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Randomized Trials on Consider This, a Tailored, Internet-Delivered Smoking Prevention Program for Adolescents

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The Internet may be an effective medium for delivering smoking prevention to children. Consider This, an Internet-based program, was hypothesized to reduce expectations concerning smoking and smoking prevalence. Group-randomized pretest-posttest controlled trials were conducted in Australia ($n = 2,077$) and the United States ($n = 1,234$) in schools containing Grades 6 through 9. Australian children using Consider This reported reduced 30-day smoking prevalence. This reduction was mediated by decreased subjective norms. The amount of program exposure was low in many classes, but program use displayed a dose-response relationship with reduced smoking prevalence. American children only reported lower expectations for smoking in the future. Intervening to prevent smoking is a challenge, and this data suggest small benefits from an Internet-based program that are unlikely to be of practical significance unless increased by improved implementation. Implementation remains the major challenge to delivering interventions via the Internet, both for health educators and researchers.

Keywords: *smoking; prevention; adolescents; Internet*

Many adolescents will try smoking and eventually become adult smokers in the absence of effective intervention (Pierce & Gilpin, 1996). One possible limitation of past interventions is that most focus on keeping children from trying their first cigarette. They do not talk with the large proportion that has tried smoking and convince them to stop (Buller et al., 2003; Hill, White, & Effendi, 2002; Office on Smoking and Health, CDC, 2002). This article reports on a trial to evaluate the effectiveness of a smoking

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prevention program, Consider This, that was delivered to schools via the Internet (Buller et al., 2001; Hall et al., 2001). It was intended to reduce smoking by children in Grades 6 through 9 by convincing those who had not smoked not to start and persuading those who had already tried smoking to stop.

A program aimed at both preventing the first cigarette and arresting experimentation needs to acknowledge children's experiences and expectancies and build off them. This presents two major challenges. First, one needs to know children's experiences with, and current plans and activities for, smoking. There may be at least four relevant groups—non-smokers (those who have never tried a cigarette), past users (those who have tried cigarettes but do not currently use them), experimental smokers (those who are smoking sporadically), and regular smokers (those who smoke every day) (Buller et al., 2003). Very few younger adolescents, the audience for Consider This, smoke regularly; thus, program content focused on the other three groups, which display variation in their beliefs and experiences that affects vulnerability to smoking (Buller et al., 2003). In the classroom, it can be difficult for teachers to recognize and take this variance into consideration when implementing a smoking-prevention curriculum. Some information could be elicited through discussion, but children might withhold information from adults or other students about their smoking experiences (or lack thereof). Also, discussing past smoking in class might encourage never-users to experiment with it if peers are seen as already doing so.

One solution to both problems, the individualization of curriculum and the desire to avoid public sharing of personal information, is to use the capacities of modern computer technology. Armed with information on children's early smoking beliefs and experiences, an Internet-based smoking prevention program can provide personalized communication at the individual rather than class level. This can create a sense of telepresence and dialogue whereby the program speaks somewhat differently to each child (Walther, Pingree, Hawkins, & Buller, 2005). Tailored messaging has become a standard procedure in many smoking-cessation programs for adults (Borland, Balmford, & Hunt, 2004; Etter & Perneger, 2001; Prochaska, DiClemente, Velicer, & Rossi, 1993a) and should be beneficial with students. Furthermore, Internet technology can create a semiprivate computer environment (Walther, 1996) that should result in students being more willing to disclose personal smoking attitudes and experiences (Paperny, Aono, Lehman, Hammar, & Risser, 1990). A personalized approach to message design also avoids exposing nonsmokers to messages about peers' smoking experiences.

The use of computerized and Internet programs to prevent risk behaviors is recent and innovative (Walters, Wright, & Shegog, 2006). Three studies suggest that Web-based

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programs can have favorable effects on adolescents' smoking (Fisher, Severson, Christiansen, & Williams, 2001; Shegog et al., 2005; Woodruff, Edwards, Conway, & Elliott, 2001); however, only one was designed to be implemented in a school curriculum (Shegog et al., 2005). Consider This was designed specifically to be adopted as curricular materials.

Two parallel randomized efficacy trials were conducted in 2001-2002—one in Australia and the other in the United States—testing the primary hypothesis that children in schools that receive the Consider This program will reduce their 30-day smoking prevalence by posttest compared to children in schools that do not receive it. Also, we verified the assumption that delivering personalized smoking prevention messages to individual students avoids the potential ill effects (e.g., expectations to smoke) that might accrue when peers reveal experimentation.

METHOD

Two randomized trials were undertaken to evaluate Consider This with children in Grades 6 through 9. The Australian trial was conducted in Victoria and South Australia and the American trial in Colorado and New Mexico. Comparable procedures were used in Australia and the United States, but there were obvious cultural differences that were acknowledged by modifying information relevant to the two contexts (e.g., country-specific smoking statistics) and using a country-specific narrator. Differences are noted in the trial description that follows.

Sample and Population

Schools were approached either directly (Australia) or through districts (United States). Teachers of appropriate classes (e.g., health education, consumer studies, and science) were invited to participate. Twenty-five schools participated in the Australian trial and 21 schools in the American trial. The Australian and American samples differed in that students were recruited from the early years of secondary school, Grades 7 to 9, in Australia and from middle schools, primarily Grades 6 and 7, in the United States. This resulted in the Australian sample being slightly older. At schools randomized to the intervention, training sessions were provided in which Consider This was introduced and implementation procedures were described. Teachers scheduled time in the computer labs when they presented Consider This to students.

Parental consent was secured for the testing procedures using different methods—passive procedures in Australia in which parents could choose not to have children participate ($n = 2,077$ students with no refusals) and active procedures in the United States in which parents had to give permission for children to participate ($n = 1,234$ students, or a 66.5% consent rate; see White, Hill, & Effendi, 2004 for general discussion of differences created by these two procedures)—because of different requirements of Institutional Review Boards (known as Institutional Ethics Committees in Australia). Prior to completing the survey, students read and signed an assent form. All consent and assent forms were approved by the Institutional Review Boards of the AMC Cancer Research Center (U.S.), University of Arizona (U.S.), University of New Mexico (U.S.), Cancer Council of Victoria (Australia), and South Australian Department of Education, Training, and Employment (Australia) prior to participant recruitment.

The Consider This Program

Consider This contained 73 online activities organized into six modules—Introduction, Media Literacy, Relationships, Mind and Body, Decision Making, and Resistance Strategies (see Buller et al., 2001 for more detail or go to www.considerthisusa.net to view the program in an open access format). Prevention content was based on principles of social cognitive theory (Bandura, 1986) and focused on social influences. As such, it was designed to create positive outcome expectancies for not smoking, negative outcome expectations for smoking, and self-efficacy expectations for avoiding or stopping tobacco use (MacKinnon et al., 1991; Stacy, Sussman, Dent, Burton, & Flay, 1992). Also it aimed to correct inaccurate perceptions of tobacco use norms (i.e., prevalence of use by peers and adults; Flay, 1995; Graham, Marks, & Hansen, 1991; Ianotti & Bush, 1992; MacKinnon et al., 1991; Rooney & Murray, 1996; Sussman, Dent, Burton, Stacy, & Flay, 1995). Children were shown that some media depictions of smoking outside of direct advertising are designed to model smoking and increase beliefs that smoking is normative; other activities taught principles of media literacy. Activities provided nondirective counseling about reasons for not smoking and the match of smoking with core values based on the motivational interviewing technique (Lawendowski, 1998; Miller, 1996; Resnicow et al., 2002). Instruction on resisting influences to smoke taught strategies for coping with group-conformity pressures and maintaining positive relationships when refusing to smoke as well as traditional skills for refusing direct offers. Activities were included to produce inoculation against common prosmoking arguments (McGuire, 1964; Pfau, Van Brockern, & Kang, 1994). Tailoring of content was based on our research on differences by levels of experience with smoking (Buller et al., 2003).

Production objectives were to maximize participation and engagement of users, privacy of information exchange, and credibility and comprehension of information in Consider This by using unique features of the Internet environment. A host of interactive activities was created that provided content contingent on responses to questions or choices in previous activities to increase participation by users. The program was designed to have students work individually with it to create a sense of privacy so they would disclose experimental smoking and smoking intentions. Audio narration, graphics, animation, sound effects, and music were combined to create a rich multimedia environment to stimulate user engagement and provide relevant nonverbal contextual information to aid learning and improve message credibility.

Program progression was controlled by the teachers who had ability to “release” modules for use by distributing each module’s password to students. Although students were required to log in to the program using their personal identification to gain general access (see Implementation Measures section), they also had to input the module password to view content. The current module was available to students, as were previous modules. However, they could not progress forward into subsequent modules until the teacher distributed the password.

Message tailoring was determined by having adolescents respond to online questions or tracking their use of program activities. Responses and usage information were written into a SQL database by scripting routines incorporating ASP technologies in concert with Macromedia Director multimedia software. The database controlled the serving of Web pages using Microsoft’s Active Server Page technology (Hall et al., 2001). In the first module, questions were posed about smoking history and, in Modules 3 and 4, questions were asked about susceptibility to future smoking, presence of friends who

smoke, and, for ever-users, experiences of their last (few) cigarettes. When tailoring was to be based on information provided in a previous session, students were asked whether things had changed and, if so, how.

Study Design and Procedures

The trial structure was a pair-matched, group-randomized, pretest-posttest controlled design, with school as the unit of randomization. Schools were paired on geographic location; size of school; proportion of female, minority, and Hispanic (American trial only) students; and proportion of students who received free or reduced-fee meals as an indicator of the socioeconomic status of the catchment areas (American trial only). (One Australian school was enrolled without a match.) One school in each pair was assigned at random to the intervention group. Students were pretested in their classrooms by trained research staff with teachers present to maintain order. Following pretesting, teachers in the intervention schools ran *Consider This* in school computer labs during six regular class meetings. Each session lasted 45 to 60 minutes. Students in control schools received standard health education. Students were posttested at the end of the school year using the same procedures.

Originally, pretesting and use of *Consider This* were planned to occur during the first half of the school year, with posttesting occurring several months later at the end of the last term. However, difficulties with implementing it in school computer labs (see Hall et al., 2001) introduced variation in the time between pretesting, program implementation, and posttesting. The technical difficulties led to lost schools in the American trial (Hall et al., 2001), breaking some of the matched pairs. Installation of broadband Internet service was delayed in a few schools in New Mexico so the trial was performed in the next school year.

Measures

Outcome Measures

The pretest and posttest contained a variety of self-report measures. The primary outcome was 30-day smoking prevalence, as measured by the number of days in the past month in which they smoked at least a whole cigarette. All students were asked whether they had ever smoked a cigarette, even taking a puff. Those who had not were classified as nonsmokers and a value of zero was recorded for 30-day prevalence. Those who had smoked were asked if they had smoked in the past 30 days and, if so, on how many days and how many on average. Those who had not smoked were classified as former smokers and those who had as current experimenters. There were insufficient frequent smokers (i.e., smoking several cigarettes daily) to justify retaining a separate regular smoker category. Change scores were calculated reflecting whether children's reported 30-day smoking prevalence changed from baseline to follow-up. These change scores had values of -1 (changed from smoking at baseline to not smoking at follow-up), 0 (no change in 30-day smoking status), and +1 (changed from not smoking at baseline to smoking at follow-up). The change scores were calculated both for smoking any portion of a cigarette, even a puff, and for smoking a whole cigarette in the past 30 days. The whole cigarette measure was selected as the primary outcome in order to evaluate *Consider This* on its ability to arrest uptake of regular smoking, not the occasional puff on a cigarette.

Two secondary outcomes of smoking uptake were assessed. Nonsmokers, puffers, and former smokers completed Pierce et al.'s three susceptibility items (Pierce, Choi, Gilpin, Farkas, & Merritt, 1996). All respondents completed a single item on future likelihood of smoking.

All students responded to questions assessing potential moderators (i.e., preexisting characteristics that might alter the affect of the program) and mediators (i.e., concepts intended to be changed by the program to reduce smoking) of program effects. Moderators were selected from the findings of past research and included extent of smoking by friends; perception of normative pressures from parents, siblings, and peers not to smoke; smoking status of parents and siblings; smoking policy in home; rebelliousness (eight items; alpha reliability = .72 [Aus.], .76 [Amer.]; Pierce et al., 1993; Smith & Fogg, 1979), sensation-seeking tendency (alpha = .53 [Aus. only]; Donohew, Lorch, & Palmgreen, 1991), decisional control, school performance, absenteeism, computer and Internet experience, and demographic characteristics. Variables that were theoretically expected to mediate the effect of Consider This on smoking behavior included attitudes related to the positive effects of smoking (four items; alpha = .82 [Aus.], .81 [Amer.]), positive feelings toward smoking (two items; alpha = .74 [Aus.], .68 [Amer.]), importance of not smoking, and value in not being a smoker, self-efficacy expectations (i.e., confidence) for not smoking, and normative beliefs about the prevalence of smoking by peers (proportion of children that tried smoking and that smoke at least once a week) and adults (items modified from the CORE survey of alcohol and drug use; Presley, Meilman, & Lyster, 1994).

Two questions were created to detect harmful effects of acknowledging the smoking experiences of experimenters. Items asked about the belief that a person had to try cigarettes to make a decision about smoking and whether students were thinking about smoking a lot.

Implementation Measures

Implementation of Consider This was monitored by its backend database. Students were provided with unique user identification codes that they entered into the program at the start of every session. The database tracked their use of each module and completion of the activities in each module. The number of modules each student used and/or completed and number of activities completed within the entire Consider This program were calculated as measures of the extent of program implementation.

Other forms of process measures, such as having students evaluate each module, were not performed because of concerns about artificiality and potential confounding. Instead, young college-aged students worked with the media developers to review activities and content for credibility and entertainment value. Also, adolescents tested the modules for usability and content comprehension at the middle and end of production (Hall et al., 2001).

Analysis Plan

The sample sizes were estimated as recommended by Donner, Birkett, and Buck (1981), and analyses conformed to procedures presented by Murray (1998). Descriptive statistics of participant characteristics were calculated for both the Australian and American data. Characteristics of those in the intervention and control groups were

examined to assess imbalances in the samples. Students who did not complete a posttest were compared to students who did for evidence of differential dropout. Plots of data were examined for trends and outliers.

Linear mixed models were performed to account for the clustering of responses within school. Associations between outcome measures and potential covariates were examined in bivariate linear mixed models. Multivariate analyses focused on significant predictors from the bivariate analysis. Alpha was not adjusted for multiple comparisons because the primary endpoint was change in smoking prevalence, and this was unaffected by these comparisons. Thus, there was no danger of alpha inflation for the primary analysis of this outcome. Alpha inflation may be a consideration when testing secondary outcomes; however, many adjustments assume independent tests, and these were not. Multi-item indices were created when appropriate. Exact, unadjusted p values are reported so the interested reader can apply various methods for adjusting alpha. Mediation analyses were conducted following MacKinnon (1994).

RESULTS

Outcomes of the two trials were analyzed separately. The results from the Australian trial are presented first, followed by results from the American trial.

Australian Trial

Profile of the Sample

In the Australian trial, pretests and posttests were collected on 1,518, or 73.1%, of the original sample of 2,077; however, 8 had incomplete data leading to a sample size of 1,510 (754 intervention, 756 control) from 25 schools (13 in intervention/12 in control). Dropouts included 207 (10.0%) who completed only a pretest because of the class dropping out as it could not operate Consider This, giving an effective response rate of 81.2%. A total of 352 (16.9%) completed only a pretest for individual reasons (primarily being absent). It should be noted that this level is high because in the last weeks of the school year in Australia, when much of the posttesting occurred, students (especially older ones) are increasingly involved in school-approved activities outside the classroom. Compared to students completing both pretest and posttest, more individual dropouts were in a higher grade ($p < .001$), had lower school performance ($p = .005$), had ever smoked ($p < .001$), and had smoked a whole cigarette in the past 30 days ($p < .001$). However, critical to this study, there were no significant differences in individual dropouts based on treatment group ($p = .87$), and there were also no effects by gender ($p = .98$), race/ethnicity ($p = .60$), or language spoken in the home ($p = .32$).

Sample characteristics are provided in Tables 1 and 2. Students were enrolled in Grades 7, 8, and 9. The sample was evenly split by gender. A large percentage (73.4%) was of Australian or British ancestry. There were no significant differences between treatment groups at baseline on demographics, computer/Internet use, and smoking history.

At baseline, 41.4% of the Australian students had ever smoked a cigarette. Girls smoked more in the past 30 days ($p = .015$ for whole cigarette; $p = .028$ for even a puff). Smoking prevalence increased with grade ($p < .0001$ for whole cigarette and for a puff) for both sexes.

Table 1. Profile of the Student Samples in the Australian and American Trials

	Intervention (<i>n</i> = 754)	Australian Control (<i>n</i> = 756)	Total	Intervention (<i>n</i> = 640)	American Control (<i>n</i> = 364)	Total
Year level (Aus. <i>p</i> = .18; Amer. <i>p</i> = .16)						
6	0.0%	0.0%	0.0%	42.8%	37.1%	40.7%
7	39.0%	30.8%	34.9%	55.3%	47.8%	52.6%
8	33.2%	34.4%	33.8%	1.7%	15.1%	6.6%
9	27.9%	34.5%	31.2%	0.0%	0.0%	0.0%
Gender (Aus. <i>p</i> = .28; Amer. <i>p</i> = .45)						
Boy	50.5%	46.2%	48.3%	48.8%	46.7%	48.0%
Girl	49.3%	53.6%	51.5%	50.3%	52.7%	51.2%
Age (Aus. <i>p</i> = .31; Amer. <i>p</i> = .11)						
10-11	0.9%	1.3%	1.1%	30.3%	20.3%	26.7%
12	23.5%	19.8%	21.7%	45.0%	43.7%	44.5%
13	34.9%	31.7%	33.3%	17.7%	29.1%	21.8%
14	28.1%	33.7%	30.9%	2.7%	5.8%	3.8%
15 or 16	10.5%	11.2%	11.0%	0.0%	0.0%	0.0%
Language at home (Aus. <i>p</i> = .21; Amer. <i>p</i> = .30)						
English only	60.5%	66.8%	63.6%	63.8%	75.3%	67.9%
Culture (Aus. <i>p</i> = .44)						
Australian or European ancestry	72.2%	74.7%	73.4%			
Non-European ancestry	18.0%	15.9%	17.0%			
Mixed ancestry	7.8%	7.0%	7.4%			
Race (Amer. <i>p</i> = .55, .87, .48 for White, African American, Hispanic)						
White				51.7%	62.9%	55.8%
Hispanic				28.1%	16.5%	23.9%
African American				3.3%	3.6%	3.4%
American Indian				1.4%	1.9%	1.6%
Asian				3.1%	5.2%	3.9%
Native Hawaiian				0.6%	0.5%	0.6%
Other				7.3%	6.9%	7.2%
Do you have a computer at home that you are allowed to use? (Aus. <i>p</i> = .62; Amer. <i>p</i> = .12.)						
Yes	83.7%	84.6%	84.2%	73.1%	84.4%	77.2%
Are you allowed to use a PC at home that can connect to the Internet? (Aus. <i>p</i> = .34; Amer. <i>p</i> = .14)						
Yes	60.7%	62.6%	61.7%	65.5%	81.8%	71.5%

NOTE: Percentages may not add to 100% because of a small number of missing responses.

Use of Consider This

Among the intervention group, 91% of children completed Module 1 (only 6% did not use Module 1). Completion of subsequent modules decreased (54.6% Module 2, 57.7% Module 3, 45.5% Module 4, 33.2% Module 5, 24.6% Module 6). Completion

Table 2. Smoking History of Students in the Australian and American Trials

	Intervention (<i>n</i> = 754)	Australian Control (<i>n</i> = 756)	Total	Intervention (<i>n</i> = 640)	American Control (<i>n</i> = 364)	Total
Have you ever smoked a cigarette? (Aus. <i>p</i> = .56; Amer. <i>p</i> = .92)						
No	58.6%	58.2%	58.4%	78.3%	83.2%	80.1%
Yes	41.4%	41.4%	41.4%	21.4%	16.8%	19.7%
During the past 30 days, on how many days did you smoke a cigarette (even a puff)? (Aus. <i>p</i> = .54; Amer. <i>p</i> = .41)						
0 days	24.7%	25.3%	25.0%	13.8%	13.2%	13.5%
1-2 days	5.3%	6.3%	5.8%	5.2%	2.5%	4.2%
3-5 days	3.4%	1.6%	2.5%	1.1%	0.5%	0.9%
6-9 days	2.4%	0.7%	1.5%	0.5%	0.0%	0.3%
10-19 days	1.2%	2.0%	1.6%	0.6%	0.3%	0.5%
20-29 days	2.4%	2.2%	2.3%	0.2%	0.3%	0.2%
All 30 days	1.6%	2.6%	2.1%	0.5%	0.0%	0.3%
Never even a puff	58.6%	58.2%	58.4%	78.3%	83.2%	80.1%
When did you last smoke a whole cigarette? (Aus. <i>p</i> = .63; Amer. <i>p</i> = .99)						
Today	2.9%	4.5%	3.7%	0.8%	0.0%	0.5%
In past 7 days	5.6%	4.5%	5.0%	1.1%	1.1%	1.1%
In past 30 days	5.8%	3.7%	4.8%	3.3%	2.2%	2.9%
1-3 months ago	5.2%	4.0%	4.6%	3.1%	2.2%	2.8%
4-6 months ago	1.3%	2.5%	1.9%	0.8%	1.6%	1.1%
7-12 months ago	2.5%	2.6%	2.6%	1.4%	1.4%	1.4%
More than a year	3.8%	5.3%	4.6%	5.6%	3.6%	4.9%
Never a whole one	13.7%	13.2%	13.4%	5.2%	4.4%	4.9%
Never even a puff	58.6%	58.2%	58.4%	78.3%	83.2%	80.1%

NOTE: Percentages may not add to 100% because of a small number of missing responses.

was greater with higher grades ($F = 17.32, p < .001$) and better school performance ($F = 14.96, p < .001$). Nonsmokers completed the most modules and current puffers/ex-smokers, the least ($F = 6.69, p < .001$). On average, children completed 43.2 out of 73 activities (59%) (activity completion increased with grade [$p < .001$]). Only 26.0% of students completed at least 90% of activities and could be reasonably considered to have completed the program.

Pre/Post Change in Outcomes

A greater proportion of Australian children exposed to Consider This who reported smoking a whole cigarette in the past 30 days at baseline said that they had not smoked one in the past 30 days at follow-up than children in the control group (intervention/control difference = $-0.045, p = .020$ adjusted for grade level; grade level effect $F = 3.89, p = .033$). The proportions in Table 3 also show that a smaller proportion of nonsmokers in the intervention group at baseline reported being smokers at follow-up. There was a similar near-significant trend in the change score on 30-day prevalence for even a puff. In both cases there were trends for fewer nonsmokers to progress to smoking and more smokers to become nonsmokers in the intervention group as compared with the

control. Further analysis revealed no interaction of intervention with gender ($p = .56$) nor differential uptake of smoking by gender ($p = .54$). By contrast there was an effect of year level on uptake, with uptake lowest overall at Year 9 ($p = .033$), but there was no significant interaction with intervention ($p = .44$).

There was no relationship between treatment group and future smoking expectations of all children and perceived vulnerability to smoking among nonsmokers. We explored whether the effect was due to a preventive effect on nonsmokers or a cessation effect on smokers at baseline. Neither was significant by itself, but there were trends for both (see Table 3).

Analyses of Loss to Follow-Up

The statistically significant unadjusted effect of treatment group on 30-day smoking of a whole cigarette was only completely eliminated if one assumed that all students who dropped out for individual reasons were smokers (difference = -0.0289 , $p = .387$) or nonsmokers (difference = -0.0350 , $p = .118$) at posttest. For all other intent-to-treat tests—assuming dropouts had their pretest smoking status (difference = -0.0347 , $p = .035$), using a hot-deck method (difference = -0.0357 , $p = .083$), employing a proportional imputation method (difference = -0.0350 , $p = .028$)—the positive program effect remained. The statistically significant effect of treatment group adjusted for grade level was only completely eliminated if one assumed that all students who dropped out for individual reasons were smokers at posttest (difference = -0.0231 , $p = .520$). For all other adjusted tests—assuming dropouts were nonsmokers (difference = -0.0438 , $p = .051$), had their pretest smoking status (difference = -0.0368 , $p = .017$), hot-deck method (difference = -0.0391 , $p = .057$), proportional method (difference = -0.0368 , $p = .012$)—the positive effect of Consider This remained.

Tests of Theoretical Mediation

Exposure to Consider This altered children's perceptions of how normative smoking was among children and adults. At posttest, more children in the intervention group compared to the control group had changed to believing that fewer children had tried smoking (difference = -0.580 , $p = .007$ adjusting for grade level and number of friends that smoke) or smoke at least once a week (difference = -0.479 , $p = .006$ adjusting for grade level), and that fewer adults smoke cigarettes (difference = -0.720 , $p < .001$ adjusting for grade level and number of people in the student's main group of friends) (Table 4). Intervention group students also believed more strongly that they would be better off as nonsmokers than controls, before covariate adjustment, but not after adjustment (difference = 0.074 , $p = .062$) (Table 4). There were no treatment group differences in student's attitudes toward smoking, confidence in not smoking in the future, and perceived importance of not smoking (Table 4).

Perceived norms for smoking by children appeared to mediate the effect of Consider This. When perceived norm for children trying cigarettes was entered into the model, it was significantly related to smoking prevalence ($F = 8.12$, $p = .004$) but treatment group was not ($F = 3.01$, $p = .096$). Likewise, perceived norm for children smoking at least once a week was significantly related to smoking prevalence ($F = 17.69$, $p < .001$) but treatment group no longer was ($F = 3.43$, $p = .077$). However, perceived norm for adult smoking did not seem to mediate the effect of Consider This, with both this perceived

Table 3. Changes in 30-Day Smoking Prevalence and Future Smoking Intentions by Treatment Group for Australian Trial

	Intervention (<i>n</i> = 754)		Control (<i>n</i> = 756)		Estimate of Group Difference	<i>p</i> Value for Group Difference
	Pretest	Posttest	Pretest	Posttest		
Smoked a whole cigarette in past 30 days (all grade levels):	13.1%	12.7%	11.2%	14.3%		
Direction of pre/post change in smoked whole cigarette (all grade levels):						
Smoked to not smoked	4.9%			3.0%	-0.0418	.038
Not smoked to smoked	4.5%			6.1%		
Stayed the same	90.6%			90.9%		
Smoked a whole cigarette in past 30 days (by grade level):						
Year 7	10.2%	11.2%	4.3%	6.0%		
Year 8	10.8%	12.0%	8.5%	15.0%		
Year 9	20.0%	15.7%	20.3%	21.1%		
Smoked any portion of a cigarette in past 30 days (all grade levels):	17.5%	16.3%	16.4%	19.2%		
Direction of pre/post change in any cigarette smoking prevalence:						
Smoked to not smoked	6.8%			5.3%	-0.0449	.099
Not smoked to smoked	5.6%			8.1%		
Stayed the same	87.7%			86.6%		
Future smoking intentions (all grade levels):	3.17 (0.96)	3.30 (0.94)	3.13 (0.98)	3.29 (0.89)	-0.0229	.669

Table 4. Mean Scores on Mediator Variables at Pretest and Posttest and Tests of Differences by Treatment Group for Australian Trial

Possible Mediators	Intervention ^a		Control ^b		Group Difference	p Value
	Pretest	Posttest	Pretest	Posttest		
Positive effects of smoking	2.72 (0.72)	2.69 (0.73)	2.78 (0.73)	2.78 (0.71)	-0.0341	.438
Positive feelings toward smoking	3.31 (0.76)	3.36 (0.76)	3.34 (0.73)	3.33 (0.77)	0.0498	.227
Proportion of peers who have tried smoking	5.38 (3.11)	5.26 (3.01)	4.90 (3.10)	5.51 (3.03)	-0.7026	.002
Proportion of peers who smoke at least once a week	3.39 (2.51)	3.47 (2.61)	3.01 (2.42)	3.49 (2.48)	-0.4291	.013
Proportion of adults who smoke	6.55 (2.30)	5.95 (2.42)	6.41 (2.23)	6.45 (2.19)	-0.6170	<.001
Confidence in not smoking in the future	3.48 (0.84)	3.51 (0.79)	3.50 (0.78)	3.50 (0.79)	0.0282	.553
Importance of not smoking in the future	3.38 (0.96)	3.40 (0.95)	3.35 (0.98)	3.34 (0.98)	0.0273	.703
Better off being a nonsmoker in the future	3.64 (0.74)	3.70 (0.69)	3.66 (0.72)	3.64 (0.75)	0.0799	.048
Need to try smoking before deciding to do it or not	2.77 (1.07)	2.72 (1.04)	2.76 (1.02)	2.78 (1.04)	-0.0432	.406
A lot of time spent each day thinking about smoking	3.50 (0.72)	3.51 (0.74)	3.48 (0.71)	3.56 (0.67)	-0.0883	.096

a. Sample sizes in the intervention group ranged from 711 to 738 students because of item nonresponse.

b. Sample sizes in the control group ranged from 720 to 744 students because of item nonresponse.

norm ($F = 5.82, p = .016$) and treatment group ($F = 4.98, p = .036$) significantly related to smoking prevalence. Believing they were better off as nonsmokers did not reduce the main effect on prevalence, so it was not acting as a mediator with both it ($F = 68.85, p < .0001$) and treatment group ($F = 5.74, p = 0.025$) remaining significant.

Potential Harmful Side Effects of Consider This

Neither measure of potentially unfavorable effects of acknowledging smoking in the Consider This program differed by treatment group. There was no relationship with perceived need to try smoking to decide on smoking in the future and treatment group or on thinking a lot about smoking (Table 4).

Relationship of Consider This Usage to 30-Day Smoking Prevalence

There was evidence of a dosage effect, especially on perceived norms for smoking in the unadjusted analysis of treatment group. As program usage increased (controls = no usage), more children perceived that fewer children had tried smoking (number of modules completed: difference = $-0.225, p < .001$; modules partially completed: $-0.160, p < .001$; number of activities completed: $-0.163, p < .001$; level of exposure: $-0.532, p < .001$) or smoked once a week (modules completed: $-0.116, p < .001$; modules partially completed: $-0.091, p < .001$; number of activities completed: $-0.085, p < .001$; level of exposure: $-0.29, p < .001$). Level of exposure was also associated with pre/post change in 30-day smoking prevalence (difference = $-0.021, p = .032$).

American Trial

Profile of the Sample

The sample analyzed in the American trial included children who completed both pretest and posttest (1,020 or 82.7% of participants), of whom 1,004 had sufficient data (640 intervention, 364 control) from 21 schools (10 in intervention/11 in control). Two types of dropouts were experienced: 110 (8.9%) students completed only the pretest due to the entire class dropping out because it could not operate the Consider This technology; and 104 (8.4%) completed only the pretest for individual reasons (most commonly being absent). There were no differences between these groups and students completing both the pretest and posttest by treatment group ($p = .18$), grade level ($p = .08$), or gender ($p = .33$). However, individual dropouts reported lower school performance ($F = 29.97, p < .001$) and were more likely to be Hispanic or African American ($F = 5.49, p < .001$), speak mostly a language other than English in the home ($F = 5.87, p = .002$), ever smoke ($F = 10.22, p = .001$), and smoke in the last 30 days ($F = 4.95, p = .026$). Details of the sample are provided in Tables 1 and 2.

Most students came from Years 6 and 7 and were aged 11 to 13. They were evenly split on gender. The largest racial/ethnic group was White, but 40.5% of the sample was minority students, mostly Hispanic (23.9%). The treatment groups did not differ at baseline on demographics, Internet experience, and smoking (Tables 1 and 2). Smoking at baseline was low (19.7% had smoked a cigarette, 6.4% had smoked in the last 30 days, and 4.5% had smoked a whole cigarette in the last 30 days). Smoking increased with grade level for ever use ($p < .0001$) and 30-day smoking prevalence for even a puff

($p = .014$) but not for gender. However, 30-day smoking of a whole cigarette was highest in Grade 7 and lowest in Grade 6 ($p = .002$).

Use of Consider This

In the intervention group, 83.1% of children completed Module 1, but fewer completed subsequent modules (47.5% Module 2, 45.6% Module 3, 42.0% Module 4, 42.0% Module 5, 18.6% Module 6). Module completion increased with higher grades ($F = 13.63, p < .001$), better school performance ($F = 5.86, p = .016$), less absenteeism ($F = 10.48, p = .001$), lower rebelliousness score ($F = 4.25, p = .040$), speaking English or mostly English at home ($F = 4.41, p = .004$), and access to Internet at home ($F = 9.77, p = .002$). It was highest for nonsmokers and lowest for current puffers ($F = 3.24, p = .012$). On average, children completed 46.6 out of 73.0 activities (64%) in Consider This, but only 24.8% of students completed at least 90% of activities and could be reasonably considered to have completed the program.

Pre/Post Change in Outcomes

There were few differences by experimental group in the American trial and less evidence that Consider This was effective than in the Australian data. We report analyses on smoking prevalence and on subjective norms and program use, which were related to program effectiveness in the Australian trial, to provide an account of this trial and avoid publication bias by not publishing analyses with largely nonsignificant findings.

There was no significant change in 30-day smoking prevalence because of exposure to Consider This for either smoking any portion of a cigarette (estimate = 0.0072, $p = .776$) or smoking a whole cigarette (estimate = 0.0247, $p = .122$). There were no interactions with gender or year level. Analyses of the outcome, change in smoking prevalence (whole cigarette), showed that when one assumed that all dropouts were smokers at posttest, the treatment group effect was statistically significant when adjusted for grade level (difference = $-0.068, p = .037$), but treatment group was not statistically significant in any other form of intent-to-treat analysis.

There was a small positive effect with students in the intervention group less likely to expect future smoking compared to the control (Intervention: pretest $M = 3.40, SD = 0.85$, posttest $M = 3.55, SD = 0.74$, pre/post difference $M = 0.13, SD = 0.88$; Control: pretest $M = 3.67, SD = 0.67$, posttest $M = 3.65, SD = 0.70$, pre/post difference $M = -0.04, SD = 0.77$; estimate = 0.1566, $p = .031$). Among nonsmokers, there was no intervention effect on susceptibility (estimate = $-0.021, p = .67$).

Pre/Post Changes in Potential Mediators

At posttest, more children in the intervention than control group had reduced their perception of smoking by adults (Intervention: pretest $M = 6.84, SD = 2.58$, posttest $M = 6.47, SD = 2.48$; Control: pretest $M = 6.16, SD = 2.45$, posttest $M = 6.32, SD = 2.24$; estimate = $-0.6029, p = .034$; estimate adjusted for the number of friends who smoke = $-0.576, p = .018$). However, there were no effects on peer norms for trying smoking (estimate = $-0.277, p = .475$) or smoking at least once a week (estimate = $-0.159, p = .630$). There was no effect of the intervention on beliefs about the positive physical or mental effects (estimate = $-0.0264, p = .745$) or positive emotional feelings (estimate = 0.0589, $p = .322$) toward smoking.

*Relationship of Consider This Usage With Pre/Post
Change in 30-Day Smoking Prevalence*

There was no evidence of a dosage effect with respect to the measures, change in smoking prevalence (whole cigarette), difference in perception of how many peers have tried smoking, and difference in perception of how many peers smoke at least once a week.

DISCUSSION

The two trials had quite different outcomes, although there was commonality in the effects of Consider This on postulated mediators. Taken together, the results suggest that Consider This may be successful at adjusting perceived norms so that children believe fewer adolescents smoke and may have the capacity to reduce smoking and/or reduce students' expectations of future smoking. Other programs that focused on social influences also have produced reductions in current smokers (Biglan et al., 1987a; Biglan et al., 1987b; De Vries et al., 1994; Ellickson & Bell, 1990) and nonsmokers (Armstrong, de Klerk, Shean, Dunn, & Dolin, 1990; De Vries et al., 1994) in the short term. However, this conclusion is tentative because the effects differed by trial. The reduction in smoking in the Australian trial appeared to be mediated in part through the program's ability to create perceptions that smoking by students is not normative, an intervention technique that has been successful in prevention of smoking and other risk behaviors (Flay, 1995; Graham et al., 1991; Hansen, Raynor, & Wolkenstein, 1991; Ianotti & Bush, 1992; Lewis & Neighbors, 2006; MacKinnon et al., 1991; Rooney & Murray, 1996; Sussman et al., 1995). However, the effects on future expectations in the American trial did not appear to be mediated through expected routes (but our analyses did not fully demonstrate mediation because both mediators and smoking prevalence were measured at the end of the trials). Although not directly evaluated, the program effects may stem from the tailoring of message to student smoking experiences, a successful technique in other studies (Borland et al., 2004; Etter & Perneger, 2001; Prochaska, DiClemente, Velicer, & Rossi, 1993b). In neither trial was there complete use of the program, but there were positive dose-response effects in Australia. This raises a number of important questions: Why do the results of the trials differ? Are the effects real? What would have been the effects if most students had received the entire program? Can the Internet be used to deliver prevention content? Consideration of the first question is crucial to beginning to answer the others.

The evidence for a prevention effect on smoking emerged in the Australian but not the American trial, whereas the effect on future expectations was unique to the American trial. The American trial may not have provided a fair test of the program's effect on the behavioral outcome. The matching of schools failed because of teacher and technological implementation problems leading to dropout (Hall et al., 2001). Unlike trials with individual-level randomization in which dropouts are routinely considered and estimates are often reasonably consistent in the populations of individuals, planning for dropouts when schools are the unit of analysis is much more problematic because a loss of a school can have a much larger impact on statistical power than the loss of an individual. Furthermore, control schools had fewer children who had ever smoked than intervention schools. Thus, we were intervening on children who were at the start of the period of maximal uptake compared to the controls that may have been behind that, so we might expect to get more experimentation in the intervention than

control schools, working against program success. Although this is plausible, we cannot rule out some alternatives—for example, more change in smoking might be expected in the controls because they were expected to catch up, and future expectations among less experienced controls might move naturally more toward smoking than among more experienced intervention students. As a result, failure of randomization does not provide a satisfactory explanation for the differences between trials. For example, if the estimated dropout rate is 80% and there are 200 patients, we expect 40 dropouts plus or minus 11, so we should end up with 149 to 171 patients. However, if there are 30 schools randomized, although we expect 24, it could range from 20 to 28, having a good deal more impact on the power of the investigation than if we were doing individual randomizations.

A second possible explanation for the failure of Consider This in the American trial is that cultural differences made it ineffective in the United States. We believe that this is unlikely. First, the program was developed in the United States and based largely on research that comes from that country, rather than Australia. Second, and more central, some similar changes were observed in proximal outcomes, especially normative beliefs in the direction of supporting not smoking in both trials, suggesting that some precursors to behavior change were being influenced. We can think of no coherent rationale to support a cultural-differences explanation.

A third possibility is that the active consenting procedures employed in the American trial produced a selection bias that worked against program success. But again, we can see no clear mechanism as to why this might be so.

Another explanation is that Consider This was more effective with older children within the Grade 6 to 9 period. The Australian sample was slightly older than the American sample, and more children were experimenting with cigarettes at pretest in the Australian trial than in the American trial. Data on U.S. smoking trends suggest that experimentation peaks in that country later than Grade 7. Thus, the differences between the trials could be because of the stage in the uptake process at which we intervened. The unique routines in tailoring content to experimenters and past users may have met the needs of older students in the Australian sample. Tailored programs of this kind may be less advantageous when virtually all the students are in a common state, as in the American trial. However, the content for children who had never tried cigarettes was similar to that provided in other prevention programs, and there is no compelling reason why it would be less effective with the younger students in the American trial. Still, in the short term, a prevention program can only work on those who have some a priori probability of changing their smoking behavior, and there was less smoking in the earlier age groups.

True, some of the younger students were smoking in the American trial, and they appear to be unaffected by Consider This. Perhaps this was because it was not designed to address issues that promote smoking among early adopters, such as problems of adjusting to school, unhappy lives, or being more innovative and high sensation seekers. These children may be a very hard group to reach with the educational materials in Consider This, for the reasons they smoke are unlikely to be related to many of the social influence factors targeted by Consider This. By contrast, students in Grades 8 to 9 who take up smoking at that time are doing so in a context in which some of their peers are already smoking, and they may be much more influenced by social factors than the earlier initiators. Consider This was intended to challenge children's social motivations for smoking, provide them skills for refusing or inoculating friends against influencing them to smoke, and provide reasons to protect themselves from the risks of

smoking when they did take it up (i.e., to move away from smoking after experimenting with it and not following the "crowd" toward regular smoking). All of these factors might be more likely to affect children in Grades 8 and 9. This intriguing hypothesis deserves further investigation.

Several limitations were imposed by the incomplete implementation of Consider This related mostly to technological impediments to Internet delivery, such as low bandwidth and filtering software, insufficient school IT support, and lack of time in computer labs (Hall et al., 2001). We were able to overcome some problems in Australia that we encountered in the United States but faced new ones. Insufficient bandwidth was solved by caching the program on school computer servers or delaying implementation until bandwidth was enlarged. The incomplete implementation appeared to be caused as much by technological barriers or the approaching conclusion of the school year as by lack of class time or disinterest by teachers or students. Teachers who were less committed to the curriculum could have reported more technical problems to rationalize incomplete implementation, and we did not place observers in the computer labs. However, the implementation measure provided by the Web server that recorded mouse clicks and Web pages served provided more precision than observational fidelity measures, which often cannot detect whether each child is attending to the program content.

It is probable that the full potential effects of Consider This were not seen in either trial, although holding users' attention to gain full exposure to computer-based education is challenging when other stimuli compete for this attention or students lack self-reliance to progress without an instructor (Howland & Moore, 2002; Svetcov, 2000). The Australian trial did have balanced randomization, and the discovery of reductions in smoking, with some evidence of a dose response, suggests that Consider This may be more successful when fully implemented. It is disappointing to be only able to study partial implementation, because later modules focused on decision-making and resistance skills that have successfully reduce smoking in some but not all trials (Dijkstra, Mesters, De Vries, van Breukelen, & Parcel, 1999; Hansen et al., 1991). However, it appeared that we were implementing a program at the limits of what schools could do with their Internet technology at that time. That said, the failure to find effects for some of the theoretical mediators suggests that some of the content in Consider This may either be ineffective at arresting smoking uptake or inadequately implemented to have only small effects.

Implications for Practitioners

These two trials have only begun to assess the potential of the Internet to deliver smoking-prevention programs to children. Although this project did not provide compelling evidence that Consider This was effective, Internet-based approaches should not be seen as fruitless. This project was mounted early in the development of the Internet when little was known about how to create and deliver programs successfully into school computer environments, school computer technology was much more limited than it is today, and many teachers had limited experience using computer-based instruction. Programs such as Consider This should be more successful now, because Internet hardware and software is more mature, researchers and health professionals have learned more about how to deploy them, and more teachers are experienced at using computers as teaching aids. Children certainly possess the skills to use Internet-based instruction both inside and outside of school, although schools may not offer as

much Internet content as students might desire, at least in the United States (Lenhart, Simon, & Graziano, 2001; Levin & Arafeh, 2002). Notably, another recent Web-based smoking-prevention program did favorably affect prosmoking attitudes, self-efficacy expectations, and belief about negative effects of smoking among sixth-graders (Shegog et al., 2005). However, some barriers remain, particularly the cross-pressures for time in the curriculum that was undoubtedly one reason for partial implementation. We may need shorter interventions for schools or interventions that are designed to be effective when only partly implemented. Designers also should consider the format of online prevention programs. Earlier modules in *Consider This* contained more game-like activities and were designed to promote engagement by users, consistent with the arousal theory approach to educational technology in which engagement is positively related to learning. More recent evidence supports, instead, a cognitive load theory. Arousal and engagement can distract from learning if the features that produce arousal are irrelevant to learning. Instead, decision-making activities, simulations, and presentations, which comprised much of the later modules in *Consider This*, promote internalization of content (Mayer, Heiser, & Lonn, 2001; Moreno & Mayer, 2000). Thus, earlier modules may benefit from extensive revision to develop activities that are less entertaining and more instructive.

We continue to believe that the Internet can be a cost-effective tool for delivering successful prevention programs both inside and outside the classroom. However, the medium per se will not determine the success of such programs; they will only be as good as the prevention content that is delivered. It may be useful to follow the best advice on program content from prior studies of smoking uptake and evaluations of prevention programs when creating a prevention program. However, we did not test the content in *Consider This* outside of the Internet environment, so we cannot be certain that it was effective at changing the mediators of smoking uptake (Meyer, 2003). Still, the capacity of the Internet to bring that information to life, personalize it, present it with culturally appropriate narrators, and potentially continue personalized relationships with children outside the classroom means that it may engage and influence students in ways more static materials cannot. However, not all Internet features may succeed at this. For instance, research has shown that irrelevant details used solely to engage students do not provide the real practice needed to instill principles into long-term memory (Garner, Gillingham, & White, 1989; Harp & Mayer, 1997a, 1997b). The game-like activities in *Consider This* could have limited its effectiveness with children who did not complete the later modules where they practiced decision making and resistance to influence skills.

An Internet prevention program, such as *Consider This*, is only one in a series of events that will occur in children's lives to cumulatively speak against smoking. Strong effects, even with full implementation, may not materialize because of the complex personal, social, and environmental issues surrounding smoking uptake. This posed a challenge for confirming the benefits of *Consider This* in a short trial with modest intervention contact. We are confident, however, that there was no evidence that our approach of talking with experimenters about their smoking had any adverse effects. Students exposed to *Consider This* did not adopt the belief that one has to try smoking before deciding whether to smoke or did not think about smoking a lot. A recent study on a program that acknowledged students' smoking experience at a classroom level in Australia also found prevention effects for both never and experimental smokers (Hamilton, Cross, Resnicow, & Hall, 2005). The semiprivate environment created on the computer (Walther, 1996) should have helped to increase disclosure of past

experiences while shielding nonsmokers from exposure to messages acknowledging past smoking.

Adolescents live in a media environment where the Internet plays a very large and increasingly dominant role (Australian Cultural Ministers Council & Australian Bureau of Statistics, 2000; U.S. Department of Commerce & National Telecommunications and Information Administration, 2005). It is an important channel in any community-based tobacco prevention program. Obviously, much more needs to be done before reaching a definitive conclusion about whether Internet programs can successfully reduce smoking by adolescents.

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