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The RealU online cessation intervention for college smokers: A randomized controlled trial

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ABSTRACT

Objectives. To determine the efficacy of providing online cessation intervention for college smokers.

Methods. This is a two-group randomized controlled trial. The intervention group received $10 weekly incentives to visit an online college life magazine that provided personalized smoking cessation messages and peer email support. Evaluation assessments occurred at baseline and 8, 20, and 30 weeks after enrollment. The primary outcome is self-reported 30-day abstinence at week 30. Carbon monoxide (CO) breath testing was performed for participants reporting 30-day abstinence at week 30.

Results. Five-hundred and seventeen college smokers at the University of Minnesota were enrolled via internet health screening (control=260, intervention=257) in the fall of 2004. Intervention participants completed an average of 18.9 (SD 2.5) of 20 weekly website visits over the course of the study. The rate of 30-day abstinence at week 30 was higher for the intervention compared to the control group (41% vs. 23%, $p<0.001$). CO testing showed low rates of under-reporting. There was no difference in self-reported 6-month prolonged abstinence measured at week 30.

Conclusion. Providing personalized smoking cessation messages as part of a general interest online college life magazine increased 30-day abstinence by the end of this two semester intervention.

Introduction

Young adulthood is a critical transition period in cigarette use over the life course. Among adolescents who experiment with cigarettes, the young adult years are often associated with an escalation in cigarette consumption and the establishment of regular smoking (Kandel and Chen, 1995; Chassin et al., 1996; Orlando et al., 2004). Several studies have also raised concerns regarding increased initiation of smoking among young adults (Wechsler et al., 1998; Rigotti et al., 2000; Husten, 2007). In a recent study, Tercyak et al. found that 25% of individuals who reported never smoking in high school had initiated smoking by 1 year later (Tercyak et al., 2007).

Encouraging cessation among young adults is a national health priority. Smokers who quit before the age of 30 avoid much of the harm related to cigarette use (Doll et al., 2004). Unfortunately, smokers under this age appear to be less likely to quit compared to older smokers (Lee et al., 2007). Recent work by Curry et al. offers some explanation for this finding (Curry et al., 2007). While young adult smokers are more likely to make attempts to quit compared to older smokers, they are less likely to use effective assistance when doing so. Studies of cessation programs designed for young adults have shown mixed results. Quinlan and McCaul found no benefit to providing stage-matched manuals to college smokers (Quinlan and McCaul, 2000). Ames et al. found no benefit to an expressive writing intervention (Ames et al., 2005). Travis and Lawrence found that providing stage tailored booklets increased abstinence at 3 months (Travis and Lawrance, 2004). Prokhorov et al. found that providing computerized feedback on "lung age" showed a marginal trend toward increased quit rates (Prokhorov et al., 2003). In a sub-analysis, Rabius et al. found an increase in short-term abstinence among young adult smokers receiving phone counseling (Rabius et al., 2004). Additional work is clearly needed to develop attractive and effective programs to help young people to quit smoking.

The internet is a promising channel to improve delivery of smoking cessation services to young adults. A growing body of literature

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supports a modest effect from online cessation programs. Schneider et al. found an improvement in abstinence at 3 months from providing personal stop smoking tips and an online discussion group (Schneider et al., 1990). Etter found that a more vs. less tailored online program increased quitting and helped maintain short-term abstinence (Etter, 2005). Swartz et al. found that providing tailored online cessation videos increased abstinence at 3 months (Swartz et al., 2006). Munoz et al. compared results from four studies and concluded that individualized email reminders increased abstinence rates (Munoz et al., 2006). Pike et al. found a modest benefit to interactive sites with higher vs. lower utilization (Pike et al., 2007). Strecher et al. found significantly higher abstinence rates resulting from tailored vs. untailored online feedback among individuals who purchased nicotine patches (Strecher et al., 2005). While these results are encouraging, it must be noted that none of these studies focused specifically upon young adult smokers.

We report here the results of the RealU study, a randomized trial testing a web-assisted cessation intervention for college smokers. The primary objective of this study was to determine if an online intervention with college smokers could increase self-reported 30-day abstinence rates at the end of a two semester intervention. While smoking rates are higher for young adults who do not attend college (Green et al., 2007; Solberg et al., 2007), college and universities in the U.S. enroll over 14 million students and are therefore an important venue to reach out to a large number of young adult smokers (U.S. Census, 2006). A novel feature of the RealU intervention is that cessation messages were delivered as part of a general interest online college life magazine rather than in a more narrowly focused smoking cessation website.

Methods

Setting

This study was conducted at the University of Minnesota (UM) Twin Cities (Fall 2004 undergraduate enrollment 28,740, prevalence of past 30-day cigarette use on campus was 26.6%) (Lust, 2005). All study procedures were reviewed and approved by the University of Minnesota's Institutional Review Board.

Participant recruitment and randomization

Study recruitment occurred via internet health screening in October 2004 and is described in detail elsewhere (An et al., 2007). A random sample of 25,000 UM undergraduates was invited by email to complete a 46-item online health screening survey. Respondents were eligible for this study if they 1) smoked cigarettes in the past 30 days, 2) were age 18 or older, and 3) indicated that they intended to be in school for the next two semesters. All eligible individuals identified on the health screening survey were then asked to complete a 90-item online baseline survey (with a $10 gift card as compensation) prior to study enrollment. Participants who completed the baseline survey and provided online consent were enrolled and randomized in real time following a blocked random number sequence generated by the study statistician. Neither participants nor investigators could be blinded as to group assignment.

Control and intervention conditions

Participants randomized to the control group received a confirmation email containing links to online health and academic resources (QuitNet.com smoking cessation website, UM Boynton Student Health Services website, UM student academic services website). In April 2005, the University Health Service also sponsored a campus-wide Quit & Win. For this contest, students who smoked signed up (in-person or online) to go smoke-free for the month of April for the chance to win a $3000 prize. This contest was promoted using advertisements in the student newspaper, campus posters, direct mail and email to all university students. Students were informed that smoking status of prize winners would be verified through the testimony of a smoke-free friend and through urine cotinine testing.

Participants randomized to the RealU intervention group were asked to make 20 weekly visits to the study website over a 30-week period (no visits during Thanksgiving, Winter, or Spring breaks or final exams). The development of RealU intervention strategies was based upon social cognitive (Bandura, 1986) and problem behavior theory (Jessor, 1991) and is described elsewhere (An et al., 2006). At the start of each week participants received an email invitation to visit the study website to 1) report on health and lifestyle habits for the prior week (e.g. days smoking, drinking, stress, etc.), 2) take an interactive quiz with tailored feedback to learn about a smoking-related (e.g. nicotine dependence) or general interest topic, then 3) view a student authored general interest online college life magazine (four to five articles with at least one article addressing smoking/quitting in college). Participants received a $10 gift card each week for completing these study activities. Smoking cessation content and messages were introduced gradually over the intervention period. For example, only one interactive quiz in the first 5 weeks explicitly addressed smoking while four of the final five quizzes did so. Participants were encouraged to take weeklong "breaks" from smoking throughout the intervention period but were not asked to quit for a longer time until the final month of the intervention (April 2005). The intervention site actively promoted the campus-wide Quit & Win contest and included links to the online sign-up for this contest.

Intervention group participants also received weekly emails written by one of nine peer coaches. Email message content was based upon templates developed by study investigators and personalized by peer coaches using information provided by participants during their weekly visits to the website. Participants were encouraged to write back to peer coaches through the use of eight "Question of the Week" contests. Topics for the Question of the Week encouraged participants to think about reasons for quitting (e.g. What are some of the best things about not smoking cigarettes?) or identify smoking triggers and coping strategies (e.g. When are you tempted to smoke? What can you do instead of smoking?). Individuals who wrote back to their peer coach during these contests were entered into a drawing for a $50 prize. Email exchanges occurred through a confidential nickname-based study email program that prevented viewing of actual email addresses and allowed central monitoring of all message content.

Evaluation and measurement

Baseline measures included participant demographic and smoking-related characteristics. Nicotine dependence was assessed by asking participants to report the time to first morning cigarette (Haddock et al., 1999). Given the high proportion of non-daily smokers, we also administered the Hooked on Nicotine Checklist (HONC) that was first developed to assess the loss of autonomy over cigarette use among younger adolescents (DiFranza et al., 2002; Wellman et al., 2005). Other measures included proportion of friends smoking, readiness to quit, recent quit attempts, and prior use of pharmacological (e.g. nicotine patch, nicotine gum, nicotine lozenge, Zyban or bupropion) or behavioral (e.g. in-person counseling, phone counseling, smoking cessation website) assistance in quitting.

Smoking outcomes were determined by online surveys 8, 20, and 30 weeks after enrollment. The week 30 evaluation occurred 1 week after the end of the campus-wide Quit & Win contest and followed the email announcement of contest winners. A $10 gift card was offered as compensation to all survey respondents. The primary outcome was a self-reported 30-day abstinence at week 30. Individuals who reported 30-day abstinence at the final evaluation were offered $50 to complete an in-person exit interview during which exhaled carbon monoxide (CO) was measured using standardized techniques with a Bedfont Micro II® Smokerlyzer device. A cut-off of 8 pper m was used as the definition of CO confirmed abstinence (Jarvis et al., 1987; Sato et al., 2003). Secondary outcomes were 7-day point prevalent abstinence at 8, 20, and 30 weeks, and quit attempts. At the 30-week evaluation, study participants were also asked to report the duration since they last smoked cigarettes (even a puff). This information was used to calculate the prevalence of a 6-month prolonged abstinence measured at the 30-week evaluation. This corresponds to individuals quitting and maintaining abstinence from week four through the end of the study. Secondary measures among continuing smokers included the frequency of smoking and readiness to quit. Process measures included use of assistance in quitting. A sample size of 250 participants per group provides an 85% power to detect a 12% absolute difference in abstinence rates between the treatment groups (i.e. control 20% vs. intervention 32%, two-sided alpha=0.05).

Statistical analysis

Logistic regression modeling was used to compare the rates of 30-day and 7-day abstinence with and without adjustment for participants' baseline characteristics. Analysis was by intention-to-treat with all non-respondents classified as continuing smokers. Participation in the campus-wide Quit & Win contest was examined as a possible mediator of intervention effects by including Quit & Win participation as an indicator variable in logistic regression models. Examination of possible moderators of intervention effects was performed using logistic regression by including a first-level interaction between intervention group and candidate moderator variables (Baron and Kenny, 1986; Frazier et al., 2004).

Results

Participants

The flowchart for the evaluation of study participants is shown in Fig. 1. An email invitation to 25,000 undergraduates led to the completion of 6492 screening surveys (26% response rate). Of the respondents, 1857 reported smoking in the prior 30 days (29% prevalence) of whom 1618 (87%) were study eligible. Reasons for ineligibility were age less than 18 ($n=8$) or greater than 24 ($n=126$) or the intention to leave school before completion of the academic year

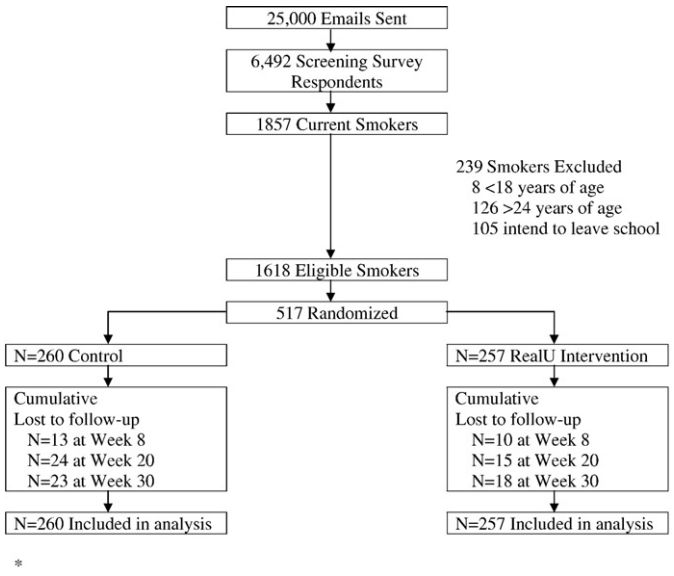

Fig. 1. Study flow, University of Minnesota Twin Cities, 2004–5.

(n=105). Among eligible smokers, 517 (32%) completed the baseline survey and enrolled in the study with 260 randomized to the control condition and 257 randomized to the intervention condition. No individuals withdrew from the study. Follow-up survey response rates exceeded 90% and did not differ between the groups at any time point.

Baseline characteristics

Study groups were similar in terms of demographic and smoking-related characteristics (Table 1). Only a small difference in age between the study groups (control 19.8 (SD 1.6) years vs. intervention 20.1 (SD 1.6) years, p=0.03) was statistically significant. The majority of the participants were occasional and light smokers (mean smoking 14.1 (SD 11.8) days in the prior 30 days) and reported smoking their first cigarette more than 1 h after waking in the morning.

Delivery of intervention

The weekly check-in and interactive quiz were linked during each weekly visit to the RealU website. Participants in the intervention group completed the weekly check-in and interactive quiz at an average of 18.9 (SD 2.5) times during the 20 active weeks of the study. Among intervention group participants, 227 (88%) completed these tasks at least 18 of the 20 weeks while 172 (67%) visited every week. Viewing of the online magazine content was not tracked at the individual level. Hits to this portion of the website averaged 1038 (SD 371) per week from 149 (SD 47.8) unique IP addresses. These results suggest some drop off in participation from the check-in and quiz to the viewing of magazine content. In response to weekly peer coach emails, participants wrote back to their peer coach an average of 4.6 (SD 3.6) times (range 0–15) over the course of the intervention. Thirty-seven participants (14%) did not write back on any occasion. Twenty-one participants (8%) wrote back only once, 60 (23%) wrote back 2–3 times, 69 (27%) wrote back 4–6 times, and 70 (27%) wrote back 7 or more times.

Smoking outcomes

Results for self-reported 7-day and 30-day abstinence are presented in Table 2. At week 30, 40.5% of individuals in the RealU intervention group (104/257) reported not smoking any cigarettes in the prior 30 days compared with 23.1% (60/260) in the usual care group (odds ratio (OR) 2.26, 95% confidence interval 1.55–3.32). There was no difference between the study groups in the rate of self-

Table 1
Characteristics of study participants, University of Minnesota Twin Cities, 2004–5

	Control (N=260)	RealU (N=257)	p-value
Demographic characteristics			
Mean age (SD)	19.8 (1.6)	20.1 (1.6)	0.03
Female (%)	196 (75.4)	181 (70.4)	0.21
Year in school (%)			0.56
Freshman	80 (30.8)	67 (26.1)	
Sophomore	64 (24.6)	63 (24.5)	
Junior	67 (25.8)	68 (26.5)	
Senior	49 (18.9)	59 (23.0)	
Non-white (%)	24 (9.2)	20 (7.8)	0.56
Employment (%)			0.85
Not working	84 (32.3)	81 (31.6)	
Part-time	159 (61.2)	161 (62.9)	
Full-time	17 (6.5)	14 (5.5)	
Residence (%)			0.48
Dormitory	84 (32.3)	71 (27.6)	
Fraternity/sorority	9 (3.5)	10 (3.9)	
With parent	15 (5.8)	22 (8.6)	
House/apartment	152 (58.5)	154 (60.0)	
Internet use (%)			0.38
1–5 days/week	26 (10.0)	32 (12.5)	
6–7 days/week	233 (90.0)	225 (87.6)	
Online per day (%)			0.64
<15 min	17 (6.5)	13 (5.1)	
15–30 min	65 (25.0)	56 (21.8)	
31–60 min	94 (36.2)	98 (38.1)	
61–120 min	43 (16.5)	53 (20.6)	
>120 min	41 (15.8)	37 (14.4)	
In past 30 days			
Mean days any alcohol (SD)	8.4 (5.8)	8.3 (6.0)	0.82
Mean days 5 or more drinks (SD)	4.8 (4.4)	4.6 (4.4)	0.79
Smoking- Rrelated characteristics			
Average days smoking past 30 days (SD)	14.7 (11.8)	13.4 (11.8)	0.21
Number of days smoking past 30 days (%)			0.67
1–4 days	87 (33.5)	97 (37.7)	
5–10 days	40 (15.4)	42 (16.0)	
11–20 days	37 (14.2)	35 (13.6)	
21–30 days	96 (36.9)	83 (32.3)	
Average cigarettes on smoking days (SD)	4.2 (5.0)	3.8 (4.7)	0.36
Number of cigarettes on smoking days (%)			0.21
1–2 cigarettes	144 (55.4)	134 (52.1)	
3–5 cigarettes	56 (21.5)	75 (29.2)	
6–10 cigarettes	35 (13.5)	29 (11.3)	
>10 cigarettes	25 (9.6)	19 (7.4)	
Time to first morning cigarette			0.96
<30 min	23 (9.5)	21 (8.9)	
31–60 min	27 (11.2)	25 (10.6)	
>60 min	192 (79.3)	189 (80.4)	
Age of 1st use (%)			0.38
12 or less	45 (17.6)	33 (13.2)	
13–15	87 (34.0)	80 (31.9)	
16–17	73 (28.5)	75 (29.9)	
18 or older	51 (20.0)	63 (25.1)	
HONC Score[a] (SD)	3.7 (3.3)	3.4 (3.3)	0.27
Proportion smoking friends (%)			0.48
None	16 (6.5)	19 (7.5)	
Few	92 (35.4)	104 (40.1)	
Half	70 (26.9)	57 (22.4)	
Most	43 (16.5)	45 (17.7)	
All/nearly all	39 (15.0)	30 (11.8)	
Live with smoker (%)			0.33
Live alone	17 (6.5)	26 (10.2)	
No	124 (47.7)	118 (46.1)	
Yes	119 (45.8)	112 (43.8)	
Intention to quit (%)			0.72
Not next 6 months	66 (25.5)	70 (27.5)	
In next 6 months	133 (51.4)	133 (52.2)	
In next 30 days	60 (23.2)	52 (20.4)	
Quit attempts past year (%)	136 (52.9)	120 (46.9)	0.17
Prior use of pharmacotherapy (%)	23 (8.9)	17 (6.6)	0.34
Prior use of behavioral programs (%)	17 (6.5)	16 (6.2)	0.88

[a] Hooked on Nicotine Checklist Score range 0–10.

reported prolonged abstinence of 6 or more months measured at the 30-week evaluation point (6% overall).

Participation with CO testing was not different between the groups (control 46/60, 76.7% vs. intervention 88/104, 84.6%, $p=0.21$) and very few individuals recorded a CO greater than 8 ppm (control 2/46, 4.5% vs. intervention 3/88, 3.4%, $p=0.79$). Among all study participants, there was a higher rate of CO validated abstinence among those in the intervention (85/257, 33.1%) compared to those in the control group (44/260, 16.9%, OR 2.43, 95% CI 1.60–3.68).

Among individuals who reported smoking in the prior 30 days at the end of the study (control $n=168$, intervention $n=126$), there was a greater decrease in the number of days smoking from baseline to the final evaluation for intervention (from 18.1 to 12.3 days/month, difference — 5.8 days) compared to control participants (from 16.6 to 14.9 days/month, difference — 1.7 days, $p=0.001$). There was no difference between the study groups in the average number of cigarettes smoked on these smoking days. Among continuing smokers, readiness to quit also increased so that by the final evaluation 51% of continuing smokers in the intervention group (64/126) reported intending to permanently stop smoking in the next 30 days compared to 27% of continuing smokers in the control group (46/168, $p<0.001$).

Results for quit attempts and use of assistance in quitting are shown in Table 3. Intervention group participants were more likely to report taking breaks from smoking of 1 week or longer. A small increase in the use of behavioral programs was primarily due to a greater use of other stop smoking websites in the intervention compared to the control group.

Participation in the campus-wide Quit & Win contest was substantially higher in the intervention group (91/239, 38%) compared to the control group (29/237, 12%, $p<0.001$). Inclusion of Quit & Win participation in a logistic regression model as a potential mediator of RealU intervention effects demonstrates that increased participation in Quit & Win accounted for some but not all of the increased abstinence in the RealU group. In this model, both participation in Quit & Win (OR 2.98, 95% CI 1.90–4.67) and randomization to the RealU intervention group (OR 1.76 95% CI 1.16–2.66) were significant independent predictors of 30-day abstinence at week 30. The interaction term between intervention group and Quit & Win participation was not significant.

We examined potential moderators of intervention effects using a series of logistic regression models including an interaction term between intervention group and participants' baseline characteristics (e.g. age, gender, year in school, readiness to quit, days smoking at baseline, days binge drinking at baseline, time to first morning cigarette). While significant main effects were found for baseline number of days smoking (OR for 30-day abstinence at week 30=0.92, 95% CI 0.91–0.95 for each additional day of smoking at baseline), number of days binge drinking (OR=0.92, 95% CI 0.88–0.97 for each additional episode of binge drinking), and time to first morning cigarette (OR=3.05, 95% CI 1.65–5.62 for individuals smoking greater than 1 h after waking vs. less than 1 h), none of the interaction terms were significant suggesting there was no difference in the efficacy of the RealU intervention related to these baseline characteristics.

Table 2
Self-reported abstinence rates at 8, 20, and 30 weeks, University of Minnesota Twin Cities, 2004–2005

	Control ($N=260$)	RealU ($N=257$)	Unadjusted odds ratio	Adjusted odds ratio[a]
7-day abstinence	*N* (%)	*N* (%)		
Week 8	65 (25)	110 (42.8)	**2.24 (1.54–3.26)**	**2.36 (1.62–3.45)**
Week 20	86 (33.1)	108 (42.0)	**1.47 (1.03–2.10)**	**1.53 (1.06–2.20)**
Week 30	100 (38.5)	152 (59.1)	**2.32 (1.63–3.30)**	**2.43 (1.70–3.48)**
30-day abstinence	*N* (%)	*N* (%)		
Week 8	42 (16.2)	41 (16.0)	0.99 (0.62–1.58)	1.03 (0.64–1.66)
Week 20	51 (19.6)	62 (24.1)	1.30 (0.86–1.98)	1.34 (0.88–2.04)
Week 30	60 (23.1)	104 (40.5)	**2.26 (1.55–3.32)**	**2.31 (1.58–3.40)**

Bold values indicate that the specific 95% confidence interval does not cross 1.0 (i.e. OR is statistically different from 1.0).
[a] Adjusted for baseline difference in age.

Table 3
Quit attempts and use of assistance with quitting, University of Minnesota Twin Cities, 2004–5

	Control	RealU	*p*-value
Breaks from smoking (%)	$N=236$[a]	$N=232$[a]	0.006
None	123 (52.1)	86 (37.1)	
1	33 (14.0)	58 (25.0)	
2	23 (9.8)	30 (12.9)	
3	14 (5.9)	15 (6.5)	
4 or more	43 (18.2)	43 (18.5)	
Quit attempts (%)	$N=235$	$N=238$	0.43
None	119 (50.6)	101 (42.4)	
1	40 (17.0)	50 (21.0)	
2	28 (11.9)	34 (14.3)	
3	10 (4.3)	14 (5.9)	
4 or more	38 (16.2)	39 (16.4)	
Used any pharmacotherapy	$N=237$	$N=239$	
Yes (%)	24 (10.1)	27 (11.3)	0.68
Used any behavioral programs	$N=237$	$N=239$	
Yes (%)	14 (5.9)	33 (13.8)	0.004
Joined Quit & Win	$N=237$	$N=239$	
Yes (%)	29 (12.2)	91 (38.1)	<0.001

[a] Number of participant changes due to item non-response.

Discussion

This study showed that providing a web-based cessation intervention as part of an online college life magazine increased rates of 7-day abstinence throughout the intervention period and increased 30-day abstinence by the end of the academic year. In addition to demonstrating the feasibility of internet health screening as a recruitment strategy, this study also identified promising strategies (e.g. incorporation of general interest content, online peer support, weekly incentives) to increase adherence to online health promotion interventions.

The abstinence rates reported for the intervention and control groups in this study were higher than that typically found in studies that enroll older smokers. The high rate of occasional smoking at baseline likely contributed to this finding. These findings are also consistent with the results of the Hooked on Nicotine Checklist reported by participants which was higher than seen among adolescents with limited prior exposure to tobacco but much lower than that reported for established adult smokers (DiFranza et al., 2002; Wellman et al., 2005). The reported abstinence rates in the control group are also consistent with declines in cigarette use, particularly among occasional smokers, reported in observational studies of college students (Wetter et al., 2004; Kenford et al., 2005; Colder et al., 2006).

The increase in 30-day but not 6-month prolonged abstinence rates (both measured at 30 weeks after enrollment) resulting from the intervention is not surprising given the inclusion of participants who had no immediate plans to quit. The gradual introduction of smoking cessation content over the course of the intervention and the initial emphasis on encouraging shorter “breaks” from smoking rather than prolonged abstinence may have also contributed to this finding. Future studies with an earlier emphasis on abstinence and/or longer term follow-up after the intervention period would be valuable.

Study limitations

There are several limitations to consider when interpreting the results of this study. First, it is important to acknowledge that this study was conducted upon a single campus and it is likely that there was some level of contamination between the study groups. Contamination may have been limited in this case by the size of the campus and the relative low proportion of all student smokers (i.e. estimated at 7% based upon survey response, eligibility, and enrollment) that enrolled in this study.

Unfortunately, we did not have any means of preventing study participants in the intervention group from sharing tobacco-related information with members of the control group nor are we unable to quantify the degree of contamination that occurred in this study. Future studies should consider an explicit assessment of contamination and/or campus-randomized designs to address this issue.

Second, it is important to note that this study tested a multi-component intervention (weekly self-monitoring of behavior, interactive quizzes with tailored feedback, online magazine format, peer email support) vs. control and it is therefore not possible to ascertain the relative contribution of each intervention component. Further studies with multiple arms are needed to identify the contribution of different intervention components.

Third, it is clear that the carbon monoxide testing performed here is an insensitive measure of occasional smoking (Dolcini et al., 2003). Cotinine measurement may also be of limited value for very occasional smokers (Benowitz, 1983). Future studies interested in biochemical assessment may consider the measurement of tobacco specific carcinogens which persist for longer periods of time (Hecht et al., 1999).

In addition, this study used a high level of incentives ($10 per week per participant) to encourage adherence. While it is reassuring to note that provision of incentives was not tied to participants' report of smoking status, gratification at receiving weekly incentives in the intervention group and conversely disappointment at not receiving weekly incentives in the control group could have influenced abstinence outcomes. This high level of incentives also poses a barrier to broader dissemination efforts. Future studies might examine how lower levels of incentives, alternative incentive structures (e.g. prize drawings), or non-monetary incentives (e.g. video or music downloads) influence adherence and intervention effects.

Finally, this intervention was tested on just one campus with a predominantly white undergraduate population. Follow-up studies involving multiple campuses with more diverse student bodies would be of great interest. Also, a relatively unique feature of the campus environment in this study was the occurrence of a campus-wide Quit & Win contest. The presence of these incentives raises the question of whether it was the online intervention or the financial incentives that increased short-term quit rates. While our subsequent analyses suggest that increased participation in this contest contributed to some but not all of the observed intervention effects, future randomized studies are needed to more clearly identify the independent effects of these different factors.

Conclusion

The RealU study demonstrates that providing an online multi-component smoking cessation intervention with financial incentives to participate is feasible and increases short-term abstinence rates during program participation among college smokers. Yet more innovative work is needed to improve long-term quit rates and to determine efficacy in the context of lower cost incentives. Additional work is also needed to determine if similar approaches would be effective among higher risk groups of young adults, such as those not attending college, who may also be less frequent internet users.

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