Smoking Cessation Research via the Internet: A Feasibility Study

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To reverse the present stagnation in progress toward reduced smoking rates, new widely accessible treatment methods for smoking cessation must be developed and evaluated with large groups of smokers.

We tested the feasibility of conducting a smoking cessation study over the Internet using a brief, self-help educational intervention. Through a direct e-mail sent from a large health information web site (WebMD), and with our presence on the Internet, we recruited 538 adult smokers to the study.

Most participants (90.5%) completed all baseline questionnaires. Questionnaires showed acceptable to good reliability and were comparable with studies using

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paper-and-pencil methods. Participants appeared to be highly dependent on nicotine. Forty-two percent indicated being ready to quit smoking at baseline. At 1-month follow-up, 42.8% of baseline participants returned a complete follow-up questionnaire, 40% of whom indicated having made a serious quit attempt, and 8.3% of whom indicated 7-day abstinence. Most follow-up participants rated the site as at least somewhat helpful to quitting (74.9%) and reported at least a slight increased intention to quit smoking over baseline (67.3%).

While Internet-enabled self-help interventions for smoking cessation are able to reach large numbers of smokers interested in quitting smoking, additional procedures are needed to retain these users for treatment and follow-up assessments.

Worldwide, it is estimated that more than 500 million current smokers will die prematurely from smoking-related diseases (Murray & Lopez, 1996). In the United States, it is widely recognized that cigarette smoking is a principle cause of preventable death. Despite this, smoking rates have dropped by only 2.2 percentage points since 1990, less than a third of the 7.7 percentage-point drop in smoking prevalence from the previous decade (National Center on Health Statistics, 1999). To accelerate the current rate of decline in smoking new cessation methods must be developed.

While the majority of current smokers report wanting to quit (Centers for Disease Control and Prevention, 1994, 2002), most attempts to do so end in relapse within less than a year (Centers for Disease Control and Prevention, 1993, 2002). In part this is likely due to the fact that smokers typically do not use smoking cessation techniques that have been shown to be effective (Pederson, Bull, Ashley, & MacDonald, 1996; Pierce & Gilpin, 2002). While face-to-face behavioral treatments for smoking cessation are among the most efficacious methods known, the travel requirements, time scheduling, inconvenience, and expense of this method act as barriers to treatment. Such barriers partially may contribute to the weak demand for such services: fewer than 4% of smokers ever participate in face-to-face treatment for smoking cessation (Schwartz, 1987).

Most smokers prefer and use self-directed help for smoking cessation (Christensen, Miller, & Muñoz, 1978; Schneider, 1986; Zhu, Melcer, Sun, Rosbrook, & Pierce, 2000). Self-help is most commonly sought in the form of printed publications, such as brief guides and manuals, which typically result in a 5% 1-year quit rate (Fiore, Bailey, Cohen, & Dorfman, 2000). One disadvantage of this approach is the cost of printing and mailing, which must be repeated whenever materials require updating. When the same content is provided on the Internet, these costs are avoided and the updating of materials has a considerably shorter development cycle. Internet-provided help for smoking cessation has the additional unique capabilities of delivering content virtually “on demand,” regardless of the time of day when it is requested and may be programmed to follow up with smokers in the future. Follow-up contact is useful for providing encouragement to smokers during the cessation process and collecting information for evaluation. An additional advantage of the Internet is the ability to rapidly tailor information based on an individual’s input, which has been demonstrated to improve cessation outcome (Revere & Dunbar, 2001). Thus, Internet-administered interventions for smoking cessation retain many of the advantages of other self-help methods through their capacity to reach large numbers of smokers, as well as certain benefits common in face-to-face treatments, such as greater interactivity and follow up.

While a variety of Internet sites currently provide information about quitting smoking, few such sites meet established guidelines for treatment or have been

evaluated in peer-reviewed scientific studies (Bessell et al., 2002; Etter & Perneger, 2001; Schneider, 1986; Takahashi et al., 1999). The first published study known to evaluate an Internet-delivered smoking cessation program reported impressive 1-month and 4-month quit rates of 37.5% and 25%, respectively (Schneider, 1986). This early study was limited, however by a small and select group of participants, consisting of 28 smokers who were primarily university students and staff. In a second study by Schneider and colleagues (Schneider, Walter, & O'Donnell, 1990), a much larger sample ($n = 1,158$) was recruited to a randomized controlled study, involving a more intensive and interactive program. Abstinence rates from this trial were considerably lower than the earlier trial; the average, 1-month quit rate was 7.5% when counting participants who were lost to follow up as smokers, and 17.7% when counting just the smokers who responded to the follow-up messages.

Since these early studies, considerable advances have been made in both Internet technology and in knowledge about effective treatments for smoking cessation. Since 1995, the proportion of U.S. adults who use the Internet has grown from less than 10% to more than 66% (Taylor, 1998, 1999, 2002b). An estimated 60 million U.S. adults went on-line in search of health information in the past year, most of whom (70%) reported that the health information they found influenced a decision about treatment (Fox & Rainie, 2000; Taylor, 2002a). During this same period of time, much has been learned about the type of help most acceptable to, and most effective for, various groups of smokers trying to quit smoking (Fiore et al., 2000; Hughes, Goldstein, Hurt, & Shiffman, 1999). Much of this progress, however has been limited to advances in pharmacological treatments and face-to-face counseling interventions (Fiore et al., 2000), which have yet to be tested with large audiences.

The Internet may be useful for disseminating cognitive behavioral and other counseling interventions found to be efficacious in randomized trials, as well as evaluating interventions pilot tested among smaller groups of smokers.

An example of one such efficacious intervention conducted by our group (Muñoz, Marin, Posner, & Pérez-Stable, 1997) is a randomized trial for smoking cessation conducted by mail with smokers who received a nationally recognized guide to Quit Smoking (Pérez-Stable, Sabogal, Marin, & Marin, 1991) or the Guide to Quit Smoking plus a mood management intervention. Approximately 11% of smokers achieved smoking abstinence with just the guide and 22% of those assigned to the guide and the mood management achieved abstinence (Muñoz et al., 1997). Moreover, the highest quit rate observed was for smokers who were assigned the guide and mood management who had a history of major depression (39% at 6 months). If smokers with a history of major depression do, in fact, derive a differential benefit from programs offering a mood management component as part of the cessation intervention, Internet-delivered smoking cessation programs could be developed to detect and treat such smokers more effectively.

As a first step toward this goal, we tested in this study the feasibility of evaluating "Guía para Dejar de Fumar" (Muñoz et al., 1997), a guide for smoking cessation, with English language participants and entirely through the web. Additionally, we constructed this website to (1) recruit participants, (2) obtain informed consent, (3) collect assessment data, (4) provide a brief educational intervention, and (5) obtain 1-month follow-up data, all without human contact. In this report, we describe characteristics of the study participants and participant evaluations of the site at 1-month follow up.

Method

Design

Volunteer smokers took part in a one-group pre- and post-test smoking cessation study conducted entirely via the web. They were administered a series of standard questionnaires and given individually tailored information based on responses to questionnaires measuring nicotine dependence, depressive symptomatology, and menstrual distress relevant to quitting difficulty. Following completion of the questionnaires, participants were given access to a published guide to quit smoking (Pérez-Stable et al., 1991) and a guide to pharmacological assistance for smoking cessation developed by our group for the smoking manual Clear Horizons (Orleans, et al., 2001). The on-line guides were equivalent to the paper guides, except that they contained links, or underlined text, giving individuals access to specific sections of the guide should they choose not to view the guide in a sequential manner. One month after enrollment, participants received an e-mail reminder with a link to a follow-up questionnaire asking about smoking status and impressions of the site.

Participant Recruitment

We recruited volunteer participants through announcements on list serves, registration with popular search engines (e.g., Yahoo, Health Web), and a direct e-mail sent from the health information site WebMD. Eligibility criteria included the following: smoking 1 or more cigarettes daily, using e-mail at least once weekly, and a minimum age of 18 years old. Those eligible were presented with an official informed consent form approved by our Institutional Review Board offering three options for continuing (1) digitally “sign” the form by entering their full name, telephone number, and e-mail address; (2) “browse” the website without having their data collected; or (3) exit the site.

Measures

Demographic and Smoking Characteristics

Demographic variables assessed are summarized in Table 1. Smoking characteristics included the following: nicotine dependence, previous withdrawal symptoms, reasons for quitting smoking, confidence in quitting, and intentions for quitting smoking. Current dependence on nicotine (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) was assessed using the Fagerström test for nicotine dependence (FTND), which has shown adequate reliability (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994) and predictive validity for cessation in epidemiologic studies (Breslau & Johnson, 2000). Previously experienced withdrawal symptoms were measured using select items from the *Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV* criteria for nicotine withdrawal (American Psychiatric Association, 1994) along with commonly reported symptoms found in other studies (Hatsukami, Skoog, Allen, & Bliss, 1995). To assess reasons for quitting, we asked participants to rate the importance of health, social, personal, or family reasons for quitting smoking using a 4-point Likert scale (1 = not important to 4 = very important).

Table 1. Demographic characteristics of participants who accessed the smoking cessation webSite and completed the assessment questionnaires, May–June 2000. Total sample = 538. Reported sample size varies by question due to missing data

Characteristic	Category	N	Percent
Gender	Men	137	26.2
	Women	385	73.8
Ethnicity	White	422	78.4
	Latino	9	1.7
	African American	17	3.2
	Asian American/Pacific Islander	5	1.0
	Native American	35	6.5
	Multiethnic	10	1.9
	Other	40	7.4
Age	18–24	28	5.2
	25–44	261	48.5
	45–64	230	42.7
	65+	19	3.5
	<12	53	10.0
Education, highest grade completed	12	190	36.2
	14	143	27.3
	16	108	20.6
	18+	31	5.9
	<12	53	10.0
Annual household income (thousands of dollars)	0–15	56	10.9
	16–35	153	30.0
	35–50	120	23.2
	51–75	110	21.3
	75+	77	14.9
Employed	Yes	267	51.7

Depressive Symptomatology

Current and past major depressive episodes were measured using the MDE Screener (Muñoz, 1998), a modified version of the depression section of the Diagnostic Interview Schedule. Recent depressive symptoms were measured using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). Menstrual cycle-related symptoms of dysphoria and distress were measured on a 5-point Likert scale (from 0 = no symptom to 4 = severe) corresponding to 13 commonly reported symptoms experienced during the most recent menstrual cycle (Stoddard, 1999).

One-month Evaluation

The follow-up survey asked whether participants had made a serious quit attempt, defined as not smoking for 24 hours or more; whether they had abstained for at least the past 7 days; and, if they had not quit, the number of cigarettes currently smoked. We also asked whether the site was helpful to quitting goals, whether intention to quit increased since enrollment, and the number of others, if any, they referred to

the site. Evaluation items (see Table 3) were derived from recommendations summarized in a U.S. Department of Health and Human Services report on interactive communications and health (Eng & Gustafson, 1999).

Intervention

As participants completed questionnaires, they received feedback about their scores and the potential implications of their responses. For example, once a subject completed the nicotine dependence questionnaire, his or her nicotine dependence score was displayed along with a label describing whether the score was considered to be high or low. Similarly, upon completing the depression instruments, participants were shown their scores along with a description about whether symptoms indicated the presence of depressive symptoms. Upon completion of all questionnaires, participants were presented with a summary of their results. Participants with a high nicotine dependence score were directed to the Nicotine Replacement Guide and advised to consider using nicotine replacement. Those with depression symptoms were shown a summary of their responses to these questionnaires and then advised

Table 2. Baseline Smoking Behaviors of Participants Who Accessed the Smoking Cessation Website and Completed the Assessment Questionnaires, May–June 2000

Item	Mean (SD)
Cigarettes per day	25.2 (12.5)
Years smoking	26.2 (11.5)
Times abstinent for 24+ hours in past year	2.5 (4.2)
Fagerstrom Score for Nicotine Dependence	6.0 (2.4)
	Percent
Smoke 1st cigarette of the day within	
5 minutes of waking	43.4
6–30 minutes of waking	39.0
31–60 minutes of waking	8.0
After 60 minutes of waking	9.6
Change in smoking planned during next 3 months	
Quit absolutely	42.1
Try to quit	41.1
Cut down	14.9
Switch brands	1.9
Tried any help with last quit attempt*	86.6
Nicotine replacement	67.7
Bupropion	15.0
Motivational tapes/recordings	24.1
Hypnosis	20.6
Group	12.6
Other self-help	10.4
Acupuncture	5.4

*Respondents often tried more than one of these methods. Percentage may add to more than 100%.

Table 3. One-month follow-up responses for participants. sample size varies by question due to missing data

Item	Total 230	Percent 100	95% Confidence limits	
			Lower	Upper
24+ hrs. abstinence in past 30 days	92	40	34	46
7-day abstinence	19	8.3	05	12
Increased intention to quit				
None	74	32.7	27	39
A little	87	38.5	32	45
Somewhat	46	20.4	15	26
A lot	19	8.4	05	12
Helpfulness of site				
Not very	57	25.1	19	31
Somewhat	121	53.3	47	60
Quite	43	18.9	14	24
Extremely	6	2.6	01	05
Sharing the website with others				
Yes	47	21.0	16	26

to print the summary and bring it to a health care professional. In addition, each questionnaire screen displayed a randomly selected message about a health improvement activity related to smoking cessation. Clicking on the tips displayed the original references, published in peer-reviewed journals, which were the source of the information.

Upon completion of the questionnaires, participants were given access to the Guide to Quit Smoking and the Nicotine Replacement Guide. Both guides contained illustrations, a table of contents, and links to various sections of the guide, should participants choose not to view the guide in a sequential manner. Participants were encouraged to use this material to aid them in their attempts to quit smoking.

Data Analysis

Scale reliabilities were tested using Cronbach's alpha coefficient. Descriptive statistics included percentages, means, and standard deviations. Change in number of cigarettes smoked was tested using a one-sample *t* test.

Results

Retention

The retention of participants throughout the sequence of questionnaires administered is shown in Figure 1. Of the 839 individuals who filled in at least some eligibility data, 538 (64%) signed the consent form. The remainder chose to browse the site. Among consented participants, 90.5% ($n = 487$) completed all baseline questionnaires and 42.8% ($n = 230$) completed the 1-month follow up. Messages

Figure 1. Schematic of recruitment and study flow.

that linked participants to the follow-up questionnaire were undeliverable to 5.6% ($n = 30$) of participants.

Figure 2 shows the recruitment rates for consented participants over time. Approximately 74% of our sample ($n = 399$) was recruited through direct e-mail messages sent to WebMD members ($n = 82,477$), including 4,000 self-identified smokers (Figure 2).

Psychometric Properties of Web-administered Instruments

Cronbach's alpha for the previous withdrawal symptoms scale was .71. For the CES-D, menstrual cycle distress, and FTND questionnaires Cronbach's alpha was .93, .89, and .63, respectively. The FTND total score was highly correlated with the individual items "number of minutes after waking until first cigarette" ($r = .81$) and number of cigarettes smoked per day ($r = .72$). The FTND also predicted the follow-up items: serious quit attempt ($F = 38.6$, $p < .0001$) and 7-day abstinence ($F = 5.72$, $p = 0.01$).

Demographics of Study Enrollees

As shown in Table 1, the majority of participants were White (78.4%), female (73.8%), and at least a graduate of high school (90%). For nearly half the sample (36.2%), high school was the highest level of education obtained.

Smoker Characteristics

Most participants (82%) smoked within 30 minutes of waking; half of these participants smoked within 5 minutes of waking. Those smoking 21 or more cigarettes daily represented 55% of the sample. Nearly all participants (86.6%) had previously sought help with cessation. See Table 2. The most common type of help sought was pharmacological, including the nicotine patch (52.8%), nicotine gum (42.4%), and both products (34.8%).

One-month Follow-up

Returning participants (42.8%) were similar to those lost to follow-up (data not shown) on baseline demographics (e.g., age, gender, ethnicity, marital status, education, and employment status), smoking characteristics (nicotine dependence, smoking history, confidence in quitting, reasons for quitting, past withdrawal symptoms, type of cessation help), and depression history. One exception to this was that returning participants had a lower household income than nonreturning participants did (chi square = 20.7, $p = 0.004$).

Among the 230 individuals who completed the 1-month follow-up questionnaire, 40% ($n = 92$) made a serious attempt to quit smoking (24+ hrs. abstinence) and 8.3% ($n = 19$) reported 7-day abstinence. When counting consented participants who were lost to follow-up as smokers, we found that 3.5% ($n = 19/538$) of participants were abstinent for 7 days or more. Intention to quit smoking increased by 67.3% from baseline, while 74.9% reported that they found the site helpful to quitting goals.

Figure 2. Number of participants recruited across the time of the study.

Discussion

The primary aim of this study was to demonstrate the feasibility of conducting a brief, self-help smoking cessation intervention over the Internet. Using a one-group, pre-post smoking cessation study over the Internet, we were able to recruit participants, obtain informed consent, collect assessment data, provide feedback to questionnaire responses, offer a minimum-contact self-help intervention, and obtain follow-up information 1 month after enrollment. The validity of data was supported by the high internal consistency of items from the questionnaires and the high correlations between variables expected to correlate (e.g., nicotine dependence and serious quit attempts).

Despite the considerable length of the baseline questionnaires (range: 85–132 items) 58% of those browsing the site and 90.5% of consented participants completed all of the items. This compares favorably with a previously Internet-administered survey where completion rates were as low as 30% (Soetikno, Provenziale, & Lenert, 1997). Our completion rates may have been higher because of the immediate and personalized feedback provided as participants completed questionnaires. The completion rate for the follow-up questionnaire (40%) is low compared with most face-to-face clinical trials, but it is nearly identical to the first known Internet-enabled trial of smoking cessation (Schneider, Walter, & O'Donnell, 1990) and mailed surveys for tobacco cessation (Jones & Pitt, 1999).

Participants who completed the survey were similar to those lost to follow up on demographic characteristics and smoking behaviors. Only one item differed between these groups: those who did not complete the study had higher income levels than those who stayed with the study. Although the relevance of this finding is unclear, one possibility is that smokers with lower income have fewer alternative options for smoking cessation treatment, particularly those involving costly prescription and over-the-counter medications. If true, this could have heightened the interest of our study among those earning less income.

Depending upon the method used to estimate abstinence, between 3.5% and 8.3% of participants had quit 1 month after enrolling in the study. It has been argued that, in studies similar to this, counting all participants lost to follow up as smokers post-treatment is an overly conservative method for estimating smoking cessation (Hall et al., 2001). The similarity between individuals who completed the study and those who did not supports this line of reasoning. As such, the true rate of abstinence among participants may be closer to 8.3% than 3.5%.

Participant demographic characteristics differed from those in the Schneider and colleagues study (1990) as well as from previous descriptions of users of the Internet (Taylor, 1999). The most striking difference between prior studies of Internet-based smoking cessation and our study is the proportion of females represented. In our study, the majority of participants (74%) were female. This differs sharply from the 15.9% of participants who were female in the Schneider and colleagues study (1990). It is likely that much of this difference can be attributed to the low proportion of female Internet users in 1990, which has since increased to approximately 50% of all Internet users (Taylor, 1999). We suspect that that the high proportion of women observed in this study, relative to general use, can be explained by the relatively higher proportion of women versus men who seek out web-based health information (Project P.I.A.L., 2000; Thompson, 1999).

Although our sample was somewhat older and less educated than the sample Schneider studied (1986), the age and education level of participants was similar

to that of smokers in the general population who seek out help for smoking cessation on their own (Gilpin, Pierce, & Farkas, 1997) and also to Internet users who search for health or medical information on-line (Project P.I.A.L., 2000).

An important question for Internet-based studies is whether smokers who seek help for cessation on the Internet are as dependent on nicotine as those participating in face-to-face clinical trials. Our results suggest that this is, indeed, the case. Participants smoked an average of 25 cigarettes per day, and most participants (82%) smoked within 30 minutes of waking. These two behaviors are highly correlated with nicotine dependence and predict inability to maintain abstinence following a quit attempt. Overall, participants scored 2 points higher on the FTND than the cut point used for classifying subjects as nicotine dependent in other studies (Breslau & Johnson, 2000; Haddock, Lando, Klesges, Talcott, & Renaud, 1999). Nicotine-dependent smokers have been found to relapse at a rate that is four times greater than non dependent smokers (Breslau & Johnson, 2000). Given these smoking behaviors, it is unsurprising that only 42% of our participants were ready to quit “absolutely” at baseline. This also suggests that, for less dependent smokers and smokers who are ready to quit, these results may understate the potential of this intervention.

For example, when considering participants who both made a serious quit attempt and who completed the study, 20.7% reported 7-day abstinence. This is comparable with other studies of self-help interventions (Curry, 1993) as well as the results reported by Schneider and colleagues (1990). Additional progress toward the goal of cessation was suggested by a 75% increase over baseline in participants’ reported intention to quit smoking, which is considered to be a primary goal of minimal contact/self-help interventions (Glynn, Boyd, & Gruman, 1990).

Due to the high proportion of participants drawn from a health information website who were relatively homogeneous with respect to educational level and race, these findings have limited generalizability to minorities, those with less education, and those with little access to the Internet or interest in health-related topics. Additionally, the Guide to Quit Smoking has previously been tested only with Spanish-speaking smokers. The relevance of this guide for English-speaking smokers is not yet known. Websites that are tailored for nonmainstream groups, such as those communicating in languages other than English, need to be created. We intend, in future studies, to compare the evaluations of this website between English-language and Spanish-language participants.

Additionally, we did not collect biochemical verification of smoking abstinence. Previous studies, however have observed a high positive correlation between self-reported abstinence and concurrent biochemical assessment (Petitti, Friedman, & Kahn, 1981), suggesting that self-report is a reasonable measure of abstinence in large-scale community studies involving minimal intervention.

The results of this study build upon earlier work using computerized and Internet applications for smoking cessation (Schneider, 1986; Schneider, Benya, & Singer, 1984). Together, these studies suggest that the web is a practical environment for delivering and evaluating smoking cessation interventions. The capacity of the Internet to interact with and treat large segments of the smoking population in a cost-effective manner remains a largely untapped resource. Future additions to this study, which are currently under development, include randomization to the Guide to Quit Smoking or the Guide to Quit Smoking + Mood Management, inclusion of Spanish-language smokers, more frequent and prolonged follow up, and the use of

incentives to increase sample retention. The aim of these future studies is to compare treatment outcomes across a wide variety of participants in an effort to learn more about the types of interventions that are most effective in helping different types of smokers achieve their goals of long-term abstinence.

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