions—Overall, participants' ratings of the Internet-based CM intervention were positive. Interestingly, the NC group regarded the treatment as acceptable, even though they did not earn vouchers contingent on abstinence and even noted this as a weakness. It is possible that there were other active components for NC participants that contributed to their favorable outlook. For example, the consensus from participants in both groups was that the primary strength of the intervention was the ability to monitor their progress with the CO meter and the graph that displayed their CO levels. Additionally, although the NC group submitted significantly fewer negative samples than the AC group, the NC group still submitted a high number of negative samples (40.8%), and this may have contributed to their more favorable views of the intervention, as well as their willingness to pay for the intervention. Indeed, regardless of group assignment, the majority of all participants reported that they would use the treatment again (68.7%). However, NC participants did give a significantly lower rating to how "fair" the intervention was, relative to AC participants. There was no correlation between earnings by the NC group and their subsequent ratings on the "fairness" question, so the reasons for this lower rating are unknown.

Although the costs associated with providing monetary vouchers contingent on smoking abstinence are likely to be less than the costs associated with lost productivity and medical complications that result from smoking (Centers for Disease Control and Prevention, 2008; Kahn, Robertson, Smith, & Eddy, 2008), the cost of incentives is often cited as a barrier to CM (Kirby et al., 2006; Petry, 2010). Monetary vouchers for smoking cessation range from \$70–500 per person for interventions lasting approximately 2–12 weeks (Dallery et al., 2007; 2008; Dunn et al., 2011). Participants in the current study earned a mean of \$235.28 (range = \$0–530; $SD = \$185.40$; Mean AC = \$245.70; Mean NC = \$223.88) across a 7-week intervention. Therefore, cost can limit both the feasibility, and long-term sustainability, of CM. One method that has been explored for reducing the costs associated with monetary vouchers in CM interventions is a "deposit contract" or "deposit incentive" procedure, where participants pay a certain amount of money upfront that can be recouped if abstinence is achieved. In addition to defraying the cost of vouchers, the deposit may also promote greater motivation to quit smoking because loss aversion has been shown to be more salient than simply earning someone else's money (Tversky & Kahneman, 1991). Deposit contract methods have been shown to be both feasible and effective at promoting smoking cessation

(Giné, Karlan, & Zinman, 2010; Paxton, 1980; 1981; 1983; Winett, 1973), and a recent feasibility study showed promise in their ability to reduce costs associated with CM interventions (Dallery et al., 2008). When we asked participants to report how much money they would be willing to pay to use the Internet-based intervention, those in the AC and NC groups reported that they would pay an average of \$96.72 and \$86.58, respectively, which could offset the costs associated with CM interventions.

Limitations—There are at least four limitations with Experiment 1. First, the majority of participants in the sample were white (76.1%), which limits the generalizability of the outcomes. Second, the results of the study relied exclusively on self-reports. Self-reported acceptability of an intervention does not necessarily translate into adoptability. However, without acceptability the likelihood of adoption and diffusion of even some of the most effective interventions can be compromised (Bride, Abraham, & Roman, 2010; Haider & Kreps, 2004; Klein & Sorra, 1996; Simpson, 2002; Stolz, 1981; R A Winett, Moore, & Anderson, 1991). Third, participants may have felt pressure to provide high ratings for the intervention because the RA was present while the questionnaire was being completed. This bias towards more favorable ratings is unlikely, however, given that the lowest rating of any dimension of the intervention was with the counseling component, which was administered by the RA who also delivered the TAQ. Fourth, the sample of participants who completed the TAQ survey was self-selected, and may already have had more favorable opinions about the intervention than a more general population of smokers. Smokers who inquired about the study but did not enroll might have rated aspects of the intervention less favorably. Additionally, participants who enrolled but dropped out of the study prior to completing the TAQ may not have rated the program as favorably. It should be noted that only 4 participants in the AC group and 6 in the NC group dropped out prior to completing the TAQ; thus, once participants enrolled in the intervention, the vast majority completed it.

Experiment 2

One novel aspect of Experiment 1 was that it surveyed end users who had already completed the intervention, which to our knowledge had not previously been evaluated with CM interventions. Because of the associations between acceptability ratings and treatment outcomes in Experiment 1, as well as the self-selection biases that may have existed, Experiment 2 sought to extend upon these findings by surveying a group of naïve smokers – those who had never experienced Internet-based CM – to determine their views on the social validity of the intervention. Additionally, each year over 70% of smokers interact with a healthcare professional, the majority of whom report awareness of smoking cessation programs (Fiore & Panel, 2008; Rutten, Augustson, Squiers, & Davis, 2010). Therefore, it is important to assess whether an Internet-based CM intervention would be endorsed by healthcare professionals if the intervention was available. Thus, Experiment 2 recruited a naïve group of smokers, healthcare providers, as well as a group of non-smokers who might be in a position to recommend the treatment to a friend or family member.

In addition to determining the social validity of Internet-based CM, a second goal of Experiment 2 was to determine the acceptability of a deposit contract procedure for helping to reduce some of the costs associated with the incentives. Experiment 2 was conducted

online with smokers, non-smokers, and healthcare professionals, and participants were randomly assigned to either one group, which learned about an Internet-based CM intervention requiring an initial \$50.00 deposit (Deposit group), or a second group, which learned about a standard Internet-based CM intervention that did not require a deposit (No Deposit group). After watching a brief video about the intervention (described below), participants provided self-reports evaluating various dimensions of the intervention shown in the video.

Methods

Participants—Participants (see Table 2) were recruited online, primarily via Craigslist classified advertisements (a free service that is available to anyone via the Internet) and through emails to healthcare professionals at hospitals and county health departments in diverse regions of the US. These methods have been shown to be effective strategies for recruiting participants, particularly smokers, in other online survey studies (Ramo, Hall, & Prochaska, 2010). The advertisement specified that University of Florida researchers were seeking participants to complete an online survey to get their opinion about a new smoking cessation intervention. The advertisement also indicated that for completing the survey participants may have the opportunity to earn a \$50.00 gift certificate for Amazon.com. All study procedures were approved by the University of Florida IRB.

Materials and Procedure—The online survey (Qualtrics™) was anonymous and participants were allowed to skip questions. After providing consent via electronic signature, participants were asked whether they were a smoker or a non-smoker, and whether or not they were a healthcare professional. Participants then answered demographic questions regarding their age, gender, race, education, and income level.

Participants who reported smoking were then asked the following: (1) How long (in years) have you been smoking? (2) Please rate your current motivation to quit smoking (1 = not at all, 10 = very much), and (3) Have you ever tried to quit smoking before? Smokers also completed the FTND. Participants who reported working as a healthcare professional were asked the following: (1) What healthcare profession best identifies you? (They selected one from a choice of 15 different options) (2) Please describe your role in the healthcare industry; and (3) How many years have you worked in the healthcare industry? It should be noted that a participant could be both a smoker and a healthcare professional. If smokers were also healthcare professionals, their healthcare professional group assignments were given precedent over their status as smokers, in the event that the two groups were given different questions.

Participants then viewed one of two videos, which showed key points of the intervention along with audio descriptions. The videos included a clip of a research assistant submitting a hypothetical sample with the CO meter and web-camera and depicted how the graphs, showing their progress, would appear on the website. The video viewed by the Deposit group was identical to the video viewed by the No Deposit group, except that the Deposit group viewed a version that included approximately 30s of additional video describing a \$50

deposit incentive that would be required to begin treatment, but that could be recouped contingent on objective evidence of smoking abstinence.

Treatment acceptability questionnaire—Similar to Experiment 1, the Treatment Acceptability Questionnaire (TAQ) consisted of two parts. The first part of the TAQ measured participants' perspectives of the Internet-based CM intervention across a number of dimensions, using a VAS (1 = lowest rating, 100 = highest rating). The cursor was placed in the middle, on 50, so that each answer was neutral by default and the participant had to slide the cursor up or down on the line to provide a rating. Non-smokers and non-healthcare professionals were asked: (a) how easy to use, (b) helpful, (c) enjoyable, (d) convenient, (e) effective, (f) cost-effective and (g) fair the Internet program seemed to be; and (h) how useful the CO monitor would be in monitoring progress, (i) how much smokers would like seeing their progress on a graph, (j) how much they would like earning vouchers, (k) earning cash, and (l) how likely smokers would be to use the Internet-based smoking cessation program if it were available. Smokers and healthcare professionals were given all of the same questions, except that for question "l" they were asked "how likely they would be to use (or recommend) the treatment if they (or their patients) wanted to quit". All participants were also given "probe" validation questions asking them to move the cursor from zero to 100 to ensure that they were not simply answering questions randomly. Participants who did not answer these probe questions correctly (i.e., did not put the cursor on 100, as instructed) were excluded from all analyses.

The second part of the TAQ consisted of multiple-choice and free-response questions. The general population and healthcare professionals were asked to select all of the age groups (e.g., 18–25, 26–35, 36–45) and the level of nicotine dependence (e.g., light, moderate, heavy) of smokers for whom they would recommend the treatment. Smokers were asked whether they would use the Internet-based intervention, an alternative intervention (from a selection of 10), or a combination of interventions if they were going to try to quit smoking. Participants were then given free-response questions asking how much they would be willing to pay to use the Internet-based CM intervention, and what they liked most and least about the program.

Data Analysis—Because participants could skip questions, surveys that were missing five or more VAS or multiple-choice questions were omitted (see Results). This exclusion criterion was decided upon prior to conducting data analyses. All descriptive and inferential statistics reflect answered questions only. To compare categorical and continuous demographic characteristics based on smoking and healthcare status, chi-square and independent *t* tests were used. Demographic variables for which groups differed were included as covariates for subsequent analyses when appropriate. Among the general population, ANOVAs were used to determine whether VAS acceptability scores differed based on smoking status and the video watched (Deposit vs No Deposit). Among healthcare professionals, independent *t* tests were used to compare VAS scores between those who viewed the Deposit and No Deposit video and to compare VAS scores between healthcare smokers and non-smokers. Independent *t* tests were used to examine gender differences in VAS scores within subgroups. All reported correlations are Pearson's *r*. Categories for the

free-response questions were generated post-hoc by two of the authors, and each response was rated independently (interobserver agreement = 89.6%). All tests were considered significant with an alpha set to .05, and tests were performed using SPSS 16.0.

Results and Discussion

Survey completion—Of the 1161 responses for which participants provided informed consent, 469 (40.4 %) were retained for analysis. Surveys that were incomplete (i.e., 5 skipped VAS or multiple-choice questions; 41.3 %), used duplicate IP or email addresses (9.6 %), or contained incorrect answers to probe validation questions (8.7 %) were excluded.

Characteristics of smokers and healthcare professionals—Smokers (47.1 %) were more likely than non-smokers to be male ($\chi^2 = 40.49$), but did not differ significantly from nonsmokers on age, race, education, or healthcare status. Smokers reported moderate nicotine dependence (mean FTND score = 4.8, $SD = 2.4$) and had smoked for an average of 12.7 years ($SD = 9.8$). The vast majority of smokers had tried to quit in the past (79.5 %), and reported high levels of motivation to quit at the time of the survey ($M = 7.6$ on a scale of 1–10, $SD = 2.4$).

Healthcare professionals (29.6 %) were more likely than non-healthcare professionals to be Hispanic ($\chi^2 = 12.04$) and to have earned a Masters ($\chi^2 = 12.33$) or professional degree ($\chi^2 = 16.35$). There were no significant differences between these groups on any of the other demographic variables. Nearly half (47.1 %) worked as nurse practitioners, registered nurses, clinical nurse specialists, or licensed practical nurses. Approximately one-third of healthcare professionals worked either as health educators/counselors (14.5 %), dentists/dental hygienists (9.4 %), or academic/clinical researchers (7.2 %). The remaining categories - administrators, physicians, psychiatrists/psychologists, respiratory therapists, and social workers - were roughly evenly distributed (2–5 %). On average, participants had worked in their respective healthcare fields for 9.4 years ($SD = 9.1$). Of the 139 healthcare professionals, 59 reported that they were smokers (41.1%). Healthcare professionals who smoked were more likely than non-smokers to be male ($\chi^2 = 31.21$) but did not differ on any other demographic variable.

Treatment acceptability—Overall, participants rated the Internet-based CM intervention favorably on the VAS. On a 100-point scale, the average acceptability rating was 77.9 ($SD = 19.2$), and all treatment components were rated positively (i.e., above original neutral rating of 50; range = 65.9–91.2).

General population (non-healthcare professionals)—Visual analog scale answers in the general population (i.e., non-healthcare professionals) can be seen in Table 3. Similar to the total sample, ratings for the Internet-based CM intervention were high ($M = 77.8$, $SD = 19.6$), with individual components ranging from 64.8 to 93.3. There were statistically significant main effects on several treatment components by smoking status and video, but no interactions. Compared to non-smokers, smokers rated the Internet-based CM intervention as being more likely to be easy to use ($F[4,323] = 4.03$, $\eta_p^2 = .012$), convenient ($F[4,323] = 10.88$, $\eta_p^2 = .033$), enjoyable ($F[4,319] = 4.50$, $\eta_p^2 = .014$), and effective

($F[4,320] = 13.72$, $\eta_p^2 = .041$). Participants who viewed the No Deposit video rated the cash ($F[4,321] = 9.08$, $\eta_p^2 = .028$) and voucher ($F[4,321] = 13.93$, $\eta_p^2 = .042$) treatment components higher than those who viewed the Deposit video. Participants who viewed the No Deposit video rated the intervention as more cost-effective than participants who viewed the Deposit video ($F[4,321] = 6.49$, $\eta_p^2 = .020$). Among smokers, women rated the voucher component ($M = 91.4$, $SD = 10.7$) significantly higher than men ($M = 83.3$, $SD = 15.5$; $t[160] = 4.14$, $d = 0.61$). Women in this group also rated the cash component ($M = 95.0$, $SD = 9.9$) significantly higher than men ($M = 87.6$, $SD = 15.2$; $t[160] = 3.68$, $d = 0.58$). These were the only statistically significant differences in VAS ratings between men and women, and these results did not depend on the video watched.

Several smoking characteristics were associated with overall VAS acceptability ratings. Smokers who were more motivated to quit ($r[153] = .416$), had longer smoking histories ($r[151] = .225$), and reported higher nicotine dependence ($r[153] = .314$) rated the acceptability of the Internet-based CM intervention higher. Smokers reported that if they were going to try to quit in the future they would use the Internet-based CM intervention (92.1%). Most would prefer to use it alone (60.4%), but some smokers reported that they would prefer to use it in combination with an alternative treatment (31.7%). The most frequently cited alternative treatments were nicotine replacement therapy (56.2%), electronic cigarettes (28.1%), varenicline (18.8%), and counseling (15.4%). There were no significant differences in future quit methods between those who viewed the No Deposit video and those who viewed the Deposit video.

The mean amount of money that smokers reported they would pay to participate in an Internet-based CM intervention was \$123.56 ($SD = \299.64) and was associated with the smoker's income and self-reported nicotine dependence. The amount of money that smokers would pay was higher among those who earned more money ($r[140] = .237$) and those who reported higher nicotine dependence ($r[140] = .244$). Motivation to quit and number of years smoking were not significantly associated with the amount of money smokers would pay for the intervention. Non-smokers reported that smokers would pay an average of \$73.91 ($SD = \68.15) for the intervention, and this amount was not significantly different from the amount of money smokers reported that they would actually pay. Among participants in the Deposit group, there was a statistically significant and positive, but weak, correlation between how cost-effective they viewed the treatment and the amount of money that they thought would be appropriate for the deposit incentive ($r[202] = .156$).

Healthcare professionals—Similar to the total sample and the general population, VAS acceptability ratings by healthcare professionals were high overall ($M = 78.9$, $SD = 18.0$) and in all treatment categories (range = 71.2–93.3). There were no significant differences in acceptability between those who viewed the No Deposit video versus those who viewed the Deposit video on any of the treatment components. Overall, healthcare professionals indicated that they would be very likely to recommend the Internet-based CM intervention ($M = 81.0$, $SD = 17.2$). They reported that they would be most likely to recommend it to smokers 26–35 years old (83.5%) but would also recommend the intervention to smokers 18–25 (71.9%) and 36–45 years old (72.7%). Far fewer healthcare professionals would recommend the intervention to smokers over 45 years old (34.1%). Healthcare professionals

reported that they would be most likely to recommend the intervention to moderate smokers (11–20 cigarettes per day; 81.3%), followed by light smokers (1–10 cigarettes per day; 71.9%), but they were less likely to recommend it to heavy smokers (>20 cigarettes per day; 46.0%). VAS acceptability ratings for healthcare professionals who smoked differed significantly from those who did not smoke in only one category – cash. Healthcare non-smokers rated the cash CM component higher ($M = 94.4$, $SD = 11.5$) than healthcare smokers ($M = 88.3$, $SD = 15.6$; $F[2, 136] = 4.64$, $\eta_p^2 = .033$). There were no other significant differences in VAS acceptability ratings between these two groups.

Free-response questions—The greatest perceived strength was the power for incentives to motivate smoking cessation (38.2% of comments included this topic). Other notable strengths were its ability to allow smokers to monitor their smoking and progress with the CO meter and graphs (26.9%), its ease of use and “fun” factor (15.4%), convenience (14.7%), and that it could hold smokers more accountable compared to traditional treatments (6.4%). The most frequently cited concern of the Internet-based CM intervention occurred for those who viewed the Deposit video. Approximately 20% of the comments for Deposit participants indicated that the deposit was not a useful treatment component or that the deposit amount (\$50) was too high, whereas only 5% mentioned it as a benefit. Other general concerns were that the CO monitoring (twice daily) was too frequent (12.2%), that some smokers may have difficulty using the technology and equipment (10%), and that only smokers with Internet access could use the treatment (7.9%).

General Discussion

Experiments 1 and 2 indicate that the overall perception of Internet-based CM was positive. Participants rated all aspects of the intervention favorably, and they found the contingent incentives to be a notable strength. Another strength of the intervention noted by participants in both experiments was the ability to monitor one's progress using the graphs and CO meter. Even among a community sample of potential end-users, as well as nonsmokers, Internet-based CM was endorsed and participants said that they would either be interested in trying it or they would recommend it to someone who wanted to quit. Similarly, a sample of health-care professionals viewed the intervention positively and said they would encourage their patients who smoke to try the intervention. This is an important finding because, although recent reports have shown an improvement in the percentage of smokers who receive information or counseling regarding smoking cessation during their clinic visit (approximately 70%), it is unlikely that they receive information about CM interventions, despite their strong evidence base. Indeed, health-care providers can play an important role in the dissemination of innovative, technology-based approaches, so it is important to obtain their support by making the intervention both appealing and accessible to this population (Haider & Kreps, 2004; Simpson, 2002).

Previous studies have investigated the social validity of CM interventions (Bride, Abraham, & Roman, 2010; Kirby, Benishek, Dugosh, & Kerwin, 2006; McGovern, Fox, Xie, & Drake, 2004; Willenbring et al., 2004); however, these studies were conducted with drug treatment providers, counselors, and clinic directors, and the CM interventions evaluated were traditional face-to-face procedures aimed at promoting abstinence from drugs such as

cocaine, alcohol, or opioids. Promberger, Brown, Ashcroft and Marteau, (2011) investigated the acceptability of financial incentives for promoting health behavior among a community sample and found that they were more likely to be supported when the patient was viewed as having little control over the behavior (e.g., mental health vs smoking). Other studies have shown that acceptability was higher when the individuals were themselves smokers (and they were asked to evaluate CM for smoking cessation; Lynagh, Bonevski, Symonds, & Sanson-Fisher, 2011; Park, Mitra, & Asch, 2012), and when financial incentives were said to be more effective than other available treatments (Promberger, Dolan, & Marteau, 2012). The current study adds to these previous findings by showing that an Internet-based CM intervention is viewed as acceptable among smokers who have not only tried the intervention, but also among smokers who might be interested in quitting at some future date, as well as among a community sample of non-smokers and health care professionals.

Although the acceptability of the deposit was generally high, some participants in the Deposit group were concerned with the deposit. A number of variables could contribute to this perception. For example, the proposed amount may have been too high (\$50), as some participants indicated. Among smokers, there was a correlation between the participant's income and the amount of money that they reported they would be willing to pay to use the intervention, suggesting that a "one-size-fits-all" deposit amount may not appeal to all smokers. Additionally, participants in the Deposit group who rated the intervention as less cost-effective also tended to report that a lower deposit might be more acceptable (although this was a weak correlation). Despite these reports about the deposit, the majority of smokers in both groups reported wanting to try Internet-based CM for smoking cessation (Deposit = 92.8% vs No Deposit = 91.3%).

One noteworthy finding was that individuals who reported being heavy smokers endorsed Internet-based CM to a greater extent than individuals who reported being light or moderate smokers. This is important because healthcare professionals reported that they would actually be least likely to recommend the intervention to heavy smokers. As indicated above, almost all of the smokers in Experiment 2, regardless of smoking severity, reported that they would try Internet-based CM to quit smoking. Perhaps more surprising is that the majority of participants also reported that they would prefer to use the intervention alone, without any other form of treatment (e.g., nicotine replacement therapy). Although the reasons why participants would prefer the intervention alone is unknown, other studies have reported that smokers can be apprehensive about using pharmacological aids because of skepticism about replacing one drug (nicotine) with another drug, doubts about efficacy, concerns about side effects, medical contraindications, or because of unsuccessful prior attempts (e.g., Benowitz, 2000; Gritz, Lam, Vidrine, & Fingeret, 2008; Pollak et al., 2007).

For those individuals who said they would like to use Internet-based CM in combination with another treatment, the three most highly endorsed complementary treatments were nicotine replacement therapy (NRT), electronic cigarettes, and varenicline (i.e., Chantix). With traditional CM, there is no evidence to suggest that adding NRT promotes greater cessation (Tidey et al., 2002; Wiseman, Williams, & McMillan, 2005), and there are no published reports evaluating the benefits of combining CM with varenicline at this time. Combining another evidence-based pharmacological aid, bupropion (i.e., Wellbutrin,

Zyban), with CM has been studied more recently, but has yielded mixed results (Gray et al., 2011; Tidey, Rohsenow, Kaplan, Swift, & Reid, 2011). Despite the efficacy of Internet-based CM relative to control conditions, there are still a large number of smokers who continue to smoke, and an even larger number who eventually relapse (similar to most smoking cessation interventions). Therefore, it would be worthwhile to explore the benefits of combining Internet-based CM with complementary pharmacological or behavioral interventions.

Experiment 2 addressed some of the limitations that were present in Experiment 1. Participants in Experiment 2 were more diverse than those in Experiment 1, with the racial and ethnic characteristics of participants in Experiment 2 being consistent with recent Census statistics (see Table 2; United States Census Bureau, 2010). Additionally, recruiting participants online who had never used Internet-based CM eliminated potential biases that may have inflated the ratings found in Experiment 1 (e.g., self-selection, experimenter demands).

Nevertheless, Experiment 2 did have at least three limitations. First, the sample was necessarily restricted to participants who had Internet access and were experienced Internet and computer users. Of course, these represent the individuals who would be in the best position to use an Internet-based CM intervention; however, restricting the sample to Internet users might limit the generality of the ratings when considering smokers who do not have access to the Internet. Indeed, the third and fourth most cited concerns in the free-response section were that the procedure may be too technically challenging and that many individuals would not have access to the Internet. Second, although it is possible that participants provided random, rather than thoughtful and honest, answers to the VAS questions just so that they could be eligible for the gift certificate given to one individual at the end of the study, this is unlikely. All participants who failed to answer the probe questions correctly, or who skipped more than five questions, were eliminated from the analyses. A specific criterion for the acceptable amount of missing data allowed in any one survey within a study does not yet exist (Schlomer, Bauman, & Card, 2010). However, five questions was the equivalent of 20% of the survey, and others have used this criterion for excluding incomplete data sets (Peng, Harwell, Liou, & Ehman, 2006). Additionally, the majority of participants (90%) provided comments in the free-response portion of the survey, which could have been left blank (doing so did not count towards the 5 missed questions in the inclusion criteria). Third, only 40.4% of the total sample was included in the analysis, mostly because participants skipped five or more VAS or multiple-choice questions. In a similar study, Ramo, Hall, and Prochaska (2010) only retained 40.2% of their entire sample for analysis due to nonresponse. A high amount of nonresponse is common in all types of survey research, and does not necessarily indicate bias (Visser, Krosnick, & Lavrakas, 2000). The only question that was skipped significantly more often than the others asked smokers how much they would pay for the intervention. It is unknown whether participants who did not respond implied "\$0" by leaving this question blank, or whether they truly did not want to provide an answer.

In conclusion, the consensus among participants in both experiments was that Internet-based CM is an acceptable form of treatment for individuals who wish to quit smoking. Not only

did smokers who had never used the intervention rate it highly, a sample of non-smokers and healthcare professionals also rated the intervention positively. The results of the current study suggest that the general public is supportive of a system that involves giving incentives to smokers to help them quit and that healthcare providers are likely to recommend such an intervention. Acceptability of Internet-based CM is one important step towards overcoming obstacles to the dissemination and implementation of this evidence-based intervention.

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Table 1

Experiment 1 - Participant demographics

	AC (n = 35)	NC (n = 32)
	<i>N (%)</i>	<i>N (%)</i>
Gender		
Female	17 (48.6)	14 (43.8)
Race		
White	25 (71.4)	26 (81.3)
Black	3 (8.6)	2 (6.3)
Hispanic	4 (11.4)	0 (0.0)
Asian	1 (2.9)	2 (6.3)
Other	2 (5.7)	2 (6.3)
	<i>Mean ± SD</i>	<i>Mean ± SD</i>
Age	40.1 ± 13.0	41.9 ± 12.4
Cigarettes per day	20.6 ± 8.9	20.6 ± 10.0
FTND total score	5.2 ± 1.9	5.3 ± 2.6
Years smoking	19.8 ± 11.9	20.8 ± 12.9
CO at intake	25.6 ± 16.2	25.9 ± 14.7
Percent of samples that were negative (abstinence during treatment)*	59.5 ± 38.6	40.8 ± 37.5

AC = Contingent, NC = Noncontingent

* Significant difference between AC and NC groups, $p < 0.05$.

Table 2

Experiment 2 - Participant demographics

	No Deposit (<i>n</i> = 253)				Deposit (<i>n</i> = 216)			
	Nonsmokers (<i>n</i> = 93)		Smokers (<i>n</i> = 80)		Nonsmokers (<i>n</i> = 73)		Smokers (<i>n</i> = 84)	
	<i>N/Mean (SD/%)</i>	<i>N/Mean (SD/%)</i>	<i>N/Mean (SD/%)</i>	<i>N/Mean (SD/%)</i>	<i>N/Mean (SD/%)</i>	<i>N/Mean (SD/%)</i>	<i>N/Mean (SD/%)</i>	<i>N/Mean (SD/%)</i>
Age	32.3 (±12.1)	32.2 (±10.7)	35.4 (±10.8)	34.0 (±13.9)	33.1 (±9.4)	32.3 (±11.4)		
Gender								
Female	64 (68.8)	43 (54.4)	44 (55.0)	58 (79.5)	42 (50.0)	43 (72.9)		
Race								
White	56 (60.2)	60 (75.0)	53 (66.3)	45 (61.6)	62 (73.8)	38 (64.4)		
Black	16 (17.2)	9 (11.3)	11 (13.8)	12 (16.4)	13 (15.5)	6 (10.2)		
Hispanic	2 (2.2)	3 (3.8)	12 (15.0)	6 (8.2)	4 (4.8)	7 (11.9)		
Asian	15 (16.1)	7 (8.8)	2 (2.5)	7 (9.6)	3 (3.6)	7 (11.9)		
Other	4 (4.3)	1 (1.3)	2 (2.5)	2 (2.7)	2 (2.4)	1 (1.7)		
Education								
Some H.S.	2 (2.2)	2 (2.5)	0 (0.0)	2 (2.7)	3 (3.6)	0 (0.0)		
H.S. or GED	19 (20.4)	21 (26.3)	7 (8.8)	22 (30.1)	21 (25.0)	1 (1.7)		
Associates	14 (15.1)	22 (27.5)	10 (12.5)	9 (12.3)	22 (26.2)	14 (23.7)		
Bachelors	34 (36.6)	25 (31.3)	35 (43.8)	30 (41.1)	30 (35.7)	22 (37.3)		
Masters	15 (16.1)	6 (7.5)	17 (21.3)	5 (6.8)	4 (4.8)	12 (20.3)		
PhD	2 (2.2)	0 (0.0)	1 (1.3)	1 (1.4)	1 (1.2)	0 (0.0)		
Professional	0 (0.0)	1 (1.3)	7 (8.8)	1 (1.4)	2 (2.4)	5 (8.5)		
Other	7 (7.5)	3 (3.8)	3 (3.8)	3 (4.1)	1 (1.2)	5 (8.5)		

Table 3

Experiment 2 - VAS acceptability scores among the general population (non-healthcare professionals)

	No Deposit		Deposit	
	Smokers (<i>n</i> = 93)	Non-smokers (<i>n</i> = 80)	Smokers (<i>n</i> = 73)	Non-smokers (<i>n</i> = 84)
	<i>M</i> ± <i>SD</i>	<i>M</i> ± <i>SD</i>	<i>M</i> ± <i>SD</i>	<i>M</i> ± <i>SD</i>
Easy *	82.2 ± 21.8	75.2 ± 20.4	77.8 ± 18.7	74.1 ± 19.3
Helpful	77.8 ± 22.3	70.6 ± 21.4	72.1 ± 21.9	69.8 ± 22.2
Enjoyable *	71.7 ± 25.4	64.8 ± 24.3	70.6 ± 24.1	65.7 ± 20.6
CO monitor	85.6 ± 16.4	85.9 ± 13.0	84.0 ± 14.1	83.4 ± 14.7
Graph	86.9 ± 15.4	83.7 ± 16.7	83.0 ± 18.3	83.5 ± 14.9
Vouchers **	89.8 ± 14.6	93.3 ± 8.5	85.7 ± 13.1	87.5 ± 15.0
Cash **	91.7 ± 15.2	93.3 ± 8.5	90.4 ± 13.5	87.5 ± 15.0
Convenient *	81.1 ± 21.0	71.4 ± 25.1	78.6 ± 21.1	72.5 ± 22.5
Effective *	78.1 ± 21.4	65.9 ± 22.2	73.3 ± 20.9	67.0 ± 20.7
Cost-effective **	82.9 ± 21.2	75.2 ± 22.6	72.6 ± 24.7	73.5 ± 20.9
Team treatment	74.0 ± 27.8	78.9 ± 18.7	78.0 ± 22.2	78.8 ± 15.9

* Indicates a statistically significant difference between smokers and nonsmokers

** Indicates a statistically significant difference between the No Deposit and Deposit groups