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Original investigation

Brief Web-Based Interventions for Young Adult Smokers With Severe Mental Illnesses: A Randomized, Controlled Pilot Study

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Abstract

Significance: About 50% of young adults with schizophrenia, bipolar disorder, and other severe mental illnesses smoke tobacco, but few studies have evaluated interventions for this group.
Methods: We conducted a randomized pilot study among 58 young adult smokers with severe mental illnesses comparing a brief interactive web-based motivational tool, *Let's Talk About Smoking,* to computerized standard education from the National Cancer Institute. An additional 23 subjects received minimal tobacco assessment at baseline and no intervention, providing a comparison condition for naturalistic cessation behavior. All participants (total $n = 81$) were assessed for smoking and breath carbon monoxide at baseline and 14 weeks and had access to standard cessation treatments.
Results: The 81 participants were stable outpatients ages 18–30 (mean 24.8 years): 43.2% were diagnosed with schizophrenia-spectrum disorders, the remainder with severe mood and anxiety disorders. They smoked 14.6 ± 10.2 cigarettes per day. All participants completed their assigned intervention; 83.4% of *Let's Talk About Smoking* users and 71.4% of standard education users rated their intervention "good" or "very good." At 14 weeks, less than 15% of participants in all conditions had used additional cessation treatment. *Let's Talk About Smoking* users were more likely to have biologically verified abstinence at 14 weeks than standard education users (14.8% vs. 0%; $X^2 = 3.7$, $p = .05$). None of the participants in the naturalistic comparison condition were abstinent at 14 weeks.
Conclusions: Interactive, web-based motivational interventions are feasible and promising for smoking cessation among young smokers with severe mental illnesses. Such interventions warrant further study among this group of smokers.
Implications: Young adult smokers with severe mental illnesses are a vulnerable population that, without intervention, goes on to experience disparate morbidity and mortality. Brief, easily disseminable interventions are needed to facilitate cessation in this group. This pilot research indicates that brief, technology-delivered, motivational interventions that are tailored for this group may be able to activate a significant number to quit without additional cessation intervention.

Introduction

In 2015, 13% of young adult Americans (defined variously as age 18–24[1] or age 18–30 years[2]) reported current smoking.[1] While genetic risk, social influences, and environmental factors play a role in smoking among young people,[3,4] mental health symptoms or distress are strongly associated with smoking in young adults.[3–8] The rate of smoking in young adults with serious psychological distress was over twice as high as the rate of those without serious psychological distress.[1] Recent rates of smoking among young adults with severe mental illnesses such as schizophrenia are three times higher than general population young adults.[9] In contrast to the general decline in rates of smoking in the United States, rates of smoking in people with severe mental illnesses or severe psychological distress have not declined or are declining at a slower rate,[1,10] indicating that smokers with severe mental illnesses are a disparity group requiring additional attention.

The adverse health effects of exposure to toxins in tobacco smoke are additive over time[11]; thus, helping smokers quit prior to many years of exposure is an important tobacco control strategy to prevent disease and early mortality. Longitudinal research shows that quitting can reduce risk of death due to cardiovascular disease, lung diseases, and cancers.[12] One study found that quitting by age 30 extended life by 10 years, increasing life expectancy to that of nonsmokers.[13]

Motivational and educational interventions have been shown to improve interest in quitting and treatment initiation among smokers with severe mental illnesses,[14–16] and a growing body of literature indicates that cessation medication with behavioral interventions is safe in this group[17] and increases their quit rates (for recent reviews, see refs. [18–20]). Qualitative research indicates that young adults with mental illness are open to getting information about cessation treatment, to using online cessation resources, and to using other cessation interventions.[21] However, little research has assessed such interventions among young people in general (for a review, see ref. [22]) and in young people with severe mental illnesses in particular (eg, ref. [23]) Additionally, one challenge to interpreting previous research in this population has been high rates of treatment response among control groups who receive substantial research assessments (as in ref. [23]). This suggests that research assessment of tobacco behavior and attitudes among young study participants may be an unintentional form of motivational intervention that could enhance response to control conditions. This possible confound must be addressed in research designs.

Although targeted education and motivational interventions may be effective for smokers, mental health providers (the clinicians who most often interact with smokers with mental illness) may not consistently attempt to educate, enhance motivation, advise these smokers to quit or provide much in the way of treatment.[24,25] Technology-delivered interventions can help to overcome this problem by delivering consistent, high-quality education and treatment with minimal provider effort. We have developed a brief, interactive, web-based, motivational intervention that can be easily used by people with severe mental illnesses and easily implemented in mental health treatment settings (where many young smokers with severe mental illnesses receive services).[26,27] This web-based motivational decision support system (called *Let's Talk About Smoking)* offers scientific information in plain language about the risks of smoking, exercises to increase self-efficacy, tailored treatment information, and video stories that exemplify treatments and create social norms for using effective cessation treatment.

We conducted a pilot test comparing the effect of this brief web-based motivational decision support system to computerized conventional education among young adult smokers with severe mental illnesses. We hypothesized that the rate of treatment initiation and cessation behaviors would be higher among motivational decision support system users. Additionally, to account for possible response related to receiving comprehensive research tobacco assessments, we also studied naturalistic quit attempts and cessation treatment utilization in a comparison condition with no intervention and minimal baseline research assessment. We hypothesized that treatment initiation and cessation behaviors would be lower in this group than in the groups that received interventions with comprehensive research tobacco assessment.

Methods

Overview

After baseline assessments, eligible, consenting participants were randomly assigned to use the motivational decision support system (*Let's Talk About Smoking*) or computerized education. All participants were then referred to locally available smoking cessation treatment. At 14 weeks, participants were assessed for the main outcome, past 3-month initiation of smoking cessation treatment and secondary outcomes, including other cessation behavior and biologically confirmed abstinence. An additional comparison condition study group was enrolled without randomization, received minimal baseline assessment, and was followed for 14 weeks to evaluate naturalistic cessation behavior and abstinence without the influence of either comprehensive baseline research assessments of smoking or intervention.

Enrollment and Study Participants

Potentially eligible smokers were recruited with flyers and brochures in waiting rooms and by clinician invitation from four mental health treatment programs serving young adults with disabling severe mental illnesses in: New York City/Queens; Nashua and Manchester, New Hampshire; and Chicago, Illinois. We enrolled English-speaking, daily smokers with severe mental illness, aged 18–30 years, who were psychiatrically stable in outpatient treatment for mental illness (Modified Colorado Symptom Index score <45),[28] and who were willing and able to give informed consent. After review of the study, participants answered questions to demonstrate comprehension of study procedures prior to signing the informed consent document. People with guardians who had impaired ability to make decisions were excluded. Smokers were excluded if they were currently or had recently (past month) used evidence-based smoking cessation treatment (indicating the subject was already motivated), were pregnant or nursing, or had current untreated alcohol or drug dependence diagnoses. Since the intervention was designed to increase motivation for cessation, intention to quit smoking was *not* required. Eighty-nine subjects were consented and assessed for eligibility; 81 were eligible and proceeded with the study, and 72 (88.9%) were assessed at the 3-month follow-up (see Figure 1 for participant flow).

Study Procedures

After obtaining informed consent, research staff gathered demographic and diagnostic information on all subjects and assessed baseline nicotine dependence, psychiatric symptoms,[28] and reading comprehension.[29] Medical record review provided physician-completed

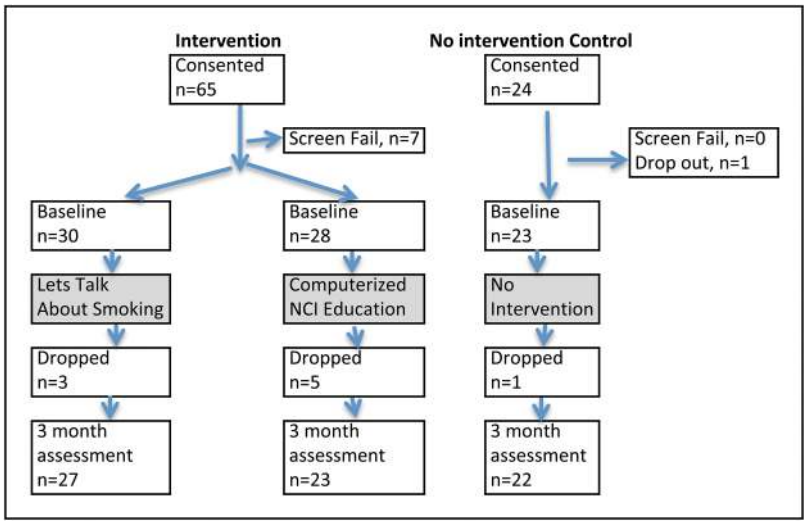

Figure 1. Study flow.

diagnoses of mental illnesses. Subjects in the intervention groups were also assessed with a structured interview for additional smoking-related measures (see Measures section).

Eligible intervention study participants were randomized to receive the motivational decision support system or computerized standard education using computer-generated random order lists in blocks of eight stratified by study site. Randomization occurred at the intervention study visit when trained site coordinators opened a sealed envelope to assign the participant their intervention. The study coordination center confirmed correct assignment. Participants used their assigned intervention within 2 weeks of their baseline assessment. After either intervention, participants completed a computerized satisfaction questionnaire. Research staff then provided participants with referral information to cessation treatment (cessation medications, cessation counseling, Quitline), available within the participant's treatment organization or community. At 14 weeks, participants provided a self-report of quit attempts and cessation treatment utilization. Research interviewers assessed subjects for past 3-month use of verifiable cessation treatment (main outcome), smoking characteristics, self-reported quit attempts with days of abstinence, and biologically verified abstinence at study follow-up visits (secondary outcomes; see Measures section). Eligible participants in the no intervention/minimal assessment condition did not receive an intervention. They were similarly assessed at 14 weeks. All subjects were paid $50 for each research assessment visit. The study was reviewed and monitored by the Dartmouth Committee for the Protection of Human Subjects and the Institutional Review Boards of participating research sites.

Conditions

Electronic Decision Support System for Smoking Cessation

This web-based computer program, *Let's Talk About Smoking*, is tailored for smokers with severe mental illnesses and designed to increase motivation to quit smoking using evidence-based treatment. It's initial development and content have been described previously.[30] It is a linear, modularized, interactive program that takes 30–60 minutes to complete. A young adult video program host, who identifies herself as an ex-smoker with mental illness, guides users through modules, each with assessments and exercises used in motivational interviewing and health decision aid systems. In Module 1 (Assessment/Feedback), users get personalized feedback about the personal, financial, and health impact of smoking after answering questions. A self-constructed inventory of nonsmoking social contacts and quit stories of famous people create social norms for not smoking and for cessation with treatment. In Module 2 (Quit Intention), information and exercises, including creation of a personal pros and cons list, and cessation treatment quit story videos facilitate change decisions. Module 3 (Education about cessation treatments, feedback and referral) provides selectable video quit stories as well as text and video information about cessation treatments. A personalized report highlights desires to quit, treatment choices and referral information.

As previously described, we used standard procedures to develop and test the computer interface and content with user feedback from smokers with severe mental illnesses to ensure that it was engaging and easy to use among people with the cognitive impairments associated with psychotic disorders.[30] We showed that the decision support system was similarly effective among smokers with various characteristics: diagnosis of schizophrenia versus severe mood and anxiety disorders; high versus low level of education and cognitive function; and high versus low mental health symptom distress.[31]

For this study, we further tailored the content of *Let's Talk About Smoking* to ensure that it was relevant for young adults. This version provided less emphasis on health and more emphasis on the financial and social impacts of smoking and quitting, based on content analysis of semistructured interviews with 18 young adults with schizophrenia and on previous research.[21] We identified and removed usability problems and system bugs by conducting user testing and cognitive interviews with three additional young adult participants.

Computerized National Cancer Institute Patient Education

This group received a reproduced version of the National Cancer Institute (NCI) patient educational handout,[32] which provides information about smoking-related diseases and smoking cessation treatments. The content was provided to participants via a laptop computer in a format similar to the decision support system: large black font on a white background with no distracting images; one concept per page in a short paragraph or bulleted sentences; and automated audio that read the content to users if they wished. By

providing the patient handout in a similarly produced computerized format with audio, this control condition was designed to provide a contrast for the tailored, interactive and motivational content of the decision support system.

No Intervention, Minimal Assessment Comparison Condition

In order to evaluate the naturalistic cessation treatment initiation and cessation behavior in a group of young adult smokers with severe mental illness, we later enrolled an additional quasiexperimental comparison condition. After the first 58 subjects were randomly assigned to the two study interventions, we enrolled an additional 23 subjects at a study site in New Hampshire using the same inclusion and exclusion criteria. During the consent process, they were told that the purpose of the study was to understand health behaviors in young adults with mental health conditions. These participants received a minimal assessment at baseline (demographics, nicotine dependence (Fagerstrom), eating and exercise habits, and psychiatric symptom distress (Colorado). They were not provided any intervention. They were assessed again at 14 weeks with the same assessment battery utilized in the controlled trial. They were then debriefed and informed that the researchers were particularly interested in their smoking and cessation behaviors.

Measures

Demographics and History

Demographics, history of computer use, health history, and smoking history were assessed with a structured interview. Physician-completed DSM-IV-TR psychiatric diagnoses and Global Assessment of Functioning (GAF) were obtained from clinic chart review. Baseline past 6-month substance use was assessed with a standardized quantity-frequency measure.[33,34] The Wide Range Achievement Test (WRAT) subtest for reading comprehension (a well validated and widely used measure) assessed participants for reading comprehension.[29]

Mental Health Symptoms

We assessed psychiatric symptom severity at baseline with the modified Colorado Symptom Index,[28] a 14-item questionnaire (0–4 scale) that is reliable and valid in patients with a variety of psychiatric disorders.[35]

Smoking Characteristics

We assessed all subjects for level of nicotine dependence with the Fagerström Test for Nicotine Dependence at baseline and 14 weeks.[36,37] We assessed intervention participants for their stage of change with the single item Stage of change question, "Are you seriously thinking about quitting?".[38] The four responses are: (1) "I am trying to quit right now"; (2)"I am planning to quit in the next month"; (3) "I am thinking of quitting but not in the next month"; and (4) "No, I am not thinking of quitting." After receiving their intervention, we assessed intention to use cessation treatment (medications, nicotine replacement therapy, and counseling) using single questions with Likert scale response options, such as "I have decided to take a medication to help me quit smoking; completely disagree = 1; completely agree = 7). To assess attitudes we used the Attitudes Towards Smoking Scale, an 18-item instrument with three subscales (adverse effects, psychoactive benefits, pleasure).[39] Test-retest correlations are high (above 0.81), and the difference between the benefits and adverse effects scores has been shown to predict smoking cessation.

Primary Outcome—Use of Smoking Cessation Treatment and Quit Attempts

Participants completed a smoking cessation treatment checklist to provide all self-reported use of cessation treatment (including nicotine replacement therapy), use of other supports to quit, and self-reported quit attempts at any time during the 14-week study period. For example, they the questionaire asked "In the past 3 months, did you take quit smoking medication (nonpill) for at least one day? Quit smoking medications are: **nicotine replacement** (patch, gum, lozenge, inhaler, nasal spray)." Self-reported use of cessation treatment was verified via clinic record review, phone calls to clinicians, and viewing bottles of medications and nicotine replacement at the 14-week assessment.

Secondary Outcome—Abstinence

Biologically verified abstinence was assessed in all subjects at 14-weeks.When participants reported current abstinence at the follow-up visit, this was verified with expired carbon monoxide (CO) less than 9 ppm (Smokelyzer Breath Carbon Monoxide Monitor, Bedfont Scientific).[40,41] For analyses, biologically verified abstinence was defined as past 7 days self-report of no tobacco produce use, and breath CO less than 9 ppm. Additionally, any self-reported quit attempts with at least one day and greater than 7 days of abstinence during the treatment period were captured with the Timeline Follow-Back method at the 14-week follow-up.[33,34,42] With this well-validated method, trained research staff assessed subjects for abstinence or amount of smoking and other tobacco product use each day, going back week-by-week over the past 3 months using a calendar to cue memories of smoking and abstinence. The Timeline Follow-Back method has been shown to be reliable and valid in the general population[42] and in people with severe mental illnesses.[43]

Intervention Satisfaction, Usability, and Likeability

Participants who received an intervention completed the Perceived Usefulness and Ease of Use Scale, an adapted 15-item semiqualitative interview[44] to obtain reactions to, and satisfaction with, the interventions.

Statistical Analyses

We used descriptive statistics to portray the study groups. We used chi-squared tests or exact tests (for categorical variables), *t* tests (for continuous variables between two groups) and analysis of variance tests (for comparing continuous variables among the three groups). Next, we assessed dichotomous outcomes between the two intervention groups with logistic regressions[45] adjusting for baseline differences, and, in cases where logistic models did not converge due to empty cells, chi-square or exact tests (eg, where abstinence rates were zero in the study groups) to assess whether *Let's Talk About Smoking* users were more likely to initiate cessation treatment and to become abstinent than the users of the computerized NCI education. We used similar approaches for the exploratory analyses comparing outcomes in the no intervention/minimal assessment group to the intervention groups.

Results

Participants are described in Table 1. The group included 81 young adults with a mean age of 24.2 years (*SD* =3.6). Just under half of the group had diagnoses of schizophrenia-spectrum disorders, and the rest had diagnoses of severe mood or anxiety disorders. The

Table 1. Baseline Demographics and Characteristics of Study Participants

	Motivational Decision Support (LTAS) *N* = 30	Computerized NCI Education (NCI) *N* = 28	No Intervention Min Assessment *N* = 23	Total sample *N* = 81
Demographics				
Gender male, N (%)	20 (66.7)	19 (67.9)	12 (52.2)	51 (63.0)
Mean age (*SD*)[b]	23.5 (3.9)	25.0 (3.2)	26.1 (3.3)	24.2 (3.6)
Mean years education (*SD*)	11.7 (1.4)	11.6 (2.0)	11.5 (1.9)	11.6 (1.7)
Race				
White, *N* (%)[b,c]	17 (56.7)	16 (57.1)	20 (87.0)	53 (65.4)
Black, *N* (%)	9 (30.0)	10 (35.7)	2 (8.7)	21 (25.9)
Other	4 (13.3)	2 (7.1)	1 (4.3)	7 (8.6)
Hispanic, *N* (%)[a,c]	6 (20.0)	0 (0.0)	5 (21.7)	11 (13.6)
Living with family, *N* (%)	16 (53.3)	17 (60.7)	7 (30.4)	40 (49.4)
Living independently, *N* (%)	8 (26.7)	6 (21.4)	13 (56.5)	27 (33.3)
Marital status, *N* single (%)	27 (90)	26 (92.9)	22 (95.7)	75 (92.6)
Technology use				
Comfortable using a computer	25 (83.3)	24 (85.7)	18 (78.3)	67 (82.7)
Own smartphone	19 (67.9)	23 (76.7)	21 (91.3)	63 (77.8)
Used Internet past year	29 (96.7)	26 (92.9)	23 (100)	78 (96.3)
Used Internet to look up health info[a,c]	14 (46.7)	21 (75.0)	12 (52.2)	47 (58.0)
Clinical characteristics				
Diagnosis schizophrenia/affective, *N* (%)	12 (40)	14 (50)	9 (39.1)	35 (43.2)
Diagnosis mood/anxiety, *N* (%)	18 (60)	14 (50)	14 (60.9)	46 (56.8)
Marijuana use last 6 months, *N* (%)	10 (33.0)	10 (35.7)	8 (36.4)	28 (34.6)
Mean Colorado Symptom Index Score (*SD*)	17.2 (11.5)	19.0 (9.3)	n/a	18.1 (10.5)
Mean Global Assessment of Functioning (*SD*)	44.7 (6.6)	47.3 (5.7)	45.1 (7.2)	45.8 (6.5)
Mean lifetime psych hospitalizations (*SD*)	4.2 (5.3)	10.9 (22.8)	6.3 (8.6)	7.7 (16.5)
Smoking characteristics				
Mean cigarettes/day (*SD*)[b]	10.9 (8.6)	13.9 (9.4)	18.8 (11.6)	14.2 ± 10.2
Mean age began daily smoking	17.7 (3.5)	16.9 (3.3)	--	--
Mean Fagerstrom dependence score (*SD*)	4.3 (1.9)	4.3 (2.1)	5.4 (1.9)	4.6 (2.0)
E-cigarette - any use past 3 months, *N* (%)	11 (36.7)	8 (28.6)	--	--
Hookah - any use past 3 months, *N* (%)	3 (10.0)	4 (14.3)	--	--
Cigars/cigarillos - any use past 3 months, *N* (%)	4 (13.3)	7 (25.0)	--	--
Attitudes Towards Smoking				
Mean Benefits Subscale (*SD*)	14.5 (2.9)	15.2 (3.2)	--	--
Mean Pleasure Subscale (*SD*)	13.6 (3.5)	12.8 (3.8)	--	--
Mean Adverse Subscale (*SD*)	40.3 (6.7)	37.5 (8.2)	--	--
Mean Total Attitudes (*SD*)	-12.2 (8.6)	-9.6 (9.4)	--	--

Min = minimal; LTAS = Let's Talk About Smoking Website; NCI = National Cancer Institute Computerized Pamphlet; *N* = number; SD = standard deviation.
[a]LTAS different from NCI; [b]LTAS different from No Intervention; [c] NCI different from No Intervention; all $p < .05$.

group had a low level of symptom distress and a high level of functional impairment. Participants smoked an average of 14.2 cigarettes per day and had a low to moderate level of nicotine dependence. Among subjects who used the interventions, 19 (32.8%) had used electronic cigarettes in the past 3 months; 22 (37.9%) reported that they intended to quit smoking within the next month.

Primary Outcome

Only about 6% of participants who received an intervention utilized verifiable cessation treatment over the 3-month follow-up period (Table 2). All who initiated a treatment that was verified used nicotine replacement therapy, none utilized cessation medication or counseling of any type (not different between groups).

Based on self-report of assistance with quitting, 13.9% of participants used any type of nicotine replacement therapy, 6.9% reported talking to a doctor about quitting, 6.9% reported talking to a counselor about quitting, and 22.2% reported talking to a friend about quitting (not different between groups). The smokers who had verified abstinence at the 14-week assessment point had not used any verifiable cessation treatment; but two reported using nicotine replacement therapy, and one of these also reported using counseling that could not be verified.

After using their assigned interventions, participants rated the importance of quitting highly (mean 5.7 ± 1.4 on a 1–7 scale), but intentions to use cessation treatments (nicotine replacement therapy, medication, and counseling) were moderately low (mean 3.6 ± 1.9 on a 1–7 scale). A third of the group (*N* = 17; 29.3%) reported at least some level of intention to use each approach (nicotine replacement therapy, cessation medication and counseling); nine participants (15.5%) reported some intention to use both pharmacotherapy and counseling. Intentions and importance of quitting were not different between intervention groups.

Secondary Outcome

Abstinence outcomes are shown in Figure 2. Those who received *Let's Talk About Smoking* were more likely to have biologically verified abstinence from smoking and other tobacco product use at the 14-week assessment than those who received the computerized

Table 2. Cessation Treatment and Support Utilization over 3-month Follow-up

	Motivational Decision Support (LTAS) *N* = 27	Computerized NCI Education (NCI) *N* = 23	No Intervention Min Assessment *N* = 22	Total sample *N* = 72
Verified treatment				
Met with doctor to discuss cessation	1 (3.7)	2 (8.7)	1 (4.5)	4 (5.6)
Attended cessation counseling	0	0	0	0
Initiated cessation medication	0	0	0	0
Initiated cessation NRT	2 (7.4)	1 (4.3)	1 (4.5)	4 (5.6)
Started any verified treatment	2 (7.4)	1 (4.3)	1 (4.5)	4 (5.6)
Self-reported treatment				
Met with doctor to discuss cessation	2 (7.4)	1 (4.3)	2 (9.1)	5 (6.9)
Attended cessation counselling	2 (7.4)	2 (8.7)	1 (4.5)	5 (6.9)
Initiated cessation medication	0	0	0	0
Initiated NRT	3 (11.1)	5 (21.7)	2 (9.1)	10 (13.9)
Talked to a friend about quitting	5 (18.5)	6 (26.1)	5 (22.7)	16 (22.2)

Min = minimal; LTAS = Let's Talk About Smoking Website; NCI = National Cancer Institute Computerized Pamphlet; *N* = number; NRT = nicotine replacement therapy; SD = standard deviation.

NCI education (14.8% vs. 0%; $X^2 = 3.7$, $p = .05$). Almost half of the young adult smokers who received an intervention reported that they had tried to quit and achieved at least 1 day of abstinence. In adjusted models, the proportions of participants self-reporting any 1 day and at least 7 days of abstinence over the past 3 months were not significantly different between intervention groups.

During the 3-month follow-up period, other product use was not different between groups: 17 (21%) used electronic cigarettes and 17 (21%) used cigar products. Other product use was not associated with abstinence at the 3-month assessment.

Intervention Usability, Use Characteristics, and Satisfaction

All participants completed the intervention to which they were assigned during a single, in-office session; no adverse events were reported. Participants who were assigned to *Let's Talk About Smoking* spent an average of 58 (±22) minutes using the intervention, with similar amounts of time in Modules 1 (26 ± 9 minutes), Module 2 (17 ± 12 minutes), and Module 3 (18 ± 11 minutes). Approximately one quarter of users elected to view additional video information about nicotine replacement therapy (24%), about bupropion (24%), and about varenicline (29%).

In terms of how the intervention content was perceived, most (87%) liked the video host "a lot." Over half (53%) said they liked the videos of doctors talking about cessation treatments. The most well-liked program components included the video host and the video quit stories (23% and 27% stated they liked these components the most). The components that were liked the least included information about cessation treatments and a questionnaire assessing likes and dislikes of smoking (23% selected these components when asked what they liked the least).

Although all intervention users felt that the interventions were "easy to use," 10.7% of NCI education users versus 3.3% of *Let's Talk About Smoking* users felt the program was "hard to understand" (see Figure 3). In terms of satisfaction, 71.4% of the NCI education users and 83.4% of *Let's Talk About Smoking* users felt their intervention was "good" or "very good," and about 95% of both groups said they would recommend their intervention to a friend. When asked what could be improved about the *Let's Talk about Smoking* program, 20% said "nothing," 23% wanted more detailed information about health effects of smoking and 3%–9% suggested more about electronic cigarettes, social impacts of smoking, and quit stories.

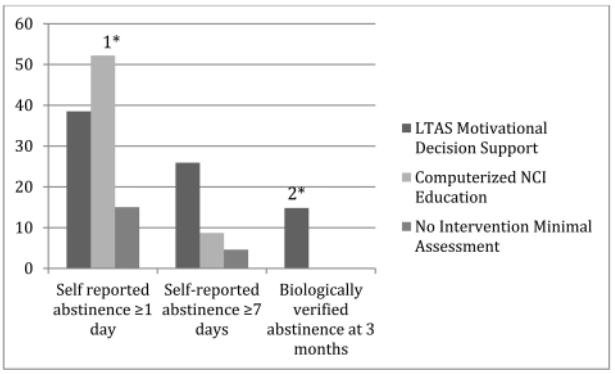

Figure 2. Abstinence outcomes among young adult smokers with SMI. LTAS = Let's Talk About Smoking Website; NCI = National Cancer Institute Computerized Pamphlet; SMI = severe mental illness. $^{1*}p < .05$ NCI versus no intervention. $^{2*}p < .05$ LTAS versus NCI and LTAS versus no intervention.

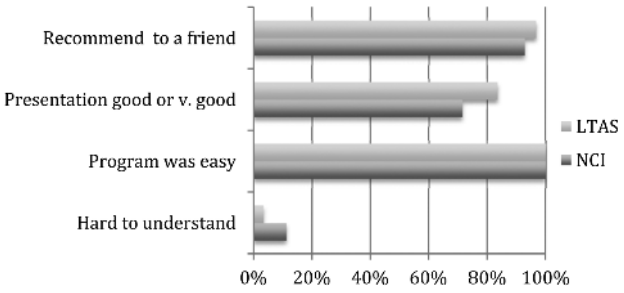

Figure 3. Intervention satisfaction and usability.

Naturalistic Cessation Activity

As shown in Figure 2, all participants in the no intervention/minimal assessment comparison condition reported that they were still smoking at the 14-week follow-up (significantly different than smokers in the *Let's Talk About Smoking* group; 0% vs. 15% abstinent; $X^2 = 7.06$, $df = 2$, $p < .05$). However, 15% reported that they had tried to quit during the study period, and 4.6% reported achieving at least 7 days of abstinence during the follow-up period. In

adjusted models, a significantly lower proportion of these comparison condition smokers reported one or more days of self-reported abstinence compared to the NCI Education group (15% vs. 52.5%; OR = 0.17; 95% confidence limits = 0.036–0.766; $p < .05$). Verified and self-reported treatment and cessation support utilization in this comparison group was not significantly different compared to the intervention groups.

Discussion

This pilot study suggests that a brief, web-based, motivational intervention may be effective for cessation among young adult smokers with severe mental illnesses and warrants further evaluation. Almost 15% of participants who used *Let's Talk About Smoking* met the study definition of biologically verified abstinence at the 14-week follow up (self-reported previous 7 or more days of abstinence with breath CO <9 confirming the past 24 hours of abstinence). In contrast, none of the smokers in the computerized NCI education group or comparison condition achieved verified abstinence. The self-reported quit attempts and self-reported abstinence findings were similarly promising for both of the intervention conditions, indicating that both interventions led to quit attempts, but the interactive, motivational program led to more effective quit attempts with sustained abstinence. The finding that our interactive, web-based intervention was more effective than a computerized, noninteractive educational control condition is similar to research on Internet-based interventions in general population smokers.[46]

Contrary to our primary hypothesis and our previous work using a similar program in middle-aged smokers with severe mental illness,[31] *Let's Talk About Smoking* did not motivate most of these young adults to use cessation treatment. Although participants interacted with the treatment information, and many viewed it positively, most participants who quit did so without verifiable treatment. This result aligns with previous qualitative research documenting negative attitudes about using cessation treatment for quitting,[21,47] as well as a previous intervention study with similarly disappointing results for engaging young people with mental illness into cessation treatment.[23] Our findings are also consistent with a study of an intervention using a popular social media platform for young smokers without mental illness, most of whom also did not use medication or other interventions for cessation.[48] A substantial proportion of young adult smokers with and without severe mental illness may be able to quit without medication or behavioral counseling due to a lower level of dependence and potentially less ingrained patterns of smoking compared to older smokers.[49] Given that many participants talked with friends about quitting, interventions that tap peer support may enhance outcomes. For those who are unable to quit after brief motivational interventions such as *Let's Talk About Smoking*, research in the general population suggests that multiple sessions with additional content may be more effective to help smokers initiate and sustain abstinence.[50]

These interventions delivered smoking education and motivational content in very easy-to-process formats. This strategy may be particularly important for young adults with severe mental illnesses, as they are more likely to have challenges with reading comprehension, attention, and information processing.[51,52] In a previous study, we utilized an interactive approach to processing health information about smoking in young smokers with psychotic disorders.[53] We demonstrated a high level of quit attempts and spontaneous smoking cessation in 15% of the group over the following month.[53]

Baseline research assessments of smoking-related constructs are typical of intervention studies and may contribute to motivating young smokers for cessation. Participants in the no intervention/minimal assessment condition were minimally assessed to avoid this problem. Although this study does not allow determination of the impact of research assessments, participants in this condition reported a lower amount of cessation activity compared to the intervention groups. However, almost 15% of this group reported quit attempts, and verified and self-reported use of cessation treatment was not different from the intervention groups. While preliminary, these results are consistent with previous focus group research among young adults with mental illness[21] and may indicate that a portion of young adults with mental illnesses are actively engaging in quit attempts and trying nicotine replacement therapy at any given time and thus could be motivated into more sustained cessation with brief interventions.

Given the ubiquity of web-based and mobile technology use among young people,[54,55] delivering tobacco interventions via technology to young adult smokers is a logical approach. Providing health education that includes details about diseases and treatments while maintaining ease of comprehension can be challenging, but we were encouraged that both the web-based decision support system and the computerized NCI education were well received by participants. Only 10% of participants indicated that the NCI educational content was "hard to understand" when we provided it in large font, bulleted text, and synchronous audio. Providing more online cessation treatment content in usable formats over a longer period of time may improve outcomes above and beyond what we found here with a single session intervention.

Limitations

This pilot study included small numbers by design and utilized unblinded research assessors, thus the results must be interpreted with caution and require replication. Comprehensive research assessments of subjects in the intervention groups could have influenced participant behaviors in addition to the interventions. Further, due to the small numbers of subjects, we were not able to evaluate moderators and mechanisms of change with use of *Let's Talk About Smoking*. However, we were able to use a randomized design to show that *Let's Talk About Smoking*, with its interactive, motivational content, resulted in greater rates of cessation than the control intervention, and cessation rates that are similar to previously studied brief interventions for smokers not ready to quit in the general population.[56] Additionally, the quasiexperimental comparison group with no intervention and minimal assessment provides an estimate of smoking and cessation activity in this group that is not influenced by comprehensive tobacco assessment, but that group included a higher proportion of Whites with slightly heavier smoking, and may have been different in other unmeasured ways that influenced smoking and quitting behavior during the follow-up period.

Conclusion

Little research has evaluated technology-delivered tobacco treatment strategies among young adult smokers with severe mental illness, a group that experiences disparate morbidity and mortality in large part due to smoking-related diseases. The results of this study indicate that this type of intervention is feasible and well received by this group. Further research is warranted to evaluate whether young adult smokers with severe mental illness can be engaged into cessation activity and abstinence with brief, web-based interventions.

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Declaration of Interests

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