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Short-term effects of Project EX-4: A classroom-based smoking prevention and cessation intervention program

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Abstract

Objective—Researchers continue to try to develop effective teen tobacco use prevention and cessation programs. Three previous school clinic-based studies established the efficacy of Project EX for teen smoking cessation. This fourth study adapts Project EX to the classroom context. This paper reports the findings based on pretest and posttest surveys conducted immediately prior and post-intervention.

Methods—An eight-session classroom-based curriculum was developed and tested with a randomized controlled trial that involved a total of 1097 students in six program and six control continuation high schools. Program-specific knowledge and smoking measures were assessed at both the pretest and posttest surveys, and were used to evaluate the program's effect on the immediate outcomes. The immediate outcomes effects were analyzed with multi-level random coefficients models.

Results—Program students provided favorable process ratings of the overall program and each session. Compared with the students in the control condition, students in the program condition showed a greater change in correct knowledge responses from pretest to posttest ($\beta=+5.5\%$, $p=0.0003$). Students in the program condition also experienced a greater reduction in weekly smoking ($\beta=-6.9\%$, $p=0.038$), and intention for smoking in the next 12 months ($\beta=-0.21$ in 5-level scale, $p=0.023$).

Conclusions—EX-4 immediate outcome results revealed favorable student responses to the program, increases in knowledge, and decreases in smoking relative to a standard care control condition.

Keywords

Cigarette smoking; Cessation; Prevention; Motivation; Behavior; Intervention

1. Introduction

In spite of the known health risks associated with cigarette smoking, nearly one-quarter of the U.S. population continues to smoke (Centers for Disease Control and Prevention, 1998). Each year, nearly half a million Americans succumb prematurely because of their dependence on tobacco, and it is projected that one-third of all smokers will die from diseases attributable to cigarette smoking (Centers for Disease Control and Prevention, 1998; Fiore et al., 2000). Most regular adolescent tobacco users are likely to continue to use

tobacco into adulthood (Flay, 1993). These youth begin to suffer physical consequences of tobacco use within a year of regular use and are relatively likely to become stereotyped as risky youth by nonsmokers (Sussman, 2002). Approximately 40% of adolescent smokers who have smoked in the last month report having tried to quit (mostly self-initiated cessation) at some point in the past and failed (Lynch & Bonnie, 1994; U.S. Department of Health and Human Services, 1994). While 53% of adolescent smokers report an interest in quitting tobacco use in the next 6 months, only approximately 18% of adolescent smokers are ready to take action and try to quit in the next 30 days (Pallonen, Prochaska, Velicer, Prokhorov, & Smith, 1998). Only 1% to 2% of heavy lifetime adolescent smokers (e.g., smoked greater than 100 cigarettes; now smoke 10 cigarettes per day or more) report self-initiated quitting for at least a 30-day period (U.S. Department of Health and Human Services, 1994) (Sussman, Dent, Severson, Burton, & Flay, 1998; Sussman, Dent, Stacy, & Craig, 1998).

Generally, tobacco-related programmatic efforts have been focused on the development of programs to prevent tobacco use among teens or promote cessation among adults. In fact, policy makers have begun to place a priority on teen tobacco use cessation research and practice only over the last 10 years. To date, programs developed to facilitate teen tobacco use cessation have been few in number, most have been poor in research design, and most have been lacking or non-disclosing in program development details (Lynch & Bonnie, 1994; Sussman, 2002; Sussman, Dent, Burton, Stacey, & Brian, 1995; Sussman, Lichtman, Ritt, & Pallonen, 1999; U.S. Department of Health and Human Services, 1994).

Project EX is an empirically-validated teen tobacco use cessation program that has shown positive 6-month outcome effects over two experimental trials and one multiple baseline single group trial (Sussman et al., 2004). In the first three studies of Project EX, the intervention that we evaluated was a tobacco use cessation program delivered as a school-based clinic to adolescent smokers. Youths who volunteered to join the program were reached through utilizing numerous recruitment strategies, and were treated in multiple clinics at each school comprised of up to 50 smokers. Utilizing an experimental design, the first trial (EX-1) demonstrated the relative efficacy of the clinic program compared to standard care among alternative high school youth at a 3-month post-program follow-up (Sussman, Dent, & Lichtman, 2001). Next, this program showed promise of generalizability among high school youth in China (Zheng et al., 2004) in a multiple baseline single group design (EX-2). The third trial (EX-3) showed that the effects could last over a 6-month follow-up for youth at both alternative and comprehensive high schools. The third study also compared EX with and without the use of nicotine gum, with no differences found between the two program conditions (Sussman et al., 2004). Through this work, our research group found intent-to-treat program quit rates of 17% (EX-1), 14% (EX-2), and 16% (EX-3), compared to control group 30-day quit rates of 3% (EX-2) to 8% (EX-1), indicating that EX program quit rates at least doubled those found in control comparisons (in the two studies that provided them) (Sussman et al., 2004).

However, while these previous school-based clinic versions of Project EX are effective, program reach is limited to those who attend the clinic (approximately 30% of smokers at school through extensive recruitment in previous trials). Reach is no longer a problem if the cessation program is delivered in a classroom setting. Both tobacco users and nonusers are found in the classroom setting. The current study, Project EX-4, focused on adapting the previous school clinic-based EX program to a high school classroom-based setting for smoking cessation among smokers as well as smoking prevention among non-smokers.

This programming was completed among youth attending alternative high schools in southern California (referred to as “continuation” high schools). Continuation high school

(CHS) students have transferred out of the regular system in California due to functional problems (e.g., lack of credits, drug use), and to fulfill a California mandate that all youth receive at least part-time education until they are 18 years of age (California Educational Code Section 48400; established in 1919). CHS students report almost twice the amount of last 30-day use of cigarettes as regular high school (RHS) students (Sussman et al., 2004). Youth at continuation high schools (CHSs) who do not smoke are confronted with smoking among their peers on a daily basis. This would seem an appropriate context to reach all enrolled youth with tobacco use education programming, to prevent potential future use as well as stop current use. Also, tobacco use addiction and cessation is an important topic to be instructed by the time youth finish attending high school, because of the significant financial and societal costs of addiction.

This paper focuses on reporting student receptivity to and immediate outcomes of Project EX-4. We hypothesized that the classroom-based curriculum would be well-received, and would render positive changes on the knowledge items targeted by the curriculum relative to the control condition. We further hypothesized that implementation of the program compared to standard care would render a positive prevention/cessation effect on cigarette smoking behavior.

2. Method

2.1. School selection and experimental design

A total of twelve continuation high schools from three counties in southern California (Los Angeles, Ventura, and Orange) were recruited as a convenience sample for participation in this study. The schools were randomly assigned to one of two experimental conditions: treatment or standard care (control); resulting in a sample of six schools per condition. Schools were blocked prior to assignment by school size, ethnicity composition, average social economic status, and % of students in classes with English as second language. Specifically, six pairs of schools were aligned using a linear composite of factor scores across a tobacco use inflate-suppress continuum (Graham et al., 1984) and randomly assigned to the two conditions. Within each program high school, project staff delivered the curriculum to all students enrolled in the subject area selected by the school for program implementation (health, science, biology, or physical education). In the standard care control condition, students received only the tobacco prevention or cessation activities, if any, provided directly by their school. Students in both the program and control conditions were administered a questionnaire at pretest and immediately after the program. The average time span between pretest and immediate posttest was 5.5 weeks (minimum of 4 weeks, maximum of 6 weeks), depending on adjustments to the programming or data collection schedule in order to meet the needs of the schools.

2.2. Project EX curriculum

The classroom curriculum is closely adapted from the Project EX clinic program (Sussman et al., 2001). It involves eight sessions nominally delivered over a 6-week period. The first four sessions are held in a 2-week period. During that period, students are prepared to strengthen their resolve not to use tobacco in the future. The second four sessions are held approximately once per week during the following month and are focused on intentions not to use tobacco, or quit-attempts.

Session 1 imparts the ground rules for the class and discusses reasons for using, not using, quitting tobacco, or remaining tobacco free. Also, the talk show “family and friends confront smokers about their habit” is completed. The smoker role talks about being nagged, whereas family members express their worries about how the smoker has become more irritable since

becoming a smoker. An experiment is requested in which the smoker attempts not to smoke in a situation within which he or she usually smokes, and discusses in the next session how that felt. Non-smokers choose one situation in which they are around people smoking tobacco and notice how they feel (e.g. whether the second hand smoke bothered them). Non-smokers who are never around smokers notice where there is any evidence of tobacco (e.g. corner store, advertisements, cigarette butts on the street, etc.) and discuss how they feel about it.

Session 2 discusses how tobacco use can cause, rather than relieve stress. The talk show “your cigarettes may be stressing you out” is completed. “Guests” include an ex-smoker, psychologist, and physician. Guests discuss how tobacco use actually increases, rather than decreases, stress. Youth learn healthy ways (skills) to cope with stress. Also, students practice a “healthy breathing” novel-type activity. They are instructed how smoking hurts one’s breathing, and are provided with exercises on healthy breathing. Information also is provided on tobacco industry marketing tactics and how they target youth. *Session 3* discusses the harmful substances in tobacco and how it can injure one’s body. Youth also play the game “is smoking on the menu”. Students create a menu of possible categories, and order questions regarding the dangers of passive smoke as a group competition.

Session 4 discusses addiction to tobacco. The first step of breaking an addiction by making a commitment to quit, and methods of quitting are discussed. Physical and psychological aspects of withdrawal are discussed. Students also play the talk show “quitting smoking: I’ve been there and it does get better”. This talk show describes guests who are smokers at different stages of the quitting process. Smokers can make personal commitments to quit. Non-smokers can make personal commitments to remain tobacco free and serve as a “listening ear” to assist those who may be trying to quit.

Session 5 discusses more about nicotine, addiction, and strategies of avoiding addiction or managing withdrawal symptoms. Psychological coping includes self-forgiveness and avoiding false expectations regarding how not using tobacco or quitting will and will not affect one’s life. *Session 6* involves learning lifestyle balance strategies, including weight control and practicing a “yoga activity”. This is a novel activity in which students learn several easy postures that they can use to feel more relaxed. *Session 7* involves learning more coping strategies, including assertiveness training and anger management. Participants also learn the “letting feelings pass” meditation activity. This is a novel activity, in which participants learn that sometimes just letting feelings pass can be more effective than reacting to them. They learn relaxation and breathing meditations. Finally, *Session 8* involves learning means to avoid using tobacco again, or staying tobacco free, and mentions how topics covered in the tobacco education program could be applicable to other substances. Youth also participate in the talk show, “warning: waiting to quit smoking may be hazardous to your peace of mind”. They learn that it’s better to not use tobacco in the future or quit and stay stopped when you are young, due to an accumulation of consequences with age.

2.3. Subjects

School enrollment and consent information were collected simultaneously. For the 12 CHSs in the study, a total of 2020 students were enrolled in the classrooms selected for participation in the study. This was 64.5% of the total enrollment ($n=3139$) for all 12 schools combined. An average of 8 classes was selected per school, with a range of 5 (smallest schools) to 13 classes (largest schools). Of the 2020 students enrolled in the classes selected, 1367 were consented for participation in the study (67.7% of the total enrolled). Of the 1367 consented students, 1097 took the pretest survey (86.2%). Among the 1097 subjects that participated in the pretest survey, 878 (391 in control and 487 in program condition) also

completed immediate post-program questionnaires (80.0% retention rate). The short-term effects analysis described in the present paper was performed with pretest and posttest data collected from these 878 subjects.

Subjects varied from 13 to 19 years of age (mean age=16.5 years, S.D.=1.0 years) at pretest. The sample was 62.7% male; 16.4% white, 70.9% Hispanic, 3.5% Asian, 5.1% African American, and 4.1% other ethnicity. Further, 51.7% of the students lived with both parents; approximately 47% of youths' fathers and 49% of youths' mothers completed high school. Modal occupations among fathers were skilled laborers (39.5%) and minor professionals or small business owners (26.9%). Modal occupations among mothers were minor professionals, semi-skilled worker, or semi-skilled laborers (39.9%) while 29.4% were housewives or homemakers. At pretest, approximately 33% were weekly smokers. Approximately 52% of the students reported that they may smoke in the next 12 months.

2.4. Data collection and measures

Pretest and immediate posttest measures were collected from students using a self-report, close-ended response questionnaire. Questionnaires were administered over one class period. Demographic items included age (in years), gender, ethnicity (coded as non-Hispanic white, Hispanic, Black, Asian, and other), mixed ethnicity (y/n), current living situation (with parents, alone, other), and parents' education (mean response across father's (or stepfather's) and mother's (or stepmother's) educational levels based on categories derived from Hollingshead & Redlich, 1958), and self reported academic performance (4 categories ranging from "poorly" to "very well").

Smoking behavioral items included weekly (last 7 days) use of cigarettes, which was assessed with the item asking "how many cigarettes have you smoked in the last seven days?". In addition, a similar measure of 30-day use was employed to divide subjects into current smokers and non-smokers, as described below. The responses could be a number from "0" to "100+". Smoking intention was assessed in the survey with the question "How likely is it that you will smoke cigarettes in the next 12 months? Would you say...", with response categories of "1: definitely not", "2: probably not", "3: a little likely", "4: somewhat likely", and "5: very likely".

The correlations between pretest and posttest measures among the control subjects may serve to validate the reliability of the measures in weekly smoking and smoking intention. The correlation was 0.66 for weekly smoking and 0.77 for smoking intention between two self-reports collected weeks apart. Among the control subjects, the pretest to posttest change in mean value was -0.7% ($p=0.66$) for weekly smoking, and -0.04 in a 5 point scale ($p=0.33$) for smoking intention. These coefficients are very similar to previous work (Graham et al., 1984; Needle, McCubbin, Lorence, & Hochhauser, 1983; Sussman et al., 1995).

In the process evaluation portion of the posttest questionnaire, several measures of student responsiveness to the program were obtained. In the first measure, students rated how much they liked each EX session (8 total ratings; from 1="terrible" to 10="excellent"). Next to the session number, a brief summary of the session was provided to assist students' recall. The second measure assessed student's ratings of the program quality. A list of 9 adjectives included words like "interesting", "informative", "well-organized", "enthusiastic", "well-informed", etc. Responses were on a 10-point scale ("not at all" to "extremely"). As in previous work (e.g., Dent, Sussman et al., 1998), these adjectives were highly inter-correlated ($\alpha=.96$ for the current study); thus ratings across the items were averaged to comprise a perceived program quality index. In the third measure of student responsiveness, the students were asked specifically whether the project had helped them do something

regarding cigarette smoking. The eight response options ranged from “quit tobacco use completely” to “strengthen your commitment to stay tobacco free”. In the fourth set of measures, also on 10-point scales, the students were asked how much they disliked or liked each of seven major curriculum components (“Talk show: family and friends confront smokers about their habit”; “Talk show: cigarettes may be stressing you out”; “Healthy breathing”; “Game: is smoking on the menu?”; “Talk show: quitting smoking: I’ve been there and it does get better”; “Yoga”; and “Meditation”).

Program-specific knowledge was assessed with 16 items that were derived from the curriculum content and designed to tap learning of the program curriculum. Approximately two items tapped material from each session. All knowledge items were in a multiple-choice format and provided two to three wrong answers along with one correct answer. All knowledge items were scored as correct or incorrect and averaged into a percent correct score for analysis.

2.5. Data analysis

Data analysis for program effects was completed by using a generalized mixed-linear model (Murray & Hannan, 1990) using the SAS statistical package (TM, 2000). Condition was considered a fixed effect variable; fixed at desired experimental levels (school). School was considered as a random factor (within program conditions). This specification allows for both the statistical accounting of intra-class correlation within clustered units (school) on computed significant levels and for the logical generalization of findings beyond the specific sample. The variables evaluated in this analysis include knowledge (% correct program-specific knowledge score), smoking intention (5 levels from “definitely not” to “very likely”), weekly smoking (dichotomized: no for “0” and yes for “>0”). The variables adjusted for in the analyses included age, gender, and ethnicity. Because the hypotheses were *a priori* directional ones assuming that the program effects on the outcomes would be positive, a one-tailed significance test was employed for the significance level calculation.

3. Results

3.1. Assessment of attrition bias

To assess the potential sampling bias due to attrition at the posttest, a comparison was made of the sample that was lost at posttest ($n=219$) to the analysis sample (retained, $n=878$, follow-up rate=80%) on eight key baseline measures. Measures included: age, gender, ethnicity, living with both parents or not, parents’ education, 30-day cigarette use, weekly cigarette use, and daily cigarette use. The comparisons utilized chi square or *t*-test models to indicate statistically significant differences (two-tailed *p* value at the .05 level). Only ethnicity showed a statistically significant difference ($\chi^2=14.2$, $df=4$; $p=0.007$) between the ‘lost’ and the ‘retained’ samples. Compared with the ‘lost’ sample, the ‘retained’ sample contained less Hispanic (69% vs. 80%, $p=0.001$) and more white (18% vs. 11%, $p=0.02$) subjects. The other seven variables failed to show statistically significant differences between the ‘lost’ sample and the ‘retained’ sample. Thus, the analysis sample approximated a random sub-sample of pretest subjects at the recruited continuation high schools. Because data on cigarette smoking and demographic characteristics were not measured among students who did not participate in the study, generalizability of the findings is limited to a population with pretest measurement access restrictions like those experienced in this study (i.e., absentee and refusal mechanisms).

3.2. Effects on knowledge and tobacco use

The average correct score across the 16 program-specific knowledge items failed to change for subjects in the control condition from pretest to post-test (53.5% to 51.2%, $p=0.6$), but it

did increase in the program condition (51.2% to 57.4%, $p<0.0001$). The net program effect (change in program condition minus change in control condition, $\beta \pm \text{S.E.}$) on knowledge items was $5.5\% \pm 1.1\%$ ($p=0.0003$), indicating a positive effect of the program on the designated knowledge items.

As shown in Table 1, the program rendered immediate effects on cigarette smoking. After adjusting for age, gender, and ethnicity, the program was found to be statistically significant in reducing smoking intentions ($\beta=-0.21 \pm 0.10$, $p=0.023$) and weekly smoking ($\beta=-6.6\% \pm 2.9\%$, $p=0.038$). The p value for interaction term for condition and pretest monthly status shows that the immediate treatment effect did not differ by pretest smoking status.

We also conducted analysis under the intention-to-treat principle: the smoking status for the subjects who were lost to follow-up at the immediate posttest was set to be the same as their corresponding status assessed at pretest survey. Data from all pretest subjects were then analyzed with the same model as was used in the analyses described above. The results employing this method of intent-to-treat analysis also revealed significant or moderately significant program effects. Specifically, the net effect was 5.2% ($p=0.0001$) for knowledge, -0.18 on a 5-point scale for smoking intention ($p=0.028$), and -4.5% for weekly smoking ($p=0.057$).

4. Discussion

Project EX-4 was designed to provide smoking prevention and cessation effects in the same program, and to test the effects of the program utilizing a controlled, randomized experimental design. Students in the program condition reported moderately favorable ratings of the program (consistent with the other trials, such as that of Sussman et al., 2001) and showed significant increases on program-specific knowledge items compared to the standard care control condition. Students in the program condition also reported being less likely to smoke in the next 12 months, and their self-reported weekly smoking was lowered by about 5% more compared with those in the control group, controlling for potential confounders (e.g., age, gender, and ethnicity).

The original Project EX school-based clinic smoking cessation intervention program was selected as a “model” evidence-based program by the Substance Abuse and Mental Health Services Administration (SAMSHA), as of 2004. The school-based clinic version has begun to be disseminated nationwide, as one of only two model teen tobacco use cessation programs. (The other “model” program is Not On Tobacco (NOT) (Horn, Dino, Kalsekar, & Fernandes, 2004).) The current report of the immediate posttest effects of EX-4 is promising. It appears that one can adapt the school-clinic-based program to the classroom-based program context, and render both smoking prevention (in non-smokers) and smoking cessation (in smokers) effects. At least regarding immediate follow-up, it appears that with older, high-risk teens, a combination of prevention and cessation material works (Sussman & Ames, in preparation).

What has been shown here is that an in class high school cessation program is both feasible, acceptable, and can effect immediate changes in the recipients. However, it is not known in what way the effects attained at the immediate posttest may change; that is, whether they will be enhanced or reduced in 6 months or 1 year. It is possible that a classroom-based program could result in weak effects on prevention and cessation in the long-run. If that were found, generalizability of the program approach beyond school-based clinic settings would be limited. We will only know this when longer-term outcome work has been completed. At present, we are collecting the longer-term follow-up data, and we will test the

curriculum by comparing the longer term and more meaningful quit rate between the program and control group.

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Table 1

Program effects at immediate posttest^a

Outcome variables	Main effect				Change from pretest to posttest ^c				Net effect ^d				Interaction ^b			
	Pretest ^e		Program		Control		Program		β		S.E.		p		p	
	Mean	S.E.	Mean	S.E.	ΔMean	S.E.	ΔMean	S.E.								
	Mean	S.E.	Mean	S.E.	ΔMean	S.E.	ΔMean	S.E.								
Knowledge (%) ^e	53.5	1.3	51.2	1.3	0.7	0.8	6.2	0.7	5.5	1.1	0.0003	0.60				
Smoking intentions ^f	2.26	0.26	2.17	0.26	-0.04	0.09	-0.25	0.08	-0.21	0.10	0.023	0.08				
Weekly smoking (%) ^g	33.3	7.7	32.5	7.6	-0.7	2.3	-6.9	2.2	-6.6	2.9	0.038	0.18				

^a Multi-level random coefficients modeling was applied to account for the intra-school clustering of the outcomes and the fact that randomization unit was school rather than individual subjects.

^b *P* for the possible interaction between program and baseline current (30-day) smoking status.

^c Without adjusting for any covariates.

^d Adjusted for age, gender, ethnicity, and pretest value of the particular outcome; *p* for significance was calculated with one-tailed *t* test because the *a priori* hypotheses were directional.

^e % Correct program-specific knowledge score.

^f 5-Point scale from definitely not (1) to definitely yes (5).

^g Dichotomous indicator of whether smoked in last week.