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Improving Quit Rates of Web-Delivered Interventions for Smoking Cessation: Full Scale Randomized Trial of WebQuit.org versus Smokefree.gov

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Abstract

Background and aims—Millions of people worldwide use websites to help them quit smoking, but effectiveness trials have an average 34% follow-up data retention rate and an average 9% quit rate. We compared the quit rates of a website using a new behavioral approach called Acceptance and Commitment Therapy (ACT; WebQuit.org) with the current standard of the National Cancer Institute's (NCI) Smokefree.gov website.

Design—A two-arm stratified double-blind individually randomized trial (n = 1319 for WebQuit; n = 1318 for Smokefree.gov) with 12-month follow-up.

Setting—USA.

Participants—Adults (N = 2637) who currently smoked at least 5 cigarettes per day were recruited from March 2014 to August 2015. At baseline, participants were mean (SD) age of 46.2 (13.4), 79% women, and 73% white.

Interventions—WebQuit.org website (experimental) provided ACT for smoking cessation; Smokefree.gov website (comparison) followed US Clinical Practice Guidelines for smoking cessation.

Measurements—The primary outcome was self-reported 30-day point prevalence abstinence at 12 months.

Findings—The 12-month follow-up data retention rate was 88% (2309/2637). The 30-day point prevalence abstinence rates at the 12-month follow-up were 24% (278/1141) for WebQuit.org and

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26% (305/1168) for Smokefree.gov (OR = 0.91; 95% CI = 0.76, 1.10); p = 0.334) in the a priori complete case analysis. Abstinence rates were 21% (278/1319) for WebQuit.org and 23% (305/1318) for Smokefree.gov (OR = 0.89 (0.74, 1.07); p = 0.200) when missing cases were imputed as smokers. The Bayes Factor comparing the primary abstinence outcome was 0.17, indicating "substantial" evidence of no difference between groups.

Conclusions—WebQuit.org and Smokefree.gov had similar 30-day point prevalence abstinence rates at 12 months that were descriptively higher than those of prior published website-delivered interventions and telephone counselor-delivered interventions.

Keywords

tobacco cessation; websites; mindfulness; acceptance and commitment therapy

Introduction

Worldwide, tobacco smoking is the second leading cause of early death and disability (1), attributable to over one in ten deaths (2). Barriers to accessing smoking cessation treatments include low reimbursement for providers and low consumer demand for traditional treatments (3). Fortunately, website-delivered interventions provide cessation assistance with high population-level reach (4). Seventy-nine percent of US smokers use the Internet (5). Eleven million US smokers each year, and many millions more worldwide, use websites to help them quit smoking (5). Compared to telephone quitline interventions, website interventions have: (1) at least 21 times higher overall national reach [11 million for web vs. 500,000 for quitlines (5),(6)], and (2) lower cost-per-quit [e.g., $291 for web vs. $1850 for quitlines (7)].

Web-delivered cessation interventions have existed for over twenty-five years (8). However, few randomized trials have tested these websites with long term follow-up, which is critical because of the high level of relapse that occurs by 12 months (8, 9). These trials have weighted average 12-month follow-up data retention rates of 34% (range: 11% to 72%). Follow-up rates below 80% can seriously threaten validity (10).

The weighted average 12-month 30-day point prevalence cessation rate for previous web-delivered intervention trials was 9% [range: 7% to 17% (8, 9)]. While 9% is higher than the 4% success rate from quitting on one's own, it is much lower than the 14% weighted average success rate of telephone quitlines (11). Thus, web-delivered interventions have great room for improvement (4, 9). Overall, there is need for rigorous randomized trials of web-based cessation interventions with long-term follow-up, with potential for high population-level impact.

To address these needs, we compared two conceptually distinct websites for smoking cessation. The first was an Acceptance and Commitment Therapy (12) (ACT) website called "WebQuit." ACT is a new approach that teaches skills for allowing urges to smoke pass without smoking, which is conceptually distinct from US Clinical Practice Guidelines (USCPG)-based standard of care approaches that teach avoidance of urges. WebQuit motivates smokers to quit by appealing to their values whereas the USCPG-based standard

approaches motivate using reason and logic. The ACT approach has demonstrated initial feasibility and usefulness for smoking cessation across a variety of delivery modalities (13, 14).

The second website, Smokefree.gov ("Smokefree"), provides the nation's current standard of care for web-delivered smoking cessation in that: (a) its content follows USCPG (15),(b) it is the most accessed cessation website in the world (3.6 million visits in 2016 [Erik Augustson, April 21, 2017, personal communication]), and (c) it has the highest user satisfaction rates of all non-profit websites for smoking cessation (16, 17). In a pilot randomized trial, both websites showed promising 3-month follow-up quit rates (14), and Smokefree has since shown promising 7-month quit rates (17).

This article presents the outcomes of a full-scale randomized trial comparing WebQuit with Smokefree on:

1. 30 day point prevalence abstinence (PPA) at 12-month follow-up (hypothesis: WebQuit will have higher abstinence rates than Smokefree);
2. acceptance of cravings and whether changes in acceptance of cravings prospectively predicted abstinence;
3. participant engagement and satisfaction.

Methods

Design

The study was a two-arm randomized controlled trial comparing WebQuit with Smokefree. Participants were recruited online, stratified randomized (to avoid chance bias), and surveyed at 12 months, with interim surveys at 3 and 6 months. The 12-month primary endpoint accounted for the high levels relapse rates that occur by 12 months (18, 19) and is directly comparable to the most rigorous trials of web-delivered smoking cessation (8, 9). Based on the 3-month quit rates observed in our previous pilot trial (14) and relapse rates occurring between 3 and 12 months after randomization (18, 19), the study was 80% powered for a two-tailed significant difference between a 14.8% WebQuit quit rate and a 10.3% Smokefree quit rate.

Procedures

Participants & Enrollment—Adult smokers (n = 2637) were recruited March 2014 to August 2015. The study participant flow diagram is shown in Figure 1. Smokers were recruited nationally via targeted Facebook ads, an online survey panel, search engine results, friends/family referral, Google ads, and earned media. The eligibility criteria were: age 18 or older; smoked ≥ 5 cigarettes a day for the last year; ready to quit in the next 30 days; lived in the United States; could read English; access to Internet and email; never used Smokefree.gov and were not currently using other cessation treatment; never participated in our prior studies; no household members already enrolled; and willing to be randomized to treatment, to complete three surveys, and to provide contact information for themselves and

two relatives. Some advertisements were targeted to minorities and enrollment was limited to no more than 75% Caucasian participants, to ensure minority representation.

Participants completed a web-based screening survey and were notified of their eligibility via email. Participants who clicked on their emailed link were returned to the study website where they provided consent, completed a baseline survey, completed a contact form, and activated the automated randomization algorithm. At each enrollment step, the study was presented as a comparison of "two web-delivered smoking cessation programs."

Since enrollment occurred online, additional actions were taken to ensure enrollees were actually eligible. These included CAPTCHA authentication, review of IP addresses for duplicates or non-US origin, and review of survey logs for suspicious response times (< 90 seconds to complete screening or < 10 minutes to complete baseline survey). Suspicious cases were contacted by staff. If their information could not be confirmed (n = 80), they were not enrolled.

All study activities were reviewed and approved by the participating sites' Institutional Review Boards.

Randomization—Participants were randomized (1:1) to either the experimental intervention (WebQuit.org, n=1319) or the control intervention (Smokefree.gov, n=1318). Using randomly permuted block randomization, stratified by daily smoking frequency (≤20 vs. ≥ 21), education (≤ high school vs. ≥ some college), and gender (male vs. female). Random assignments were concealed from participants until after study eligibility, consent, and baseline data was obtained. Neither research staff nor study participants had access to upcoming randomized study arm assignments.

Blinding & Contamination—To ensure participants were blinded to their assigned intervention, each website was branded as "WebQuit" and neither mentioned ACT or Smokefree.gov. Contamination between sites was avoided with a unique user name and password provided only to the individual user and by having an eligibility criterion of not having family, friends, or other household members participating.

Follow-up Assessment—Participants completed follow-up surveys at 3, 6, and 12 months post-randomization. Participants received $25 for completing each survey and an additional $10 bonus if the online survey was completed within 24 hours of initial email invitation to take the survey. Persons who did not complete the survey online were sequentially offered opportunities to do so by phone, mailed survey, and then, for main outcomes only, by postcard.

Interventions

WebQuit—WebQuit covered the six core processes in ACT— Values, Committed Action, Willingness, Being Present, Cognitive Defusion, and Self-as-Context. The program had four parts. Step 1, Make a Plan, allowed users develop a personalized quit plan, identify smoking triggers, learn about FDA-approved cessation medications, and upload a photo of their inspiration to quit (ACT processes: Values and Committed Action). Step 2, Be Aware,

contained three exercises to illustrate the problems with trying to control thoughts, feelings and physical sensations rather than allowing them to come and go (ACT process: Creative Hopelessness). Step 3, Be Willing, contained eight exercises to help users practice allowing thoughts, feelings and physical sensations that trigger smoking (ACT processes: Willingness, Being Present, and Cognitive Defusion). Step 4, Be Inspired, contained 15 exercises to help participants identify deeply-held values inspiring them to quit smoking and to exercise self-compassion in response to smoking lapses (ACT processes: Values and Self-as-Context). The program also prompted users to track smoking, cessation medications, and practice of ACT skills. Tracking results were displayed graphically along with the user's inspiration for quitting and badges earned for program use. The website contained a forum for asking questions about quitting and anytime tips (e.g., a list of tips for dealing with other smokers).

Smokefree—We hosted a secured private version of the Smokefree site. Users were able to navigate through all pages of the website at any time and there were no restrictions on the order in which the content could be viewed. Smokefree had three main sections: "Quit today," "Preparing to quit," and "Smoking issues". The "Quit today" section had seven pages of content that provide tips for the quit day, staying smoke-free, and dealing with cravings. The section also provided information on withdrawal, benefits of quitting, and FDA-approved cessation medications. The "Prepare to quit" section had seven content pages providing information on various reasons to quit, what makes quitting difficult, how to make a quit plan, and using social support during a quit attempt. The "Smoking issues" section provided five pages on health effects of smoking and quitting, depression, stress, secondhand smoke, and coping with the challenges of quitting smoking for the lesbian, gay, bisexual, and transgender community. The section also contained five quizzes that provided feedback about level of depression, stress, nicotine dependence, nicotine withdrawal, and secondhand smoke as well as tips for coping with them.

Both interventions were available for login anytime for 12 months after randomization. Neither was modified during the course of the study. For 28 days after randomization, participants in both arms were sent via text or email (their choice) up to four daily messages (≤ 160 characters) designed to encourage logging in, unless they opted out.

Measures

Baseline measures—At baseline, participants reported on demographics, mental health measures, alcohol use, and smoking in their social environment, such as whether they currently lived with a partner who smokes and the number of close friends who smoke regularly. Mental health measures included depression [CES-D (20)], generalized anxiety [GAD-7 (21)], panic disorder [ANSQ (22)], post-traumatic stress disorder (PTSD) [PCL-6 (23)], and social anxiety [mini-SPIN (24)].

Nicotine dependence—Nicotine dependence was measured with the six-item Fagerström Test for Nicotine Dependence [FTND (25)] at baseline and 12-month follow up.

ACT theory-based acceptance process—At baseline and three-month follow-up, willingness to experience and not act on cravings to smoke (i.e., acceptance) was measured using a nine-item physical sensations subscale of the Avoidance and Inflexibility Scale [adapted from (26, 27)]. Response choices for each item ranged from "Not at all" (1) to "Very willing" (5). Scores were derived by averaging the items.

Main outcome—For direct comparability with the most rigorous internet-based randomized trials to date (8), the primary outcome of the study was complete case 30-day point prevalence abstinence (PPA; i.e., no smoking at all in the past 30 days) at 12-month follow-up. Due to low demand characteristics for false reporting, the SRNT Subcommittee on Biochemical Verification recommended biochemical confirmation is unnecessary in population-based studies with no face-to-face contact and studies where data are optimally collected through the web, telephone, or mail (28). Self-reported smoking is a standard method for assessing the efficacy of web-delivered interventions (8, 9). Therefore, smoking status was the self-reported response to the question "When was the last time you smoked, or even tried, a cigarette?"

Secondary outcomes

Secondary cessation outcomes—Imputed missing=smoking 30-day PPA, complete case 7-day PPA, and imputed missing=smoking 7-day PPA.

Engagement outcomes—Measures of website engagement were collected for 12 months after randomization. The number of times a participant logged in, length of use of the website from first to last login in days, time spent on each session in minutes, number of web pages visited per login, and time spent on each web page in minutes were calculated from data automatically logged by the secured server. Any user activity occurring more than 15 minutes from the previous activity was considered a new login. Participants in the top 25% of number of logins for their assigned website were considered "high engagers."

Treatment satisfaction outcomes—Treatment satisfaction outcomes were extent to which: (1) assigned website was useful for quitting, (2) user was satisfied with assigned website, and (3) user would recommend assigned website to friend. Example item: "Would you recommend your assigned website to a friend?" Response choices for all items ranged from "Not at all" (1) to "Very much" (5) and were dichotomized at a threshold of "Somewhat" (3) or higher.

Statistical analyses

Specified *a priori* as the primary outcome was the 12-month follow-up 30-day point prevalence abstinence using a complete case analysis in which those who did not provide follow-up data were excluded. As secondary outcomes, 30-day and 7- day PPA abstinence were also examined among all enrolled participants with missing cases imputed as smokers, and complete case 7-day PPA was also examined. While some research suggests that missing=smoking outcomes may be biased (29, 30), they are recommended by the Russell Standard (31), allow for comparison of results with prior web-delivered intervention trials, and provide a sensitivity analysis. We used logistic regression models for the cessation

outcome as well as secondary binary outcomes related to cessation and treatment satisfaction. Negative binomial models were used to assess differences between treatment arms for zero-inflated count outcomes (e.g., number of logins), while generalized linear models were used for continuous outcomes. We controlled for multiple comparisons in all secondary and subgroup analyses using the Holm procedure (32). We evaluated the Bayes factor for the primary cessation outcome to provide a summary of the presence and magnitude of the treatment effect (33, 34). All statistical tests were two-sided, with α=0.05, and analyses were completed using R 3.3.0 (35) and R packages 'BayesFactor' (36) and 'MASS' (37).

Baseline balance and covariate adjustment—Baseline characteristics were balanced between treatment groups, except that the WebQuit arm had slightly more married participants than the Smokefree arm (39% vs. 35%, p=.040). However, marital status was not associated with cessation outcomes so was not included as a covariate. We adjusted for the three stratification variables used in randomization to avoid losing power and obtaining incorrect confidence intervals (38).

Results

Participant characteristics

Participant baseline characteristics are shown in Table 1. Overall, these characteristics were very similar to those of prior published web-delivered smoking intervention trials (8, 9).

Participant retention

The data retention rate was 88% (2309/2637) and did not differ between arms (WebQuit: 87% (1141/1319); Smokefree: 89% (1168/1318); OR=0.82 (0.65, 1.04), p=.096). Participants completed the 12-month follow-up survey via web (92% of respondents), telephone (3%), mail (3%), and by postcard short survey of primary and selected secondary outcomes (2%). Sixty five percent of those who completed the survey did so within 24 hours of receiving the email invitation that noted the $10 bonus incentive.

Primary cessation outcome

The 30-day PPA rates at the one-year follow-up were 24% for WebQuit.org and 26% for Smokefree.gov (Table 2). The Bayes Factor for the primary abstinence outcome was 0.17, indicating "substantial" evidence for the null hypothesis of no difference between groups ((39)).

Secondary outcomes

The missing=smoking 30-day PPA rate at the 12-month follow-up was 21% for WebQuit and 23% for Smokefree. The complete case 7-day PPA rate at the 12-month follow-up was 30% (missing=smoking rate: 26%) for WebQuit, as compared to the 32% (missing=smoking rate: 28%) abstinence rate for Smokefree. Further secondary outcomes are available in the Supplementary Table.

Among high engagers, the 30-day PPA rate at the 12-month follow-up was 30% for each website. In addition, the two arms' 30-day PPA rates did not differ by race/ethnicity, gender, education level, age, employment status, sexual orientation, baseline depression or anxiety, smoking history, baseline friend and partner smoking, baseline acceptance of cravings, or other baseline variable in Table 1 (all $p>.050$).

Among those who were highly engaged with their website, WebQuit participants had a higher increase in acceptance of cravings to smoke than Smokefree participants (0.19 vs. 0.08 increase; $p=0.034$). Each one-unit increase, from baseline to 3-month follow-up, in the acceptance of cravings score was strongly associated with 30-day PPA at 12-month follow-up among all participants (OR=4.11; 95% CI=3.40–4.97).

Utilization & Satisfaction

As shown in Table 3, compared to Smokefree, WebQuit participants had a higher: (1) average number of logins, (2) average time spent on each login session, and (3) average number of web pages visited per login. The average length of website usage was the same in both programs at 57 days. Participants in both arms reported high satisfaction with their assigned website, though satisfaction was somewhat higher in the WebQuit arm. For example, 95% of WebQuit participants would recommend the website to a friend, compared to 90% for Smokefree.

Discussion

To overcome limitations of prior trials of web-delivered cessation interventions, we conducted a trial comparing the quit rates of a website using a new approach called Acceptance and Commitment Therapy (ACT; WebQuit.org) with the National Cancer Institute's (NCI) Smokefree.gov website for cessation. Twelve-month, 30-day point prevalence quit rates were high in both arms (26% for Smokefree; 24% for WebQuit). These quit rates were nearly three times higher than the 9% quit rates obtained in prior web-based randomized trials with at least 12-month follow-up (8). Moreover, the quit rates were over one and a half times higher than the 14% quit rates obtained in prior randomized trials of telephone interventions with at least 12-month follow-up [range: 8 -20% (11)].

Quit rates

Comparing the pilot trial (14) with the current full-scale trial, one pattern of results is striking: the WebQuit abstinence rate stayed about the same (23% three-month 30-day quit rate in the pilot compared to 24% 12-month 30-day quit rate in the current trial) while the Smokefree abstinence rate over doubled (10% three-month 30-day quit rate in the pilot compared to 26% in the current trial). This increase was potentially due to the study design of the pilot (14) vs. the current study: the pilot trial had a smaller sample size (222 vs. 2637) and lower retention rate (54% vs. 88%), thus making the point estimate of the pilot less reliable (14). Other reasons might be the synergistic effect of Smokefree content and design revisions that NCI made before the start of the current trial, includign: (1) a front page feature called "I'm craving cigarettes" that provided advice on how to cope with cravings; (2) a front page feature called "I feel depressed" that provided advice on how to cope with

depressive symptoms; (3) an interactive feature for selecting pharmacotherapy for smoking cessation, including comparisons of efficacy, cost, and side effects; (4) graphical interactive feature for viewing health effects of smoking and quitting; (5) improved site navigability and page layout.

Engagement and satisfaction

Participants were more engaged with WebQuit than Smokefree and were slightly more satisfied than Smokefree participants. High engagers had higher quit rates and, in general, engagement in web-delivered programs is a well-known predictor of cessation (40). There are a variety of potential reasons why WebQuit users were more engaged. First, participants may have found the ACT content novel and thought provoking. To support this possibility, in qualitative data from the outcome survey, participants made comments such as, “I especially liked the advice to ride with the urges to smoke rather than to try to ignore them or replace them with diversion.” Additionally, WebQuit was a structured program with its main content funneling users in a logical order, and evidence suggests that funneling improves engagement (41, 42).

Implications for ACT research

The current study provides the largest randomized trial of ACT conduced to date. As of May 2017, there were 175 published peer-reviewed randomized controlled trials of ACT, focusing on a variety of outcomes including weight loss and pain management (43). Of these, 22% had a sample size of ≥ 100 [n=39 (43)], 3% had ≥ 300 participants [n=6 (43)], with the largest having 586 participants (44). Of the trials with ≥ 300 participants, the average follow-up length was 8 months, and the average retention rate was 60%. Similar to prior ACT trials, the current trial shows that ACT increases acceptance of internal experiences (e.g., cravings) among those who engage with the content and this acceptance in turn has a strong positive impact on clinical outcomes. The theoretical premise of the ACT model is therefore supported. As to why increased acceptance in the ACT arm did not translate into quit rates higher than the control, we speculate that the control arm had unique theoretical processes that positively and equally impacted its quit rate relative to the ACT arm. Overall, the current study provides a methodologically robust contribution to the ACT scientific literature, and suggests that the ACT model is a reasonable alternative to mainstream approaches to smoking cessation.

Strengths

This study has a number of strengths, including a large sample and long-term follow-up. Most notably, the trial’s 88% 12-month outcome retention rate contributes to confidence in the study findings. Several design factors are believed to contribute to the high retention rate: (1) $25 cash for completing the outcome surveys, (2) $10 bonus cash for completing the web-based survey within 24 hours, and (3) having four methods (web, telephone, mail, and post card) to complete the survey that were offered in sequence (instead of in parallel which is known to reduce overall response rate (45)]. This 88% retention was over 2.5 times higher than the average rate (34%) obtained in prior trials with at least 12-month follow-up (8, 9).

Limitations

This study has several limitations. First, cessation outcome data were self-reported for reasons stated in the Methods. Remote biochemical validation of smoking cessation would have introduced biases including low response rates, challenges with confirming the identity of the person providing the sample, inability to confirm abstinence beyond 24 hours, and false positive errors due to secondhand smoke. Second, without a third minimal treatment arm (e.g., print-based self-help material), it is possible that observed quit rates would have been achieved with little intervention if participants were highly motivated to quit. However, we think that is highly unlikely for several reasons: (1) the inclusion criteria, recruitment methods, and baseline characteristics of the sample were very similar to prior trials with at least 12-month follow-up (8); (2) smoking cessation self-help materials have low (6%) quit rates (46); and (3) users' baseline motivation to quit was very similar to other trials of web-delivered smoking cessation (8, 9). For these reasons, we considered and then rejected the idea of a minimal intervention third arm when planning the trial. Third, only 23.8% (2637/11070) of those screened were randomized into the trial. This level of selection bias is highly consistent with prior published *web*-delivered smoking intervention trials (8, 9) and with prior *telephone*-delivered cessation intervention trials (11). Indeed, in one of the largest randomized trials of telephone-delivered smoking cessation (47), only 18.5% of those screened were randomized (4614/24089). Note also that the allocation sequence was concealed from investigators and, the inclusion criteria, recruitment methods, and baseline characteristics were very similar to prior web-delivered cessation trials (9). Loss to follow-up is another potential source of bias; however, because retention rates were high and did not vary between arms, and because the missing=smoking analysis led to a similar conclusion as complete case analysis, this potential bias was minimized.

Conclusion

This trial identified two websites that obtained 12-month quit rates higher than any prior published *website*- or *telephone counselor*-delivered intervention trial for smoking cessation. To illustrate the potential public health impact, consider that impact is a product of reach and efficacy (48). The projection derived from the current research trial's conditions is that for every 1 million smokers reached with either website, at least 240,000 would quit smoking. Both websites are helpful options for people seeking online help quitting smoking.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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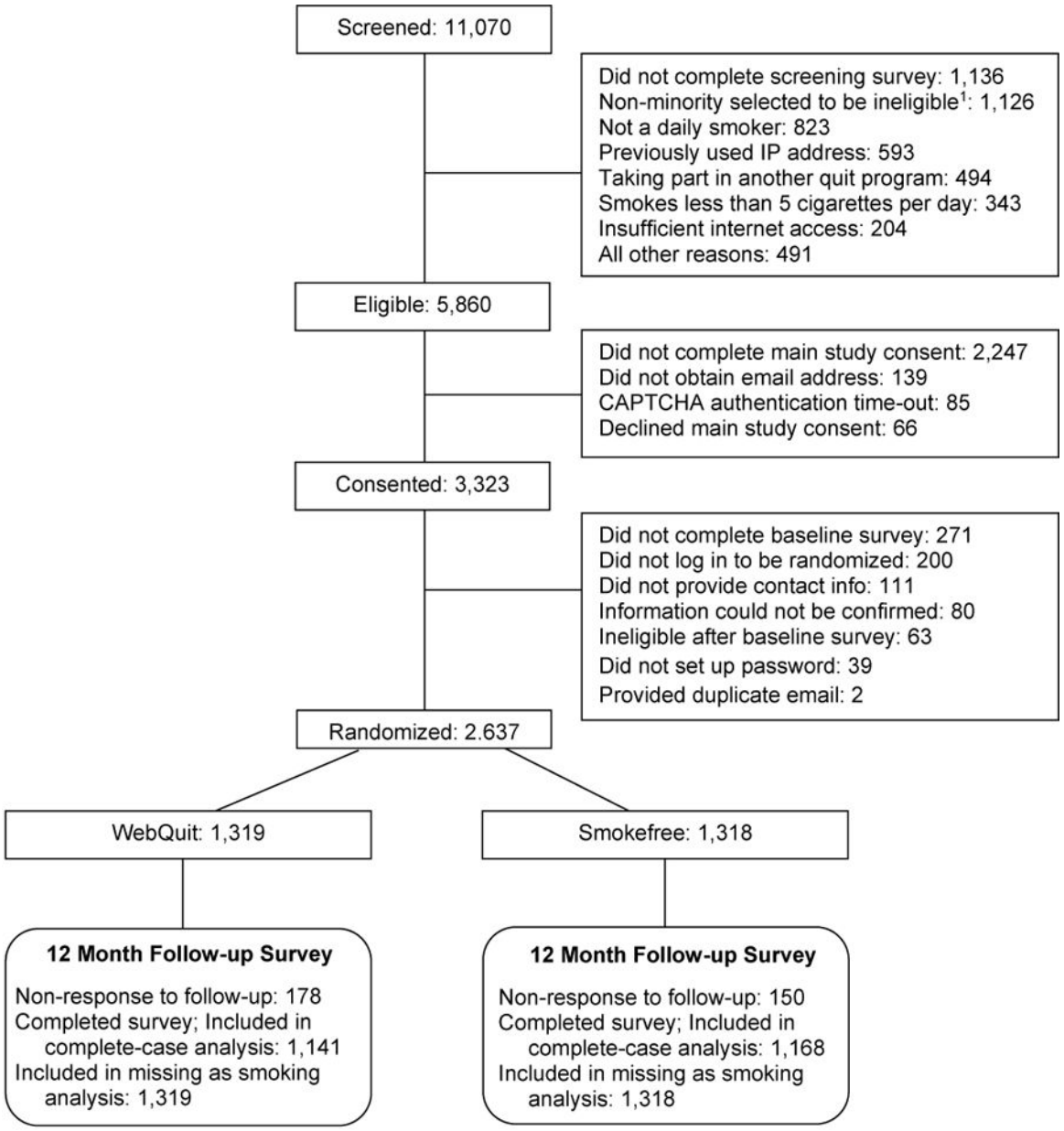

[1] In order to increase enrollment of racial and ethnic minorities, some non-minorities who were otherwise eligible for study enrollment were randomly selected to be excluded.

Figure 1.
Participant Flow Diagram

Table 1

Baseline demographics, mental health, and smoking behavior.

	Total (n=2,637)	Smokefree (n=1,318)	WebQuit (n=1,319)
Demographics			
Age, mean (SD)	46.2 (13.4)	46.1 (13.3)	46.2 (13.4)
Male	21%	21%	21%
Caucasian	73%	72%	73%
African American	11%	11%	10%
Asian	2%	2%	2%
Native American or Alaska Native	2%	2%	2%
Native Hawaiian or Pacific Islander	<1%	<1%	1%
More than one race	5%	5%	4%
Hispanic	8%	9%	8%
Married	37%	35%	39%
Working	52%	52%	53%
HS or less education	28%	28%	28%
LGBT	10%	10%	9%
Mental Health			
Current depression symptoms (CES-D >=16)	56%, n=2622	56%, n=1309	56%, n=1313
Current anxiety symptoms (GAD-7 >=10)	34%, n=2623	35%, n=1316	34%, n=1307
Current panic disorder symptoms (ANSQ >1)	48%, n=2364	49%, n=1187	48%, n=1177
Current PTSD symptoms (PCL-6 >=14)	53%, n=26	53%, n=1316	53%, n=1312
Current social anxiety symptoms (mini-SPIN >=6)	30%, n=2630	31%, n=1315	30%, n=1315
Smoking Behavior			
FTND score, mean (SD)	5.6 (2.2)	5.6 (2.2)	5.6 (2.2)
High nicotine dependence (FTND >=6)	55%	55%	54%
Smokes more than half pack per day	79%	79%	79%
Smokes more than one pack per day	33%	33%	33%
First cigarette within 5 minutes of waking	41%	41%	42%
Smoked for 10 or more years	80%	80%	80%
Used e-cigarettes at least once in past month	34%	34%	34%
Quit attempts in past 12M, mean (SD)	1.6 (5.0), n=2511	1.6 (4.6), n=1270	1.6 (5.3), n=1241
At least one quit attempt in past 12M	45%, n=2511	46%, n=1270	43%, n=1241
Commitment to quitting	4.0 (0.8), n=2628	4.0 (0.8), n=1316	4.0 (0.7), n=1312
Friend & Partner Smoking			
Close friends who smoke, mean (SD)	2.2 (1.6)	2.2 (1.6)	2.2 (1.6)
Number of adults in home who smoke, mean (SD)	1.5 (0.8)	1.5 (0.8)	1.5 (0.8)
Living with partner who smokes	30%	29%	30%
ACT Theory-Based Measure, mean (SD)			
Acceptance of physical triggers	2.93 (0.47), n=2603	2.93 (0.48), n=1302	2.93 (0.47), n=1301
Alcohol Use			
Heavy drinker	11%, n=2573	11%, n=1285	11%, n=1288

Table 2

Smoking cessation outcomes at 12-month follow-up.

Outcome Variable	Overall (n=2637)	Smokefree (n=1318)	WebQuit (n=1319)	OR (95% CI)[3]	p-value
30-day PPA, complete case[1], n (%)	583 (25%), n=2309	305 (26%), n=1168	278 (24%), n=1141	0.91 (0.76, 1.10)	0.334
30-day PPA, missing=smoking[2], n (%)	583 (22%)	305 (23%)	278 (21%)	0.89 (0.74, 1.07)	0.200
7-day PPA, complete case, n (%)	709 (31%), n=2309	369 (32%), n=1168	340 (30%)., n=1141	0.92 (0.77, 1.10)	0.393
7-day PPA, missing=smoking, n (%)	709 (27%)	369 (28%)	340 (26%)	0.89 (0.75, 1.06)	0.393

[1]Complete case analysis (i.e., exclusion of participants lost to follow-up) was specified *a priori* as the primary outcome.

[2]The missing=smoking outcomes are provided as recommended by the Russell Standard.

[3]Odds ratios are adjusted for the three factors used in stratified randomization: daily smoking frequency, education, and gender.

Table 3

Treatment engagement and satisfaction. All items were assessed at 12-month follow-up, with the exception of the last two, satisfaction and recommendation, which were assessed at 3-month follow-up.

Variable	Overall (n=2637)	Smokefree (n=1318)	WebQuit (n=1319)	OR, IRR, or point estimate (95% CI)[1]	p-value
Number of times logged in, mean (SD)	7.2 (22.8), median=3	5.1 (11.9), median=3	9.2 (29.9), median=3	1.79 (1.64, 1.96)	<0.0001
High engagers (>=5 logins CBT, >=7 ACT), n (%)	757 (29%)	401 (30%)	356 (27%)	0.84 (0.91, 1.00)	0.180
Length of use of website in days, mean (SD)	57 (84), median=21	57 (84), median=22	57 (84), median=19	1.00 (0.89, 1.12)	0.988
Time spent on each session (minutes), mean (SD)	5.6 (6.1), n=2624	3.6 (4.1), n=1309	7.6 (7.1), n=1315	4.0 (3.6, 4.5)	<0.0001
Number of web pages visited per login, mean (SD)	4.5 (3.5), n=2624	3.1 (3.1), n=1309	5.8 (3.4), n=1315	2.8 (2.5, 3.0)	<0.0001
Time spent on each web page (minutes), mean (SD)	1.1 (0.9), n=2345	1.4 (1.2), n=1245	0.9 (0.6), n=1245	-0.44 (-0.51, -0.36)	<0.0001
Website was useful for quitting, n (%)	1448 (69%), n=2099	719 (67%), n=1067	729 (71%), n=1032	1.16 (0.96, 1.40)	0.227
Satisfied with assigned website, n (%)	1681 (81%), n=2068	846 (80%), n=1063	835 (83%), n=1005	1.26 (1.01, 1.57)	0.180
Would recommend assigned website, n (%)	1703 (93%), n=1839	846 (90%), n=936	857 (95%), n=903	2.00 (1.38, 2.89)	0.001

[1] OR indicates odds ratio in logistic regression for binary variables, IRR indicates incident rate ratio in negative binomial regression for count variables (i.e., number of times logged in and length of use of website), and point estimate indicates difference between treatment arms for continuous variables. Results are adjusted for the three factors used in stratified randomization: daily smoking frequency, education, and gender.

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