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ORIGINAL INVESTIGATION

Randomized Controlled Trial of MyLastDip: A Web-Based Smokeless Tobacco Cessation Program for Chewers Ages 14–25

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ABSTRACT

Introduction: Use of smokeless tobacco (ST) is a significant public health problem for young adults, many of whom want to quit. We describe the outcome of a Randomized Controlled Trial (RCT) examining the efficacy of two web-based ST cessation interventions targeting young chewers.

Methods: One thousand seven hundred and sixteen ST users wanting to quit were recruited online to the *MyLastDip* program and randomly assigned to one of two fully automated web-based ST cessation interventions: (a) an Enhanced Condition ($N = 857$) with tailored treatment recommendations and interactive features, or (b) a Basic Condition ($N = 859$) that provided an online ST cessation guide in static text.

Results: Assessment completion rates at 3 months, 6 months, and for both 3 and 6 months were 73%, 71%, and 65%, respectively. No significant differences were found between conditions. Using complete case analysis for repeated point prevalence (3- and 6-month assessments), all tobacco abstinence was 28.9% for participants in the Enhanced Condition and 25.6% in the Basic Condition. Using intent-to-treat analysis, abstinence rates were 35.2% versus 32.3%. Similar results were obtained for ST abstinence. Participants reported being satisfied with their programs and the Enhanced Condition participants were relatively more engaged. Differences in program engagement were not related to tobacco abstinence at 6 months.

Conclusions: Both web-based ST cessation programs encouraged robust levels of absolute tobacco and ST abstinence at follow-up. The absence of between-group differences was discussed in terms of composition of the control condition and implications for next steps in treatment development and testing.

INTRODUCTION

Although cigarettes continue to be the primary tobacco product used by American teens, there is also a high prevalence of smokeless tobacco (ST) use exhibited primarily by adolescent males. The 2011 Monitoring the Future national survey (Johnston, O'Malley, Bachman, & Schulenberg, 2011) revealed overall 30-day prevalence of ST use for boys in grade 10 (~15 years of age) to be 11.5% and 14.2% among boys in grade 12 (~17 years of age). The prevalence of ST use among 18–25-year-old males is 12.0% (United States Department of Health and Human Service [USDHHS], 2012). ST use is associated with cancer in the mouth, throat, stomach, and pancreas (USDHHS, 2005). Mouth lesions are also strongly associated with use of snuff and chewing tobacco (International Agency for Research on Cancer, 2007). Given its prevalence and health consequences, regular ST use represents an important public health problem for many of America's youth and yet relatively little research has focused on developing efficacious tobacco cessation programs targeted to this population (USDHHS, 2012).

Web-based tobacco interventions can reach a large audience interested in receiving help to quit. Reach is particularly important for ST users because they often lack access to cessation services tailored to ST cessation, and users tend to be located in more rural settings that are removed from services. Our previous ChewFree Randomized Controlled Trial (RCT) examined the efficacy of a web-based cessation intervention for ST users ≥18 years of age (Severson, Gordon, Danaher, & Akers, 2008). Significantly, more chewers assigned to an Enhanced Condition (interactive and engaging; $N = 1,260$) quit all tobacco and ST at 3- and 6-month follow-up assessments than participants in a Basic control condition (static text; $N = 1,263$) . The current RCT represents a significant content update over our earlier ChewFree intervention—we created altogether two new Web sites that once again were designated as "Enhanced" and "Basic." We also tailored the marketing

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and especially the content of the Enhanced Condition to target adolescent and emerging adult ST users 14–25 years of age. We designed our current study to test the following hypotheses:

(a) ST users ages 14–25 (participants) randomized to an Enhanced Condition would report significantly greater tobacco abstinence at follow-up assessments than participants assigned to the Basic Condition.
(b) Participants exhibiting greater program engagement and exposure to the program would report greater tobacco abstinence at follow-up assessments.
(c) Participants would rate the Enhanced intervention as being usable and acceptable.

METHODS

Study Design

The RCT compared two web-based ST cessation programs: an Enhanced intervention and a Basic control/comparison condition. The content of both conditions was based on multicomponent cognitive–behavioral interventions used in smoking cessation, informed by our earlier ChewFree.com RCT (Severson et al., 2008).

Basic Condition

The Basic Condition was not interactive and it did not specifically target young ST users. It included an online version of the "Enough Snuff" pocket guide for quitting ST (Severson, 2002) that described best-practices steps using 11 webpages (select screenshots of MyLastDip program are available upon request). The program also included a Resource section with informational materials (e.g., the ingredients of ST, role of nicotine, health effects of ST, prescription medications, and fake chew [herbal snuff]) and links to Web sites offering content on ST cessation Web sites and relaxation strategies. Participants could print content.

Enhanced Condition

The Enhanced web-based condition presented best-practices ST cessation content using interactive and multimedia features. Content included preparing to quit, quitting, maintaining abstinence, and retooling if lapse/relapse occurred. Participants were encouraged to create personal lists online (e.g., reasons for quitting), to watch videos of young ST quitters who overcame challenges to quit, to review/download relaxation audios and videos, to choose a quit date, and to create personal behavioral contracts. They were also encouraged to use a Web blog moderated by research staff. Personalized program content was automatically accumulated into a workbook. Automated E-mail reminders encouraged use of the Web site and provided supportive messages surrounding the quit date. The Enhanced Web site included the Resources section described earlier for the Basic Condition. Personalized content was summarized in a printable online workbook.

Participant Recruitment

Aware that recruiting young chewers ages 14–25 would be challenging (Backinger et al., 2008; Civljak, Sheikh, Stead, & Car, 2010; Koo & Skinner, 2005), we marketed our program using Google AdWords (Google, 2012), other online channels (e.g., AdBrite, YouTube, Facebook), advertisements in newspapers and radio, and outreach efforts to professionals in tobacco control agencies and schools. We averaged 6–15 recruits each week during the ~2.75-year period from October 15, 2008 to July 1, 2011.

Participant Registration and Enrollment

Interested chewers accessed the MyLastDip.com marketing page to provide their E-mail address. They were then sent an invitation with a unique registration number and URL that enabled them to begin online screening. Eligibility criteria included (a) used ST for at least 1 year and currently using ≥1 can of ST/week), (b) interested in quitting all tobacco, (c) 14–25 years old, (d) resident of United States or Canada, (e) used E-mail account ≥1 time/week, and (f) willing to provide personal contact information.

Following completion of an online informed consent, users who completed a baseline assessment and were immediately and continuously randomized to either the Enhanced or the Basic Condition using a computer-generated vector, and they were then "taken" to the home page of their assigned condition.

The research protocol was approved by the Oregon Research Institute's (ORI) Human Subjects Institutional Review Board (approval FWA00005934) and registered with ClinicalTrials.gov (ID NCT00680615). The ORI IRB waived informed parental consent.

Assessments

Follow-up assessments 3 and 6 months following baseline were completed using a 3-stage approach: (a) an opportunity to complete an online assessment, (b) if not completed within 2 weeks, research staff tried to complete a phone assessment (25 call attempts), and (c) if calls were unsuccessful, the assessment was mailed. Any participant who did not complete a follow-up assessment within a 45-day interval using any of these methods was adjudicated to be *failure to complete*. Participants received $10 for completing each follow-up assessment and an additional $20 for completing both assessments.

Tobacco Outcome Measures

Primary Tobacco Outcome Measures

Point prevalence was measured at follow-up by asking the following: *In the past 7 days, have you used any chew/snuff?* and *In the past 7 days, have you smoked cigarettes or any other tobacco product?* (answer options: *Yes* or *No, not even a puff*).

Secondary Tobacco Outcome Measures

For participants who continued to use tobacco, we examined secondary outcomes including self-reports of reduced ST/tobacco use (number of days cans/pouch used per week, changes in smoking behavior, and attempts to quit).

Participant Exposure to the Web-Based Programs

Because engagement with web interventions influences efficacy (Danaher & Seeley, 2009), we unobtrusively tracked number of Web site visits, time/date descriptors of visits, duration of visits, and specific webpages visited (Danaher, Boles, Akers, Gordon, & Severson, 2006).

Extent of Engagement
Because participants in both conditions could access identical Resources sections, we measured how often they viewed and printed content. Because it was not possible to measure whether content was actually printed, we used clicking the *print* button as a proxy.

Program Usability and Acceptability
Usability was measured using a 6-point scale: *Very easy* to *Very difficult*. Acceptability was measured by asking participants if they would recommend the program to friends or family members who use chew/snuff.

Statistical Analyses

We used SPSS (version 19) for all statistical analyses.

Primary Tobacco Use Analyses
Seven-day point prevalence abstinence for tobacco and ST was examined using: (a) complete case analysis of participants who completed assessments and (b) Intent-to-treat (ITT) imputation analysis in which missing cases were considered to be using tobacco. Results were analyzed separately for the 3- and 6-month assessment as well as for combined 3- and 6-month assessments as a measure of more lasting abstinence. Tobacco abstinence was defined as not using ST, snuff, cigarettes, and/or pipes in the past 7 days.

Secondary Tobacco Use Analyses
Generalized Linear Model (GLM) repeated measures analyses were used to examine whether non-abstinent participants (complete cases) reduced their ST use (days a ST can lasts) and made additional quit attempts.

Predictors of Tobacco Outcomes
For complete cases from both conditions, we initially used univariate binary logistic regression to examine a selected set of baseline participant characteristics as potential predictors of tobacco abstinence at the 6-month assessment or at both the combined 3- and the 6-month assessments. Significant univariate predictors were included in a subsequent multivariate binary logistic regression using backwards elimination to remove nonsignificant variables. To identify any differential effects of the intervention on the prediction of these outcomes, we included treatment condition as well as the interaction of the condition with each variable in separate logistic regression models. The order of variables was reversed in these calculations to make $OR > 1.0$.

Program Engagement
Because the frequency and duration of Web site visits tend to be positively skewed, program engagement was measured using the composite measure defined as the mean of the *Z*-score transformations of visits (number) and duration (minutes) (Danaher et al., 2006).

We used chi-square and nonparametric Mann-Whitney *U* analyses to examine the extent that participants in both conditions printed program content and viewed the Resources section. For participants in the Enhanced Condition, we examined viewing and posting of blog messages.

RESULTS

Participants

Of the 11,489 Web site visitors who started the screening process, 1,716 participants (14.9%) were randomized and enrolled into the study (Figure 1). A general pattern of participant attrition was observed over follow-up: A total of 72.8% completed the 3-month assessment, 70.7% completed the 6-month assessment, and 64.6% completed both follow-ups. There were no significant between-condition differences in assessment completion.

Baseline Characteristics

Baseline descriptors of participants are reported in Table 1, including current and prior tobacco use, demographic characteristics, and potential predictors of outcome. Participants were mostly from the United States: (97.5%), predominantly male (96.5%), White (95.7%; 1,643 of 1,716), and not married or living with a partner (79.7%). Consistent with the aim of the current RCT, the participants were younger ($M = 20.8$ years, $SD = 2.64$ years) than in our earlier ChewFree trial ($M = 36.8$ years, $SD = 9.6$ years) (Severson et al., 2008). In this study, younger chewers (14–17 years of age) accounted for 10% of the participant sample (8.8% of the Enhanced Condition and 11.2% of the Basic Condition). At total of 86.6% of participants indicated that they had made a *serious attempt to quit using chew/snuff for more than 24 h in the last 12 months* with 15.3% indicating 5 or more attempts. No between-condition differences were found for any of these baseline characteristics.

Primary Tobacco Outcomes

Analyses of tobacco abstinence failed to uncover any statistically significant differences in tobacco outcomes between the Enhanced Condition and the Basic Condition (Table 2, top panel). Results using complete cases were 37.1% versus 33.1% at 3 months, 43.2% versus 40.0% at 6 months, and 28.9% versus 25.6% for both the 3- and 6-months. Results using ITT analyses yielded similar results but relatively lower absolute abstinence rates: 26.7% versus 24.6% at 3 months, 29.6% versus 2930% at 6 months, and 18.6% versus 17.3% for both the 3- and 6-months. ST abstinence (Table 2, lower panel) showed a similar pattern of results.

Secondary Tobacco Outcomes

Changes in Tobacco Use and Quit Attempts
Participants who continued to use ST at both 3- and 6-month assessments points ($N = 494$) reported that cans of ST lasted more days compared with use at baseline (baseline: $M = 2.04$ [$SD = 1.38$], 3-month assessment: $M = 3.12$ [$SD = 2.05$], and 6-month assessment: $M = 3.51$ [$SD = 2.19$]). A repeated measures analysis revealed a significant change over time for both baseline to 3-month ($F = 190.99$, $df = 1$, $p < .001$) and baseline to 6-month assessments ($F = 282.62$, $df = 1$, $p < .001$), but no time × condition interaction. Additionally, these participants reported making more quit attempts compared with baseline: Baseline: $M = 2.17$ ($SD = 1.55$), 3-month assessment: $M = 2.90$ ($SD = 1.64$), and 6-month assessment: $M = 2.93$ ($SD = 1.67$). Repeated measures analysis revealed a significant change over time for both baseline to 3-month ($F = 66.40$, $df = 1$, $p < .001$) and baseline to 6-month assessments ($F = 70.33$, $df = 1$, $p < .001$), as well as a significant time × condition interaction

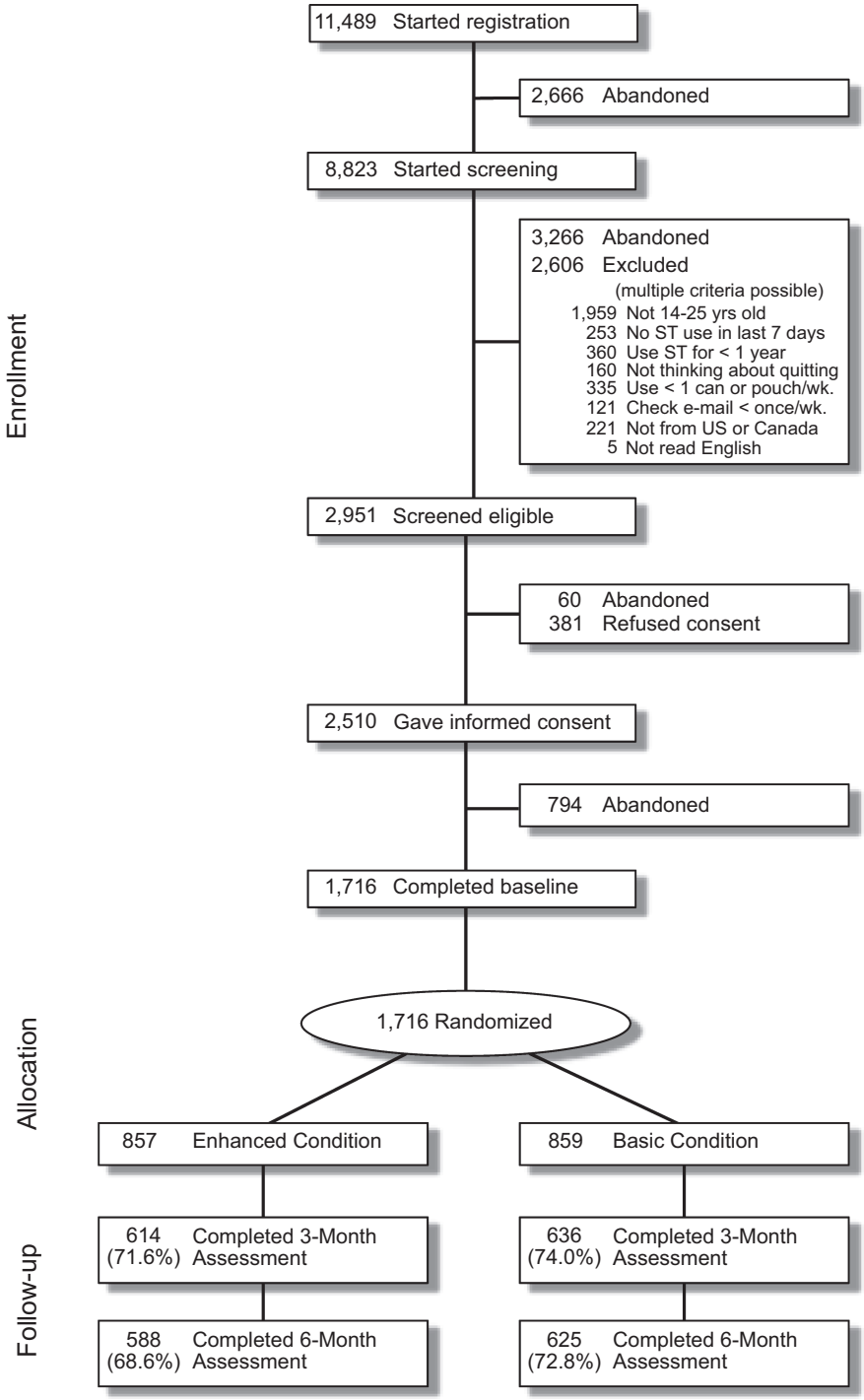

Figure 1. CONSORT diagram.

at both 3-month (F = 8.89, df = 1, p < .01) and 6-month assessment (F = 16.31, df = 1, p < .001) with participants in the Enhanced Condition reporting a greater number of quit attempts than participants in the Basic Condition.

Program Engagement

Number and Duration of Web Site Visits

Participants in the Enhanced Condition visited the web-based program more often than participants in the Basic Condition (Table 3; Mann-Whitney U test: Z = –3.13, p = .002), and they spent more time accessing their Web site overall (Mann-Whitney U test = [Z = –12.97, p < .001]), and in terms of the composite exposure measure (Mann-Whitney U test: Z = –9.67, p < .001). Similar results were found when we examined results for all participants or for just those participants who visited the Web site at least one time. Younger (aged 14–17) versus older participants did not differ in terms of number of visits (Mann-Whitney U test: Z = –1.02, p = .31) or duration of visits (Mann-Whitney U test: Z = –0.67, p = .50).

Table 1. Participant Baseline Characteristics[a]

Characteristics	Enhanced condition (N = 857)	Basic condition (N = 859)	Total (N = 1,716)
Age, *M* (*SD*)	20.9 (2.6)	20.7 (2.7)	20.8 (2.6)
Male, *n* (%)	834 (97.3)	822 (95.7)	1,656 (96.5)
Married or long-term partner, *n* (%)	183 (21.4)	165 (19.2)	348 (20.3)
Race/ethnicity, *n* (%)			
White	822 (95.9)	821 (95.6)	1,643 (95.7)
Black	11 (1.30)	9 (1.0)	20 (1.2)
Asian	12 (1.4)	6 (0.7)	18 (1.0)
Native American	21 (2.5)	32 (3.7)	53 (3.1)
Pacific Islander	7 (0.8)	4 (0.5)	11 (0.6)
Hispanic	24 (2.8)	23 (2.7)	47 (2.7)
Education, *n* (%)			
Not high school graduate	110 (12.8)	115 (13.4)	225 (13.1)
High school graduate	520 (60.6)	547 (63.7)	1,067 (62.1)
College graduate	213 (24.9)	185 (21.5)	398 (23.1)
Post graduate degree	15 (1.7)	12 (1.4)	27 (1.6)
Rural, *n* (%)[b]	253 (30.6)	213 (25.6)	446 (28.1)
Days can/pouch lasts, *n* (%)			
Less than 1 day	60 (3.5)	57 (3.3)	117 (6.8)
1 day	263 (15.3)	252 (14.7)	515 (30.0)
2 days	285 (16.6)	287 (16.7)	572 (33.3)
3 days	155 (9.0)	142 (8.3)	297 (17.3)
4 days	50 (2.9)	47 (2.7)	97 (5.7)
5 days	21 (1.2)	41 (2.4)	62 (3.6)
6 days	12 (0.7)	8 (0.5)	20 (1.2)
7 or more days	13 (0.8)	23 (1.3)	36 (2.1)
Cans/week, *n* (%)			
Less than 1 can/pouch per week	0 (0.0)	1 (0.1)	1 (0.1)
1–2 cans or pouches a week	235 (13.7)	259 (15.1)	494 (28.8)
3–4 cans or pouches a week	314 (18.3)	320 (18.6)	634 (36.9)
5 or more cans or pouches a week	310 (18.1)	277 (16.1)	587 (34.2)
Number of years using ST, *M* (*SD*)	4.5 (2.6)	4.6 (2.6)	4.6 (2.6)
Use ST ≤ 30 min waking, *n* (%)	310 (36.1)	294 (34.2)	604 (35.2)
SSTDS dependence, *M* (*SD*)[c]	11.3 (3.6)	11.3 (3.6)	11.3 (3.6)
Current smoking, *n* (%)	102 (11.9)	130 (15.1)	232 (13.5)
≥100 cigarette smoked lifetime, *n* (%)	371 (43.2)	368 (42.8)	739 (43.0)
≥1 ST quit attempt in last year, *n* (%)	737 (85.9)	750 (87.3)	1,487 (86.6)
Five best friends use ST, *M* (*SD*)	2.7 (1.5)	2.7 (1.6)	2.7 (1.5)
Readiness to quit ST, *M* (*SD*)[d]	9 (2.1)	9.1 (2.0)	9 (2.1)
Confident not using tobacco in 1 year, *M* (*SD*)[e]	3.3 (1.0)	3.2 (1.0)	3.3 (1.0)
Expect support from partner, *n* (%)	377 (98.7)	379 (98.7)	756 (98.7)
Depression, *M* (*SD*)[f]	3.1 (1.14)	3.1 (1.10)	3.1 (1.1)
≥13 Drinks/week, *n* (%)	156 (18.2)	162 (18.9)	318 (18.5)

Note. [a]Participants were able to refuse to answer any question. Sample for all data was 1,716 except for expected support for which n = 766.

[b]Rural versus urban home locations based on Rural Urban Commuting Areas (RUCAs) (Danaher, Hart, McKay, & Severson, 2007; Hart, Larson, & Lishner, 2005) for 446 participants who provided valid US ZIP codes.

[c]Based on the Severson Smokeless Tobacco Dependence Scale (SSTDS) (Ebbert, Severson, Danaher, Schroeder, & Glover, 2012) with ratings ranging from 0 to 19 (larger numbers indicating higher dependence).

[d]Based on the Contemplation Ladder (Biener & Abrams, 1991) adapted for ST cessation that used an 11-point Likert scale with 1 = Not ready to quit, 3 = Should consider quitting someday, 5 = Should quit but not quite ready, 7 = Thinking about cutting down or quitting, 9 = Have cut down and seriously considering quitting, and 11 = Ready to quit now.

[e]Item asked How confident are you that you will not be using any tobacco a year from now? and used a 5-point Likert scale: 1 = Not at all confident, 3 = Somewhat confident, and 5 = Completely confident.

[f] Item asked Describe the degree of depression you felt, all things considered, during the past month with the following answer options: 1 = Extremely depressed, 2 = Somewhat depressed, 3 = Neither depressed nor happy, 4 = Somewhat happy, and 5 = Extremely happy.

Use of Resources Section

Significantly, fewer participants in the Enhanced Condition viewed at least one webpage in the Resources section than did participants in the Basic Condition (χ^2 [1, n = 1,716] = 71.36, $p < .001$). Similarly, participants in the Enhanced Condition viewed fewer total Resources webpages than did participants in the Basic Condition (Mann-Whitney U test: $Z = -7.76$, $p < .001$).

Table 2. Tobacco Abstinence at Follow-up Assessments

	Three months, *n*/*N* (%)	Six months, *n*/*N* (%)	Three and six months, *n*/*N* (%)
All tobacco			
Complete case analyses			
Enhanced condition	228/614 (37.1)	254/588 (43.2)	159/551 (28.9)
Basic condition	210/635 (33.1)	250/625 (40.0)	149/583 (25.6)
Intent-to-treat analyses			
Enhanced condition	229/857 (26.7)	254/857 (29.6)	159/857 (18.6)
Basic condition	211/859 (24.6)	249/859 (29.0)	149/859 (17.3)
Smokeless tobacco			
Complete case analyses			
Enhanced condition	265/614 (43.2)	285/588 (48.5)	194/551 (35.2)
Basic condition	254/636 (39.9)	291/625 (46.6)	188/583 (32.2)
Intent-to-treat analyses			
Enhanced condition	265/857 (30.9)	285/857 (33.3)	194/857 (22.6)
Basic condition	254/859 (29.6)	291/859 (33.9)	188/859 (21.9)

Table 3. Participant Engagement Analysis

	Enhanced condition					Basic condition				
	N	%	Mean	Median	Range	*N*	%	Mean	Median	Range
Number of all visits	857	100	2.47	1.00	0–26	859	100	1.79	1.00	0–8
Duration (min) all visits[a]	857	100	26.34	16.30	0–286.10	859	100	10.68	7.10	0–128.40
Print requests[a,b]	150	17.5	1.35	1.00	1–5	117	13.6	3.76	1.50	1–21
Resources views	389	45.4	0.75	0.00	0–12	564	65.7	.97	1.00	0–6
Blog views[a]	327	38.2	0.59	0.00	0–21	N/A	N/A	N/A	N/A	N/A
Blog posts[a]	40	2.3	0.06	0.00	0–3	N/A	N/A	N/A	N/A	N/A

Note. $N = 857$ for enhanced condition and $N = 859$ for the basic condition.

[a]Only participants in the enhanced condition had access to the blog feature.

[b]Number of distinct print dialog pages triggered by participant. Clicking the *print* button to launch print dialog box is a proxy of printing program content.

Printing Results

Significantly, more participants in the Enhanced Condition clicked the *print* button at least one time (Table 3): 17.5% versus 13.6% (χ^2 [1, n = 1,716] = 4.92, $p < .05$). Interestingly, participants in the Basic Condition tried to print more often ($M = 3.76$; $SD = 4.15$; $M = 1.35$; $SD = 0.62$; Mann-Whitney U test: $Z = –4.82$, $p < .001$).

Blog Views and Posts

The blog feature was available only to participants assigned to the Enhanced Condition. A small proportion (4.7%) of these participants wrote a blog message (Table 3), whereas 38.2% read blog messages written by others.

Program Engagement and Tobacco Outcomes

The composite measure of program engagement was found to be unrelated to the 6-month tobacco abstinence for complete cases ($r = –.02$, $p = .56$), and marginally—but minimally—related to repeated point prevalence of abstinence for complete cases ($r = –.06$, $p = .049$).

Usability and Satisfaction With Programs

On the 3-month assessment, participants rated both of the Web sites to be easy to use with: 1 = *Very easy*, 2 = *Easy*: $M = 1.94$, $SD = .95$, n = 1,249). The Enhanced Condition was rated as easier to use than the Basic Condition ($M = 1.86$ versus 2.02, $t(1,247) = 2.84$, $p < .01$), and participants in the Enhanced Condition indicated that they were more likely to recommend the program to their family and friends who wanted to quit than did participants in the Basic Condition: 95.6% versus 92.9%; χ^2 (1, n = 1,250) = 4.13, $p < .05$).

Predictors of Abstinence

Drawing upon our previous research (Severson et al., 2008), we examined a set of baseline variables as putative predictors of tobacco abstinence outcomes, including experimental condition, age, married/partner status, days a can/pouch lasts, using ST ≤ 30 min after waking, ST quitting attempts in the previous year, lifetime smoking, friends who chew, dependence (Severson Smokeless Tobacco Dependence Scale [SSTDS]), heavy drinking, readiness to quit (Contemplation Ladder), and confidence in not using tobacco in 1 year (self-efficacy). Significant multivariate predictors of tobacco abstinence at 6 months included confidence in not using tobacco in 1 year ($\beta = 0.36$, $OR = 1.43$, 95% $CI = 1.27–1.60$, $p < .001$) and using ST ≤ 30 min after waking ($\beta = 0.25$, $OR = 1.28$, 95% $CI = 1.00–1.64$, $p < .05$). Only confidence in not using tobacco in 1 year (self-efficacy) predicted tobacco abstinence using 3- and

6-month assessments (β = 0.32, *OR* = 1.38, 95% *CI* = 1.20–1.59, $p < .001$). None of the predictors significantly moderated the condition effect.

DISCUSSION

We compared the effectiveness of two web-based programs in helping young users (14–25 years of age) quit smokeless tobacco. The Basic Condition was a static, text-based quitting program, whereas the Enhanced Condition was highly interactive. As predicted, youth in the Enhanced Condition had significantly greater engagement with the program compared with the Basic Condition, but we failed to find any significant differences in tobacco cessation between the two conditions. We found a small difference (Complete Case analyses) in favor of the Enhanced Condition—43.2% versus 40.0% at 6 months and 28.9% versus 25.6% at both 3 and 6 months—but it was far less than in our earlier ChewFree trial (Severson et al., 2008), which showed a large and significant advantage for its Enhanced Condition: 46.2% versus 31.0% at 6 months and 40.6% versus 21.2% at both 3 and 6 months. The absolute level of complete case tobacco abstinence (collapsed across conditions) in this study is very similar to results obtained in the ChewFree trial: 41.5% versus 38.1% at 6 months and 27.2% versus 30.0% at both 3 and 6 months. It is important to note that the size of the Complete Cases samples in MyLastDip and ChewFree were remarkably similar at the 6-month assessment (1,213 versus 1,126) and at both 3- and 6-month assessments (1,134 versus 863).

The lack of predicted differences in tobacco and ST abstinence between the Enhanced and Basic Conditions together with the high levels of tobacco abstinence—similar to the quit rates in our prior study—have prompted us to review some of our assumptions about the composition of the Basic Condition used in the current research. Elsewhere (Danaher & Seeley, 2009), we have argued that a web-based program with content presented as static text provides a stringent comparison condition that controls for attention placebo factors while assisting in an online marketing campaign that promises all prospective participants a helpful online treatment program. A static text control condition represents a *treatment as usual* comparison in that it provides the relatively generic, text-based content that a reasonably skillful web user could find via a Google search. It is possible that the content we provided in our Basic Condition may have exceeded the boundaries of this treatment-as-usual model. For example, the Basic Condition provided participants with an online version of the best-practices ST cessation *Enough Snuff* guide (Severson & Gordon, 2005) that has proven efficacious when delivered in printed format (Severson, Akers, Andrews, Lichtenstein, & Jerome, 2000; Severson et al., 2007; Severson, Andrews, et al., 2000).

Because both MyLastDip and ChewFree included an online version of the *Enough Snuff* guide in their respective Basic Conditions, it is also possible that outcome differences between the two studies are associated with the composition of the respective samples: The MyLastDip trial aimed at ST users 14–25 years of age (*M* = 20.8 years, *SD* = 2.64 years), whereas participants in the ChewFree trial were ≥18 years of age (*M* = 36.8 years, *SD* = 9.6 years). Other published results of web-based tobacco cessation studies have reported similar nonsignificant differences between so-called Enhanced and Basic Conditions (e.g., Mason, Gilbert, & Sutton, 2012; Wangberg, Nilsen, Antypas, & Gram, 2011).

Finally, there is a pragmatic argument to consider that more tobacco users who want to quit may well be interested in enrolling in a web-based cessation program that offers a tailored, interactive, and engaging experience. Civljak et al. (2010) have reported that young people prefer tailored tobacco cessation Web sites. And it seems clear that user expectations about what constitutes an attractive Web site will only increase over time: The *enhanced innovative* Web site of today will inexorably become the *basic* Web site of tomorrow.

We found that baseline self-efficacy and first chew upon waking predicted 6-month tobacco abstinence, but only confidence in quitting (self-efficacy) was predictive of the repeated point prevalence assessments at 3 and 6 months. Results of our previous web-based ST cessation study (Severson et al., 2008) identified first chew ≤30 min upon waking, days a can lasts, nonsmoker status, readiness to quit (Contemplation Ladder), and confidence in quitting (self-efficacy) as predictors of tobacco abstinence at the 6-month assessment. In that study, readiness to quit and friends who chew emerged as predictors for repeated point prevalence at 3- and 6-month assessments.

There are several strengths of this study. First, it was a pragmatic clinical trial for web-based tobacco cessation research (Graham et al., 2011) in that it tested online users in the *real world* to maximize external generalizability and practical relevance while maintaining internal validity. In addition, we successfully recruited a large sample of 1,716 geographically diverse ST users ages 14–25 who wanted to quit.

It is true that 2.75 years were used in the MyLastDip trial to recruit 1,716 participants (quite a bit longer than the 15 months needed to recruit 2,523 adult ST users in the original ChewFree trial). We do not conclude that this recruitment period was excessively long, however, because of our recent experience with an ongoing web-based ST cessation intervention, which required 2.83 years to recruit 1,683 adult ST users. However, we were able to encourage almost 9,000 individuals to begin the screening process, which resulted in almost 2,000 ST users being randomized (a steady flow of 6–15 recruits each week).

Our successful recruitment plan combined online marketing and a concerted effort to enlist the collaboration of tobacco control professionals and educators from around the United States and Canada. We also had the advantage of being able to recruit ST users as young as 14 years of age without needing to obtain parental consent. We might have accelerated the rate of recruitment had we increased our online visibility by paying for Google AdWords advertising to supplement the GoogleGrant we received.

Another strength of this study is that 71% of participants completed the 6-month follow-up—a marked improvement over the 45% completion rate in our prior ChewFree RCT with adult ST users (Severson et al., 2008). Attrition in this study did not differ as a function of condition or participant baseline characteristics, and interactions between attrition and condition were not significant predictors of tobacco outcome measures. Nonetheless, ST cessation RCTs need to continue to improve the engagement of participants in programs and follow-up assessments.

In terms of limitations, we did not include biochemical validation of self-reported tobacco abstinence. Our decision was informed by the advice of Glasgow et al. (1993) and the Society for Research on Nicotine and Tobacco Subcommittee

on Biochemical Verification (Benowitz et al., 2002) that validation measures are not recommended when a study's self-help design makes them impractical, when demand characteristics are not likely to differentially affect reports by condition, and/or when accurate estimates of tobacco use can be obtained through using multiple self-report measures. We also concluded that the possible benefit of using validation measures was outweighed by their likely negative impact on our recruitment of young ST users (Grimshaw & Stanton, 2006).

Although we did not find significant differences between our two conditions, we continue to recommend the use and additional research examination of web-based tobacco cessation programs that embody tailored program content. We agree with Strecher (2007) that the efficacy of web-based programs can be enhanced through improving our understanding of how individual participant characteristics may moderate the impact of message content and delivery, and how program content should change dynamically based on the participants' experience while working with the program.

Future research might also explore augmenting the efficacy of the Enhanced Condition with a mobile treatment adjunct designed to proactively *push* content to participants (Klasnja & Pratt, 2012). The use of mobile treatment adjuncts is consistent with a recent Pew Report (Lenhart, Purcell, Smith, & Zickuhr, 2010) and other similar reviews (Nielsen, 2009), concluding that texting is indispensable to the lives of American teens and young adults. Finally, there is growing evidence showing that automated text messaging can assist health behavior change (Fjeldsoe, Marshall, & Miller, 2009; Fjeldsoe, Miller, & Marshall, 2010; Patrick, Griswold, Raab, & Intille, 2008) including tobacco cessation (Brendryen, Drozd, & Kraft, 2008; Brendryen & Kraft, 2008; Free et al., 2009; Rodgers et al., 2005). In this promising scenario, the web-based program could deliver a full-featured, engaging, tailored intervention, whereas the tightly integrated mobile adjunct could push messages to participants' phones in order to promote interaction, increase motivation, challenge dysfunctional beliefs, and provide cues to action (Webb, Joseph, Yardley, & Michie, 2010).

In summary, the present research underscores that the web-based interventions for ST cessation that we tested have impact (reach) and are both attractive and acceptable to the audience of young chewers who want to quit. Additional research is needed to explore the use of possible adjunctive approaches (e.g., mobile technologies) to extend the reach and improve the efficacy of the interventions.

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DECLARATION OF INTERESTS

None.

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REFERENCES

Backinger, C. L., Michaels, C. N., Jefferson, A. M., Fagan, P., Hurd, A. L., & Grana, R. (2008). Factors associated with recruitment and retention of youth into smoking cessation intervention studies: A review of the literature. *Health Education Research*, *23*, 359–368. doi:10.1093/Her/Cym053

Benowitz, N. L., Jacob, P., Ahijevych, K., Jarvis, M. R., Hall, S., LeHouezec, J., …Velicer, W. (2002). Biochemical verification of tobacco use and cessation. *Nicotine & Tobacco Research*, *4*, 149–159. doi:10.1080/14622200210123581

Biener, L., & Abrams, D. B. (1991). The Contemplation Ladder: Validation of a measure of readiness to consider smoking cessation. *Health Psychology*, *10*, 360–365.

Brendryen, H., Drozd, F., & Kraft, P. (2008). A digital smoking cessation program delivered through internet and cell phone without nicotine replacement (Happy Ending): Randomized controlled trial. *Journal of Medical Internet Research*, *10*, e51. doi:10.2196/jmir.1005

Brendryen, H., & Kraft, P. (2008). Happy Ending: A randomized controlled trial of a digital multi-media smoking cessation intervention. *Addiction*, *103*, 478–484. doi:10.1111/j.1360-0443.2007.02119.x

Civljak, M., Sheikh, A., Stead, L. F., & Car, J. (2010). Internet-based interventions for smoking cessation. *Cochrane Database of Systematic Reviews*, *8*, CD007078. doi:10.1002/14651858

Danaher, B. G., Boles, S. B., Akers, L., Gordon, J. S., & Severson, H. H. (2006). Defining participant exposure measures in Web-based health behavior change programs. *Journal of Medical Internet Research*, *8*, e15. doi:10.2196/jmir.8.3.e15

Danaher, B. G., Hart, L. G., McKay, H. G., & Severson, H. H. (2007). Measuring participant rurality in Web-based interventions. *BMC Public Health*, *7*, 228. doi:10.1186/1471-2458-7-228

Danaher, B. G., & Seeley, J. R. (2009). Methodological issues in research on Web-based behavioral interventions. *Annals of Behavioral Medicine*, *38*, 28–39. doi:10.1007/s12160-009-9129-0

Ebbert, J. O., Severson, H. H., Danaher, B. G., Schroeder, D. R., & Glover, E. D. (2012). A comparison of three smokeless tobacco dependence measures. *Addictive Behaviors*, *37*, 1271–1277. doi:10.1016/j.addbeh.2012.06.011

Fjeldsoe, B. S., Marshall, A. L., & Miller, Y. D. (2009). Behavior change interventions delivered by mobile telephone short-message service. *American Journal of Preventive Medicine*, *36*, 165–173. doi:10.1016/j.amepre.2008.09.040

Fjeldsoe, B. S., Miller, Y. D., & Marshall, A. L. (2010). MobileMums: A randomized controlled trial of an SMS-based physical activity intervention. *Annals of Behavioral Medicine*, *39*, 101–111. doi:10.1007/s12160-010-9170-z

Free, C., Whittaker, R., Knight, R., Abramsky, T., Rodgers, A., & Roberts, I. G. (2009). Txt2stop: A pilot randomised controlled trial of mobile phone-based smoking

cessation support. *Tobacco Control*, *18*, 88–91. doi:10.1136/tc.2008.026146

Glasgow, R. E., Mullooly, J. P., Vogt, T. M., Stevens, V. J., Lichtenstein, E., Hollis, J. F., … Vogt, M. R. (1993). Biochemical validation of smoking status: Pros, cons, and data from four low-intensity intervention trials. *Addictive Behaviors*,*18*,511–527.doi:10.1016/0306-4603(93)90068-K

Google. (2012). AdWords: Advertise your business on Google. Retrieved June 22, 2012, from https://accounts.google.com/ServiceLogin?service=adwords&hl=en_US&ltmpl=jfk&passive=true&ifr=false&alwf=true&continue=https://adwords.google.com/um/gaiaauth?apt%3DNone%26ltmpl%3Djfk&sacu=1&sarp=1

Graham, A. L., Cobb, N. K., Papandonatos, G. D., Moreno, J. L., Kang, H., Tinkelman, D. G., … Abrams, D. B. (2011). A randomized trial of Internet and telephone treatment for smoking cessation. *Archives of Internal Medicine*, *171*, 46–53. doi:10.1001/archinternmed.2010.451

Grimshaw, G. M., & Stanton, A. (2006). Tobacco cessation interventions for young people. *Cochrane Database Syst Rev, 4*, CD003289. doi:10.1002/14651858.CD003289.pub4

Hart, L. G., Larson, E. H., & Lishner, D. M. (2005). Rural definitions for health policy and research. *American Journal of Public Health*, *95*, 1149–1155. doi:10.2105/AJPH.2004.042432

International Agency for Research on Cancer. (2007). Smokeless tobacco and some tobacco-specific nitrosamines, *89*. Retrieved from http://monographs.iarc.fr/ENG/recentpub/mono89.pdf

Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2011). Decline in teen smoking resumes in 2011. Retrieved April 30, 2012, from http://monitoringthefuture.org/data/11data.html#2011data-cigs

Klasnja, P., & Pratt, W. (2012). Healthcare in the pocket: Mapping the space of mobile-phone health interventions. *Journal of Biomedical Informatics*, *45*, 184–198. doi:10.1016/j.jbi.2011.08.017

Koo, M., & Skinner, H. (2005). Challenges of internet recruitment: A case study with disappointing results. *Journal of Medical Internet Research*, *7*, e6. doi:10.2196/jmir.7.1.e6

Lenhart, A., Purcell, K., Smith, A., & Zickuhr, K. (2010). Social media and mobile internet use among teens and young adults. *Pew Internet & American Life Project*. Retrieved June 19, 2012, from www.pewinternet.org/~/media//Files/Reports/2010/PIP_Social_Media_and_Young_Adults_Report_Final_with_toplines.pdf

Mason, D., Gilbert, H., & Sutton, S. (2012). Effectiveness of web-based tailored smoking cessation advice reports (iQuit): A randomized trial. *Addiction*, *107*, 2183–2190. doi:10.1111/j.1360-0443.2012.03972.x

Nielsen. (2009). How teens use media: A Nielsen report on the myths and realities of teen media trends. Retrieved June 19, 2012, from http://blog.nielsen.com/nielsenwire/reports/nielsen_howteensusemedia_june09.pdf

Patrick, K., Griswold, W. G., Raab, F., & Intille, S. S. (2008). Health and the mobile phone. *American Journal of Preventive Medicine*, *35*, 177–181. doi:10.1016/j.amepre.2008.05.001

Rodgers, A., Corbett, T., Bramley, D., Riddell, T., Wills, M., Lin, R. B., & Jones, M. (2005). Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tobacco Control*, *14*, 255–261. doi:10.1136/tc.2005.011577

Severson, H. H. (2002). *Enough snuff: Pocket guide to quitting smokeless tobacco* (Vol. *6*). Eugene, OR: Applied Behavior Science Press.

Severson, H. H., Akers, L., Andrews, J. A., Lichtenstein, E., & Jerome, A. (2000). Evaluating two self-help interventions for smokeless tobacco cessation. *Addictive Behaviors*, *25*, 465–470. doi:10.1016/S0306-4603(99)00032-5

Severson, H. H., Andrews, J. A., Lichtenstein, E., Danaher, B. G., & Akers, L. (2007). Self-help cessation programs for smokeless tobacco users: Long-term follow-up of a randomized trial. *Nicotine & Tobacco Research*, *9*, 281–289. doi:10.1080/14622200601080281

Severson, H. H., Andrews, J. A., Lichtenstein, E., Gordon, J. S., Barckley, M., & Akers, L. (2000). A self-help cessation program for smokeless tobacco users: Comparison of two interventions. *Nicotine & Tobacco Research*, *2*, 363–370. doi:10.1080/713688152

Severson, H. H., & Gordon, J. S. (2005). *Enough snuff: A guide for quitting smokeless tobacco* (Vol. *7*). Eugene, OR: Applied Behavior Science Press.

Severson, H. H., Gordon, J. S., Danaher, B. G., & Akers, L. (2008). ChewFree.com: Evaluation of a Web-based cessation program for smokeless tobacco users. *Nicotine & Tobacco Research*, *10*, 381–391. doi:10.1080/14622200701824984

Strecher, V. (2007). Internet methods for delivering behavioral and health-related interventions (eHealth). *Annual Review of Clinical Psychology*, *3*, 53–76.

United States Department of Health and Human Service [USDHHS]. (2005). *Report on Carcinogens (RoC; 11th Edition)*. Retrieved January 12, 2009, from www.ntp.niehs.nih.gov/ntp/roc/eleventh/profiles/s176toba.pdf

USDHHS. (2009). Code of Federal Regulations: Protection of Human Subjects: Section 45 CFR 46.116(d). Retrieved July 12, 2012, from www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html/ - 46.116

USDHHS. (2012). *Preventing tobacco use among youth and young adults: A report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

Wangberg, S. C., Nilsen, O., Antypas, K., & Gram, I. T. (2011). Effect of tailoring in an internet-based intervention for smoking cessation: Randomized controlled trial. *Journal of Medical Internet Research*, *13*, e121. doi:10.2196/jmir.1605

Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research*, *12*, e4. doi:10.2196/jmir.1376