

ORIGINAL INVESTIGATION

Long-Term Efficacy of *Click City*[®]: Tobacco: A School-Based Tobacco Prevention Program

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ABSTRACT

Introduction: *Click City*[®]: Tobacco is an innovative, computer-based tobacco prevention program designed to be implemented in 5th-grade classrooms with a booster in 6th grade. The program targets etiological mechanisms predictive of future willingness and intentions to use tobacco and initiation of tobacco use. Each component was empirically evaluated to assure that it changed its targeted mechanism. This paper describes long-term outcomes for students who participated in a randomized controlled efficacy trial of the program.

Methods: A total of 26 middle schools were stratified and randomly assigned to the *Click City*[®]: Tobacco program or Usual Curriculum. The 47 elementary schools that fed into each middle school were assigned to the same condition as their respective middle school. In *Click City*[®]: Tobacco schools, 1,168 students from 24 elementary schools and 13 middle schools participated. In Usual Curriculum schools, 1,154 students from 23 elementary schools and 13 middle schools participated. All participating students completed baseline, post-6th grade program, and 7th grade assessments.

Results: As compared to students in schools that continued with their usual curriculum, intentions and willingness to smoke increased less from baseline to 6th grade and from baseline to 7th grade, among students in schools that used the *Click City*[®]: Tobacco curriculum. Changes in mechanisms were also in the expected direction. The program was particularly efficacious for at-risk students.

Conclusions: Results provide evidence to support the long-term efficacy of *Click City*[®]: Tobacco. Program development, based on an empirical evaluation of each component, most likely played a role in the success of the program.

INTRODUCTION

Despite a general downward trend in smoking among adolescents over the past decade, the prevalence of tobacco use among youth continues to be problematic in the United States (Johnston, O'Malley, Bachman, & Schulenberg, 2012). According to the 2011 Monitoring the Future Study (Johnston et al., 2012), the 30-day prevalence of smoking for 8th graders was 6.1%, and that of 12th graders was 18.7%, which is approaching that of the general population. Findings from epidemiological studies (Andrews, Tildesley, Hops, Duncan, & Severson, 2003; Harrell, Bangdiwala, Deng, Webb, & Bradley, 1998) show that the use of tobacco increases dramatically between elementary and middle school (ages 9–13). These data suggest that a tobacco prevention intervention program would be optimally delivered prior to the increase in tobacco use onset. Therefore, we developed and evaluated the efficacy of a tobacco prevention program, *Click City*[®]: Tobacco to be

delivered in schools in the 5th grade, with 6th grade booster sessions.

The *Click City*[®]: Tobacco program was designed to change etiological mechanisms, that is, risk factors or processes, theoretically contributing to behavioral intentions and willingness to use tobacco. The ultimate goal of the program was to delay or prevent the initiation of tobacco use among children or early adolescents. Behavioral intentions are theorized to be the first step in smoking initiation (Pierce, Choi, Gilpin, Farkas, & Merritt, 1996), and a recent meta-analysis (Webb & Sheeran, 2006) indicates that changing intentions lead to changing of the related behavior. Willingness measures openness to risk-associated opportunities (Gibbons, Houlihan, & Gerrard, 2009), such as tobacco use, and are less playful than intentions. Both intentions and willingness to use tobacco increase developmentally across adolescence (Hampson, Andrews, & Barckley, 2007) and have been shown to be predictive of subsequent tobacco use (Andrews, Hampson,

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& Barckley, Gerrard, & Gibbons, 2008; Gerrard et al., 2006). Since few children smoke cigarettes more than experimentally by 6th or 7th grade, these outcomes were more suitable for these young children (Andrews et al., 2011).

Etiological mechanisms included health cognitions and risk perceptions. Targeted mechanisms included those based on the “prototype/willingness” model of Gibbons and Gerrard (1997; Gibbons, Kingsbury, & Gerrard, 2012), which emphasizes the importance of prototypes or social images and descriptive norms, beliefs regarding the prevalence of peer smoking, as predictors of intentions and willingness (Andrews, Hampson, Barckley, et al., 2008; Sherman, Presson, Chassin, Corty, & Olshavsky, 1983), and those based on the Theory of Planned Behavior and the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Ajzen, 1988). According to Theory of Planned Behavior and Theory of Reasoned Action, normative beliefs are a major predictor of intentions to engage in a behavior. Normative beliefs are an individual’s perception of others’ behaviors, thoughts, or feelings. Thus, these normative beliefs include not only descriptive norms but also normative social images, which are defined as the perception of the favorability of peers’ social images of smokers (Andrews, Hampson, & Barckley, 2008). Mechanisms based on risk perception and decision research theories included risks of short- and long-term health consequences, risks of exposure to secondhand smoke, and risk of addiction. Component development targeting these mechanisms was guided by the “affect heuristic” proposed by Slovic (Benthin, Slovic, & Severson, 1993; Slovic, 2000; Slovic, 2001; Slovic, Peters, Finucane, & MacGregor, 2005), which shows an inverse relation between perception of risk and positive affect toward a product, optimism bias (Weinstein, 1998), which suggests that individuals, including adolescents (Quadrel, Fischhoff, & Davis, 1993), believe that risk of harm is higher in others than in themselves, and the perception that risks are cumulative (Diamond, 1990). Some of these mechanisms (e.g., descriptive norms) have been targeted in effective school-based social influence tobacco prevention programs (Botvin & Griffin, 2007; Sussman et al., 1993;

Sussman, 2001). A more complete description of the theoretical basis for the components of *Click City*[®]: *Tobacco* is given in a previous publication (Andrews et al., 2011).

Description of *Click City*[®]: *Tobacco*, Component Evaluation, and Short-Term Efficacy

Click City[®]: *Tobacco* is an interactive, computer-based program that is delivered in the classroom. The program consists of eight sessions delivered in 5th grade and two booster sessions in 6th grade. A complete description of the 21 activities and 17 evaluated components, within the 5th grade program, is provided in the study by Andrews et al. (2011). The description of the seven activities and five evaluated components, for the 6th grade booster session, is shown in Table 1.

As part of the development process, all components (consisting of one or two activities) were empirically evaluated to ensure change in one or more targeted etiologi cal mechanisms (Andrews et al., 2011; MacKinnon, Taborga, & Morgan-Lopez, 2002). Only components that were effective in changing the targeted mechanism(s) were retained in the final program. Andrews and colleagues (2011) reported on the short-term efficacy of the 5th grade program. They showed that the 5th grade program changed behavioral intentions and willingness to use tobacco, as well as the targeted etiologi cal mechanisms from baseline to immediately following the 5th grade program.

Evaluation of Long-Term Efficacy

Long-term efficacy was assessed by comparing students in schools that had implemented the *Click City*[®]: *Tobacco* curriculum in 5th grade with students in schools that continued with their usual tobacco education (Usual Curriculum schools). In this paper, we present data from the baseline (T1), 6th grade (T3), and 7th grade (T4) assessments. The T1 assessment occurred 1 week prior to implementing the 5th grade *Click City*[®] program, the T3 assessment occurred 1 week following the 6th grade booster (approximately 1 year following the 5th

Table 1. Activities Included in the *Click City*[®]: *Tobacco* 6th-Grade Booster

Activity/mechanism	Description
Classmates II/descriptive norms; normative social images	Students estimate their classmates’ responses to a confidential survey asking about tobacco use, intentions, and social images. They compare their estimates with how their classmates actually responded to counteract overestimation bias.
Addiction 201/risk of addiction	Students visit the addiction lab where they watch experiments demonstrating four aspects of addiction (including physical and mental addiction).
Addiction Road/risk of addiction	Students race a car and try to avoid cigarettes. They find that they cannot avoid addiction, once they have their first cigarette. They see testimonials from smokers who want to quit.
Mystery game/risk of consequences from secondhand smoke	Students solve a mystery and find out the consequences of exposure to secondhand smoke.
Dr. Time/risk of long-term consequences; cumulative risk	Students visit a clinic where they examine patients and make a diagnosis regarding their health problems based on the amount of time they have smoked. They learn that the longer they smoke, the more health problems can occur.
Make a friend/social images; normative social images	Student makes a friend who is similar to themselves. They do various activities with their friend, meet other kids who smoke, and discuss that kids who smoke are not exciting or cool.
Scavenger hunt/a review activity	Students use clues to find locations on maps and hear messages reinforcing the concepts from the previous lessons.

grade program), and the 7th grade assessment occurred 2 years following the 5th grade program.

We hypothesized that the short-term effects shown in 5th grade (reviewed in Andrews et al., 2011) would be maintained by the booster, and that these effects would be maintained through the 7th grade. Thus, we hypothesized a significant difference in outcome variables between T1 and T3 and between T1 and T4, as a function of the intervention. While we assessed tobacco use in 7th grade, the prevalence among all students was low. Thus, our primary outcomes were intention and willingness to use tobacco.

Click City[®]: Tobacco was designed as a universal prevention program and was expected to be implemented with all students within a school. However, to assure that the program was effective with students who were high in sensation seeking, programs were designed with an emphasis on the engagement of these youth. In addition, we evaluated the long-term efficacy of the program for those students expected to be “at risk” as compared to those “not at risk” (Griffin, Botvin, Nichols, & Doyle, 2003). Based on the literature, we defined “at-risk” students as having family members who smoked (Andrews, Hops, & Duncan, 1997; Bricker et al., 2007), being high in sensation seeking (Urbán, 2010), and trying cigarettes prior to the first assessment (Maggi, Hertzman, & Vaillancourt, 2007). In addition, since social influence variables may be stronger predictors of tobacco initiation for girls than boys (e.g., Andrews, Hampson, Barckley, et al., 2008), we assessed moderation of the long-term efficacy of *Click City[®]: Tobacco* by gender.

METHODS

Design of the Efficacy Trial

The trial took place in 47 elementary and 26 middle schools in three counties in Western Oregon. The 26 recruited middle schools were stratified according to school type (i.e., grades 6–8 or K–8), size of school (average size 432; range 127–719), and socioeconomic status of the population served (as assessed by proportion of students who met or exceeded reading and literature benchmarks and proportion of students who qualified for free and reduced lunch). We randomly assigned middle schools to receive either the intervention (*Click City[®]*) or to continue with their usual curriculum (Usual Curriculum). Usual Curriculum middle schools did not differ from *Click City[®]* middle schools on either proportion of students that met or exceeded reading and literature benchmarks (*Click City[®]*: 73.65; Usual Curriculum: 73.65; $t(24) = 1.18$; nonsignificant [ns]) or proportion with free and reduced lunch (*Click City[®]*: 46.54; Usual Curriculum: 42.31; $t(24) = -0.60$; ns). All participating elementary schools that fed into each respective middle school were automatically assigned to the same condition as that middle school. Thus, students who received the intervention in elementary school were likely to receive the intervention in middle school. Pairs of schools across conditions were matched to assure similar timing of assessments across the 2-year data collection period.

Participants

In *Click City[®]* schools, 1,168 students from 24 elementary and 13 middle schools participated. In Usual Curriculum schools,

1,154 students from 23 elementary and 13 middle schools participated. A complete description of demographic and tobacco use characteristics of the sample is provided in the study by Andrews et al. (2011). Students in *Click City[®]* schools did not differ from students in Usual Curriculum schools on intention to smoke or chew, willingness to smoke, having a family member who smoked, or having previously tried smoking. However, students in *Click City[®]* schools were more likely to be African American (3.7% vs. 2.4%; $\chi^2 [1, n = 2,157] = 3.25, p < .10$) than were students in Usual Curriculum schools.

Among students who completed the baseline assessment in *Click City[®]* schools, 67.4% ($n = 787$) completed the 6th grade assessment and 64.7% ($n = 756$) completed the 7th grade assessment. Among students who completed the baseline assessment in Usual Curriculum schools, 75.9% ($n = 876$) completed the 6th grade assessment and 69.7% ($n = 804$) completed the 7th grade assessment. Attrition was primarily due to student mobility, student’s not attending the middle school that their elementary school fed into, and one middle school with participating elementary feeder schools declining participation when students were in 6th grade. Students who did not complete the 6th or the 7th grade assessment were similar to those who did on gender, race/ethnicity, and sensation seeking. But those who did not complete the 7th grade assessment were significantly more likely to have tried smoking at baseline (8.8% vs. 3.1%; $\chi^2 [1, n = 2,322] = 35.63, p < .001$), and to come from a family where members smoked (46.8% vs. 37.0%; $\chi^2 [1, n = 2,322] = 20.51, p < .001$).

Procedures

The internal review board of Oregon Research Institute reviewed and approved the assessment process (IRB registration no. 00000278). A passive consent procedure was used to recruit students within schools since anonymity of students was assured. Parents of students were sent a letter and a postcard to return if they did not want their child to participate in the assessments. Across the 5th, 6th, and 7th grade, the rate of passive consent was 98%, 99%, and 98%, respectively.

Research staff set up networked, Microsoft Windows[®] laptops in *Click City[®]* schools, and assisted teachers and students during the first 1–2 sessions in the 5th grade and for the first session in the 6th grade. Assessments were completed by questionnaire by students in the classroom. Research assistants, who were not blind to the school’s experimental condition, answered questions and assisted students, as needed.

Measures

We conducted a pilot study to obtain reliability, stability (across two assessments, T1 and T2, 2-weeks apart), and validity of our measures (Andrews et al., 2011).

Primary Outcomes

(a) Behavioral intentions to smoke ($\alpha = 0.85$; $r_{T1T2} = 0.69$) and chew tobacco ($\alpha = 0.84$; $r_{T1T2} = 0.59$) in the future. Each was measured by two items assessing the likelihood of smoking (or chewing) as a teen and as an adult. The validity of this measure of intentions has been supported in numerous studies (e.g., Andrews et al., 2003; Andrews, Hampson, Barckley, et al., 2008); and (b) Willingness to smoke ($\alpha = 0.86$; $r_{T1T2} = 0.80$). Willingness was measured by the

likelihood of the occurrence of each of three behaviors (“try a few puffs,” “smoke the whole cigarette,” and “smoke one and take one for later”) in response to two scenarios (“with a group of kids and some were smoking” and “kids are smoking and you want to be part of the crowd”). This measure of willingness was prospectively related to tobacco use among youth (Andrews, Hampson, Barckley, et al., 2008). On the 7th grade assessment, students were also asked if they had smoked an entire cigarette.

Health Cognitions

(a) Descriptive norms (two items; $\alpha = 0.84$; $r_{T1T2} = 0.80$), measured by perception of prevalence of smoking among same-grade youth at their school and other schools. (b) Social images ($\alpha = 0.79$; $r_{T1T2} = 0.72$), measured by endorsement of five positive adjectives, such as “cool,” “popular,” and “exciting” describing what they “think kids who smoke are like”; (c) Normative social images (five items, $\alpha = 0.79$; $r_{T1T2} = 0.78$), measured by endorsement of positive adjectives describing what they “think other fifth grade kids think kids who smoke cigarettes are like.” The previous three measures have been shown to be both reliable and valid with similar age groups in the Oregon Youth Substance Use Project (Andrews et al., 2003).

Risk Perceptions of Health Consequences

(a) Risk of short-term consequences (five items; $\alpha = 0.89$; $r_{T1T2} = 0.63$; e.g., shortness of breath, yellow teeth) as a result of smoking over 2 years; (b) Perceived harm from smoking (five items; $\alpha = 0.65$), measured by agreement to items such as every cigarette “hurts their health”; (c) Risk of long-term consequences (12 items; $\alpha = 0.91$; $r_{T1T2} = 0.66$), measured by risk of disease (e.g., cancer, heart disease) as a function of increasing extent of smoking; (d) Risk of consequences from environmental tobacco smoke (five items; $\alpha = 0.87$; $r = 0.54$), measured by risk of health problems resulting from “being around a smoker a lot.”

Risk Associated With Addiction

(a) Risk of addiction (five items; $\alpha = 0.93$; $r = 0.45$), measured by perception of cumulative risk of “you” getting addicted from smoking varying quantities of cigarettes; (b) Optimism bias regarding risk of addiction, measured by subtracting perception of own addiction from perception of “teen” addiction (five items; $\alpha = 0.86$; $r_{T1T2} = 0.80$); (c) Perceived difficulty in quitting tobacco (five items; $\alpha = 0.84$; $r_{T1T2} = 0.61$), measured by perception of ease of quitting after smoking for varying lengths of time; and (d) Personal control over smoking (four items; $\alpha = 0.89$; $r_{T1T2} = 0.72$) assessed perceived control over varying lengths of time.

Moderators

(a) Family smoking, measured by parents’ and siblings’ current cigarette use ($r_{T1T2} = 0.81$); (b) Family chewing, measured by one question assessing current chewing of tobacco by a family member ($\phi_{T1T2} = 0.51$); (c) Trying smoking ($r_{T1T2} = 0.75$), assessed by report of age of first trying a cigarette versus never tried; and (d) Sensation seeking ($\alpha = 0.74$; $r_{T1T2} = 0.76$), measured using the Brief Sensation Seeking Scale (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002).

RESULTS

Analysis Strategy

The sample consisted of those who completed the baseline and/or the 6-week follow-up assessment in the 5th grade. This intent to treat approach maximized the 5th grade sample and assumed that all students who completed at least one assessment participated in the 5th grade intervention or completed their usual curriculum. Among these 2,322 students, 149 students missed the baseline assessment, 175 missed the 5th grade follow-up assessment, 659 did not complete the 6th grade assessment, and 762 did not complete the 7th grade assessment. Missing data were estimated using full information maximum likelihood methods.

Data were analyzed using a general linear mixed model with participants nested within school and schools nested within condition (i.e., a factorial analysis of variance design with nested factors; Winer, Brown, & Michels, 1991) using the Proc Mixed SAS procedure. Since schools were randomized to condition, both the school and the participant were random effects. Assessment period (time) was also included as a fixed effect. Race/ethnicity (African American vs. not) was included as a covariate due to baseline differences in race/ethnicity across conditions.

We examined the moderating effects of family smoking, previous experimentation with cigarettes, gender, and sensation seeking on the effect of the intervention on changes in intentions to smoke and use smokeless tobacco and on willingness to smoke through assessing the significance of the three-way interactions in the model (moderator \times condition \times time). For this analysis, we categorized sensation seeking into three groups: (a) high sensation seekers (+1 *SD* above the *M*); (b) low sensation seekers (–1 *SD* below the *M*); and (c) moderate sensation seekers (between +1 and –1 *SD*s from the *M*). For reasons of parsimony, we eliminated all three-way interactions, the associated two-way interactions, and the main effect of the moderator from each model, and then re-evaluated the model. We decomposed significant three-way interactions using simple interactions, assessing the interaction of condition with time for each risk group.

Correlations Among Outcome Variables

The correlation between intention to smoke and willingness to smoke in both the 6th grade and 7th grade was 0.71. The correlation between intention to smoke and intention to use smokeless tobacco was 0.63 in the 6th grade and 0.58 in the 7th grade.

Intraclass Correlations

We assessed the within-school intraclass correlations at the baseline assessment. Intraclass correlations of all outcomes and etiological mechanisms ranged from 0.001 to 0.03, with the exception of descriptive norms (0.10). Since this variable is a major predictor of behavior, the need for the analytic strategy (a nested design) was justified.

Outcomes

Intentions and Willingness

As shown in Table 2, although effect sizes (Cohen’s *d*) were small to moderate, the normative developmental increase in

Table 2. Means of Primary Outcomes and Etiological Mechanisms at Baseline (T1), 6th Grade (T3) and 7th Grade (T4) by Intervention Condition

Risk factors	Usual Curriculum				Click City®				T1-T3		T1-T4	
	T1	T3	T4	T4	T1	T3	T4	T4	F(1,46)	d	F(1,46)	d
Primary outcomes												
Intention to smoke	2.60	2.76	2.86	2.86	2.60	2.65	2.75	2.75	4.60*	0.08	3.96*	0.08
Intention to chew	2.26	2.39	2.41	2.41	2.26	2.31	2.39	2.39	2.69	0.08	.33	0.02
Willingness to smoke	6.47	7.11	7.63	7.63	6.57	6.97	7.33	7.33	4.99*	0.10	9.50**	0.15
Health cognitions												
Descriptive norms	7.16	9.00	10.23	10.23	7.39	9.31	10.29	10.29	0.65	0.03	1.76	0.06
Positive social images of smokers	7.78	7.56	7.89	7.89	7.84	7.06	7.55	7.55	27.84***	0.28	14.16***	0.19
Positive normative social images of smokers	8.18	8.39	8.84	8.84	8.41	7.69	8.53	8.53	63.21***	0.38	17.23***	0.21
Risk perceptions of health consequences												
Risk of short-term consequences	19.20	19.69	19.37	19.37	19.55	20.60	20.08	20.08	8.16**	0.15	2.80	0.09
Perceived harm from smoking	16.19	20.89	20.54	20.54	16.05	21.61	21.07	21.07	24.41***	0.29	14.33***	0.22
Risk of long-term consequences	42.16	40.70	39.72	39.72	42.17	41.75	40.59	40.59	11.27***	0.14	5.50*	0.13
Risk of consequences from environmental tobacco smoke exposure	16.34	16.08	15.86	15.86	16.23	18.45	17.06	17.06	159.84***	0.47	47.51***	0.32
Risk associated with addiction												
Optimism bias regarding addiction	8.54	4.73	4.31	4.31	8.80	2.75	2.62	2.62	46.79***	0.35	33.08***	0.31
Personal risk	10.03	13.32	13.38	13.38	9.91	15.76	15.26	15.26	75.65***	0.43	46.24***	0.35
Perceived difficulty in quitting	17.93	16.93	16.60	16.60	17.71	17.74	17.14	17.14	45.10***	0.32	19.74***	0.23
Perception of personal control over smoking	11.39	11.21	11.68	11.68	11.33	9.94	11.09	11.09	31.91***	0.32	9.08**	0.14

Note. F value and effect sizes are for the condition × time interactions.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Long-term efficacy of *Click City*[®]: Tobacco

willingness and intentions was significantly less among students who were in the *Click City*[®] schools than in students who were in Usual Curriculum schools. In addition, the effect of the program on willingness to smoke was larger in the 7th grade than in the 6th grade. There were no differences between conditions on intentions to chew tobacco.

Smoking

Among students who reported that they had tried cigarettes at baseline ($n = 115$), 16 (13.9%) had smoked an entire cigarette by 7th grade. Among these students, 10.7% ($n = 6/56$) of students in the *Click City*[®] schools had smoked an entire cigarette as compared to 16.9% ($n = 10/59$) of students in the Usual Curriculum schools ($\chi^2 [1, n = 115] = 0.93$; ns). For those who had not tried smoking prior to baseline, 3.9% (42/1,067) of students in the *Click City*[®] schools as compared to 2.6% (30/1,141) of students in the Usual Curriculum condition ($\chi^2 [1, n = 2,208] = 2.99$; ns) reported smoking an entire cigarette by 7th grade.

Etiological Mechanisms

A comparison of mechanisms across time, as a function of the intervention group, showed that, in general, change from baseline (T1) to 1-year follow-up (T3) was in the expected direction for the majority of targeted etiological mechanisms, and effect sizes remained significant but were slightly smaller over time (T1–T4). Change in descriptive norms did not vary as a function of intervention condition, and the intervention effect on change in short-term consequences decreased to nonsignificance at the 2-year follow-up (T4). A comparison of students in the *Click City*[®] schools with students in the Usual Curriculum schools showed that (a) Social images and normative social images of smokers became less favorable; (b) Risk perceptions regarding long-term consequences, exposure to secondhand smoke, and perceived harm increased; (c) Optimism bias regarding getting addicted and personal control over smoking decreased; and (d) Risk perceptions associated with addiction increased.

Examination of Moderators

We examined the moderating effect of gender, having tried smoking, having a parent or sibling who smoked, and level

of sensation seeking on long-term changes in intentions and willingness to smoke and intention to chew from baseline (T1) to 6th grade (T3) and from baseline to 7th grade (T4). Significant changes across time for each level of potential moderators are shown in Table 3. Report of having tried smoking at baseline moderated the effect of the program on both changes in intentions to smoke ($F[1,46] = 6.34, p < .000$) and on willingness to smoke ($F[1,46] = 20.83; p < .000$) from T1 to T3. Across this same time period, having a family member who smoked moderated the effect of the program on intentions to chew tobacco ($F[1,46] = 4.61, p < .05$). Having tried smoking moderated the effect of the program on changes willingness to smoke ($F[1,46] = 19.83, p < .0001$) from T1 to T4. No other variables moderated the effect of the program on changes in outcome variables over this time period. The program was most effective at changing intentions and willingness to smoke for those who had tried smoking. In addition, the program was most effective at changing intentions to chew tobacco for those with family members who smoked.

DISCUSSION

These results provide evidence to support the efficacy of the *Click City*[®]: Tobacco program in reducing students' intentions and willingness to smoke in the future. The program was particularly efficacious for those students who are most at risk. The program did not significantly impact initiation of smoking behavior, possibly due to the low prevalence in smoking among this age group. The findings from this study are particularly important since both intentions and willingness are precursors to, and predictive of, subsequent tobacco use (Andrews, Hampson, Barckley, et al., 2008). Thus, *Click City*[®]: Tobacco may have the potential to postpone or prevent initiation of cigarette use and regular smoking. In addition, our findings suggest that the program is efficacious at reducing several of the etiological risk factors associated with cigarette use, which may lower the risk of initiation.

The program was most effective at decreasing intentions and willingness to smoke for those who were most at risk for future nicotine dependence (those who had tried smoking prior to the 5th grade). Since early cigarette use is related to

Table 3. Means of Primary Outcomes by Moderator and Intervention Condition, F for Significant Condition \times Time Interactions

Outcomes	Moderators	Usual Curriculum			<i>Click City</i> [®]			T1–T3	T1–T4
		T1	T3	T4	T1	T3	T4	$F(1,46)$	$F(1,46)$
Intention to smoke	Tried smoking	4.36	4.12	5.02	4.33	3.48	4.36	4.72*	NS
	Did not try smoking	2.50	2.67	2.50	2.50	2.59	2.50	2.43	NS
Willingness to smoke	Tried smoking	9.34	11.34	14.23	10.32	9.94	12.55	7.19*	4.87*
	Did not try smoking	6.31	6.86	6.57	6.37	6.78	6.54	1.75	1.41
Intention to chew	Family member smoked	2.36	2.57	2.53	2.42	2.45	2.51	5.40*	NS
	Family member did not smoke	2.19	2.26	2.34	2.16	2.23	2.32	.02	NS

Note. Only significant moderators are reported; NS = not significant for either level of the moderator.

* $p < .05$.

more extensive use later in adolescence and emerging adulthood (Riggs, Chou, Li, & Pentz, 2007) and eventual nicotine dependence (Hu, Griesler, Schaffran, Wall, & Kandel, 2012), it is gratifying that *Click City*[®] was effective at decreasing intentions and willingness for those who had an early onset of smoking. Intentions and willingness for youth who had not tried smoking were low and changed little as a function of condition.

However, *Click City*[®]: *Tobacco* was not effective at changing student's intention to use smokeless tobacco in the long term. The program changed these intentions only for 1 year and for those at risk (those with family members who smoked). This finding may be due to the limited activities within *Click City*[®]: *Tobacco* that target smokeless tobacco. Based on the findings of Dent et al. (1995), which showed that components of Project Towards No Tobacco (TNT) (Sussman et al., 1993) targeting physical consequences decreased initiation of smokeless tobacco, we limited our activities on chewing tobacco to those designed to change risk of physical consequences. However, in contrast to Project TNT, which was designed for 7th graders, the *Click City*[®] program was implemented in the 5th and 6th grade. As shown in Andrews et al. (2003), intentions and use of smokeless tobacco at these grades are lower than for students in 7th grade (Andrews et al., 2003). Thus, the ns effects shown herein could also be due to low intentions to chew tobacco among these young children across both conditions.

Meta-analyses of school-based tobacco prevention programs have shown mixed results regarding the long-term effectiveness of these programs (Skara & Sussman, 2003; Wiehe, Garrison, Christakis, Ebel, & Rivara, 2005). According to the most recent Cochrane review of school-based smoking prevention programs (Thomas & Perera, 2006), about half of the programs based on a social influence model that were evaluated in a well-designed trial were effective. Social influence programs that showed long-term effectiveness included Project TNT (Sussman et al., 1993) and the Life Skills Training program (Botvin, Baker, Filazzola, & Botvin, 1990; Botvin, Baker, Dusenbury, Botvin, & Diaz, 1995).

In these studies, the assessment of long-term effectiveness was based on smoking initiation or extent of smoking, which was assessed the year prior to high school (Project TNT) or senior year (Life Skills). The results of this study did not show a significant effect of the intervention on smoking an entire cigarette. Our sample was much younger than those of previous studies, and few of our participants had smoked an entire cigarette. However, the effectiveness of the intervention was demonstrated in that students who were in the *Click City*[®] schools showed less intention and willingness to use tobacco as compared to those in the Usual Curriculum schools. Of note, a nonsignificantly larger proportion of participants in the *Click City*[®] condition had smoked an entire cigarette than those in the Usual Curriculum condition. This suggests the possibility of iatrogenic effects potentially due to an increased awareness of smoking.

Evaluations of component effectiveness are recommended by methodologists interested in the design of interventions (Flay, 2000). However, most occur after the program has already been implemented. We conducted an empirical study to assess if the component changed the targeted mechanism that it was designed to change prior to including a component in the program. We only included components in the final program that were effective. We are confident that the systematic evaluation of components as part of the design of the program contributed to the long-term efficacy of *Click City*[®]: *Tobacco*.

Click City[®]: *Tobacco* has several advantages over more traditional school-based prevention programs. First, since the mechanisms targeted are theoretically based, it is translational, transforming theory into practice. Second, the method of delivery via a computer facilitates program implementation fidelity. The program is designed so that all students must progress through the program in the same order. Although programs may be effective in controlled settings, adoption and implementation in real-world settings are often not successful (Botvin et al., 1995; Rohrbach, Graham, & Hansen, 1993). Third, the design and content of the activities, combined with the networked computer delivery system, encourage active student engagement and interactions with other students. In a meta-analysis of 120 school-based drug prevention programs, Tobler & Stratton (1997) identified an interactive (vs. didactic) teaching format as being more effective. Interactive teaching formats in that they engage students in the instruction process and allow students to attain feedback from other students regarding their behavior and attitudes. The *Click City*[®] program provides feedback to students about their classmates' behaviors and attitudes either in aggregate form or with anonymity preserved. *Click City*[®] also provides an ideal environment for students to engage in "experiential learning," an important method of behavior change (Slovic, 2001).

Limitations

There are three major limitations to this trial. First, the trial was conducted among primarily Caucasians in Oregon. The efficacy shown here may not generalize to other race/ethnicities or other regions of the country. Second, the long-term outcomes encompass only 2 years (between 5th and 7th grades). To overcome this limitation, we hope to conduct follow-up assessments with students who participated in this trial in high school, where smoking initiation is more likely to occur. Third, not all schools may have computers with high-speed Internet access, and low socioeconomic schools may be less likely to have Internet access. However, according to a 2009 survey of schools conducted by the National Center for Education Statistics (Gray, Thomas, & Lewis, 2010), 93% of all elementary schools had access to the Internet, and the majority of classrooms (96%) in these schools had at least one computer with Internet access. This survey found no differences as a function of school characteristics including the proportion of minority students and the percent of students eligible for free or reduced lunch (an indicator of the income of families) suggesting that a large majority of students will have access to the program, once it is disseminated.

SUMMARY AND CONCLUSIONS

Findings from this study are encouraging and suggest that the method used for the development of the program enhances efficacy. The long-term findings showing that students in *Click City*[®] schools have decreased intentions and willingness, as compared to students in Usual Curriculum, replicate the short-term findings (Andrews et al., 2011) and compare favorably to other prevention programs (Thomas & Perera, 2006). If the decrease in willingness and intention shown here results in a subsequent decrease in tobacco use, as expected, *Click City*[®]: *Tobacco* could potentially prevent youth from regular tobacco use and experiencing the associated health consequences.

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DECLARATION OF INTERESTS

None declared.

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