Nicotine & Tobacco Research Volume 10, Number 9 (September 2008) 1477–1485

informa
healthcare

Impact of A Smoking Prevention Interactive Experience (ASPIRE), an interactive, multimedia smoking prevention and cessation curriculum for culturally diverse high–school students

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Received 13 August 2007; accepted 26 February 2008

Few studies have examined the long-term efficacy of computer-based smoking prevention and cessation programs. We analyzed the long-term impact of A Smoking Prevention Interactive Experience (ASPIRE), a theoretically sound computer-based smoking prevention and cessation curriculum for high school students. Sixteen predominantly minority, inner-city high schools were randomly assigned to receive the ASPIRE curriculum or standard care (receipt of the National Cancer Institute's *Clearing the Air* self-help booklet). A total of 1160 students, 1098 of whom were nonsmokers and 62 smokers at baseline, were included. At 18-month follow-up, among baseline nonsmokers, smoking initiation rates were significantly lower in the ASPIRE condition (1.9% vs. 5.8%, $p<.05$). Students receiving ASPIRE also demonstrated significantly higher decisional balance against smoking and decreased temptations to smoke. Differences between groups in self-efficacy and resistance skills were not significant. There was a nonsignificant trend toward improved smoking cessation with ASPIRE, but low recruitment of smokers precluded conclusions with respect to cessation. ASPIRE demonstrated the potential for an interactive multimedia program to promote smoking prevention. Further studies are required to determine ASPIRE's effects on cessation.

Introduction

School-based interventions hold considerable promise with regard to tobacco control education and promoting tobacco-free lifestyles among youth. The school environment is compelling because most children and adolescents spend much of the daytime at school, can be easily reached there, and are more receptive to health-related educational programs in a disruption-free atmosphere than elsewhere (Botvin, 2000; Peterson, Kealy, Mann, Marek, & Sarason, 2000). Short-term studies of school-based smoking prevention programs have reported lower rates of subsequent youth smoking (Dent et al., 1995; Sussman et al., 1993). However, mixed evidence exists with respect to the efficacy of school-based smoking prevention programs, and there has been no demonstrated lasting effect on smoking prevalence (Wiehe, Garrison, Christakis, Ebel, & Rivara, 2005).

School-based smoking cessation programs have traditionally encountered recruitment, dissemination, and fidelity challenges. Most youth smokers who intend to quit smoking are not aware of the availability of smoking cessation programs at their schools (Leatherdale, 2005). While such programs

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ISSN 1462-2203 print/ISSN 1469-994X online © 2008 Society for Research on Nicotine and Tobacco

DOI: 10.1080/14622200802323183

are potentially effective, the majority of student smokers will not participate in school-based smoking cessation programs or clinics (Leatherdale, 2006). Further, retention rates for cessation programs tend to be low (McCormick et al., 1999; U.S. Department of Health and Human Services, 1994). Reluctance of students to participate in smoking cessation programs is possibly related, in part, to the stigma attached to smoking behavior and the necessity for the participants to self-identify as tobacco users.

Existing smoking prevention and smoking cessation education programs are difficult to disseminate and often inconsistently implemented by teachers (Pallonen, Prochaska, Velicer, Prokhorov, & Smith, 1998; Resnicow, & Botvin, 1993; Rohrbach, Graham, & Hansen, 1993). Interventions that are teacher led, as opposed to research staff led, are subject to possible intervention failure because of poor teacher compliance and lack of commitment, which may help explain why the Hutchison Smoking Prevention Project, often considered by many to be a gold-standard intervention in prevention science, found no effect on outcomes (Clayton, Scutchfield, & Wyatt, 2000; Peterson, Kealy, Mann, Marek, & Sarason, 2000).

Computer-based interactive multimedia curricula have the potential to overcome recruitment, dissemination, and implementation challenges. Programs can be individually tailored, can be confidential, can be easily accessed via the Internet in 99% of U.S. public schools, can provide a standardized education experience, and are motivational for adolescents (National Center for Education Statistics, 2003; Strecher, Shiffman, & West, 2005). Computer-based applications for smoking prevention and cessation in school are encouraging, having demonstrated feasibility, high acceptance by students, and positive impact on determinants of smoking (Shegog et al., 2005). However, few computer-based applications have been examined for effectiveness at long-term (18-month) follow-up.

In the current study, we present the results from A Smoking Prevention Interactive Experience (ASPIRE), a theoretically and empirically based interactive, multimedia smoking prevention and cessation curriculum for culturally diverse high school students. We hypothesized that students in schools receiving the ASPIRE curriculum would have lower rates of smoking initiation (for nonsmokers) and higher rates of smoking cessation (for smokers) at 18-month follow-up compared with students in comparison schools. We also hypothesized that well-established determinants of smoking, including decisional balance (Hudmon, Prokhorov, Koehly, DiClemente, & Gritz, 1997; Velicer, DiClemente, Prochaska, & Brandenburg, 1985), temptation to smoke (Hudmon et al., 1997; Velicer, DiClemente, Rossi, & Prochaska, 1990), self-efficacy (Bandura, 1977), resistance skills (Lloyd-Richardson, Papandpontos, Kazura, Stanton, & Niaura, 2002), peer smoking (Killen et al., 1997), and parental smoking (Flay, Phil, Hu, & Richardson, 1998), would mediate the effect of the intervention on both initiation and cessation of smoking.

Methods

ASPIRE, an interactive, multimedia smoking prevention and cessation curriculum for culturally diverse high school students, was a 4-year, nested-cohort, group-randomized, controlled trial designed to compare the effect of a CD-ROM-based smoking prevention and cessation intervention against the effect of a standard-care intervention (receipt of the National Cancer Institute's *Clearing the Air* self-help booklet) among culturally diverse high-school students. The study was approved by the institutional review board of The University of Texas M. D. Anderson Cancer Center. Before students participated in the study, informed consent was obtained from parents of students who were younger than 18 years of age and from students who were 18 years of age or older.

Study design and intervention

Complete details of the intervention methodology, project logistics, procedures, intervention program content, and the baseline sample characteristics are provided elsewhere (Prokhorov et al., under review). Key study parameters are briefly presented here.

The study was conducted at 16 high schools in the greater Houston area. We selected schools located in ethnically diverse, socioeconomically disadvantaged communities. After schools were recruited and school coordinators were assigned, the 16 participating schools were randomly assigned to the ASPIRE intervention (eight schools) or to the standard care comparison (eight schools). Participants were 10th grade students who could speak, read, and write English.

At baseline, participants completed an 87-item self-report questionnaire regarding sociodemographic characteristics, smoking status, and environmental and behavioral determinants of smoking. Many of the questionnaire items were derived from existing scales or were utilized in our previous studies of adolescent smoking.

At baseline, on the basis of questionnaire answers, students were categorized as smokers (''smoke every other week,'' ''smoke less than a pack a week,'' ''smoke one pack a week,'' ''smoke more than a pack a week,'' ''smoke a pack a day,'' or ''smoke more than a pack a day'') or nonsmokers. The nonsmokers were further classified as never smokers (''never smoked even part of a cigarette''), experimenters

("only smoked part of a cigarette" or "smoked only a few times"), or former smokers ("used to smoke regularly but quit in last 12 months" or "quit more than 12 months ago").

ASPIRE was programmed with MacroMedia Director™ and FLASH™ software and contained embedded animations, video, and interactive activities. It was composed of five weekly sessions in one semester and two "booster" sessions in the following semester (each 30 min in duration) accessed on a desktop computer in the classroom during lesson periods. Overall, ASPIRE featured eight educational "tracks" (over 5-hr of videos, animations, interactive quizzes, etc.) and was designed to address the needs of both smokers and nonsmokers. At the commencement of each session, students completed a series of questions designed to determine their smoking status and stage of smoking acquisition or cessation. They were then provided with a series of activities that were tailored to stage of intention and designed to promote movement through the stages toward smoking cessation (for smokers) or reduced likelihood of initiation (for nonsmokers). ASPIRE was founded on the Social Cognitive Theory (Bandura, 1977) and the Transtheoretical Model of Change (Prochaska, Redding, & Evers, 1997). The follow-up assessment was performed at 18 months after the beginning of the intervention program.

Primary outcomes examined

We estimated the rate of smoking initiation at 18-month follow-up, which was defined as the proportion of students who reported being nonsmokers at baseline who reported current smoking at 18-month follow-up. We also characterized cigarette smoking behavior at 18-month follow-up using the Minnesota Smoking Index (MSI) (Murray, Prokhorov, & Harty, 1994; Pechacek et al., 1984), a composite three-item smoking index, scaled to reflect the number of cigarettes smoked per week. Respondents with MSI scores of 1 or higher were categorized as weekly smokers, while those with MSI scores of less than 1 were categorized as nonsmokers. The MSI is well correlated with biochemical measures of smoking among high school students and has been used in adolescent smoking research for more than 20 years to validate reported smoking behavior (Murray et al., 1994). We were able to compute the MSI for both self-reported smokers and self-reported nonsmokers.

Secondary outcomes examined

At baseline, among nonsmokers, we evaluated well-established primary determinants of smoking behavior to determine if these would mediate any effect of the ASPIRE intervention on smoking initiation at 18-month follow-up. *Decisional Balance* was assessed using a previously validated 12-item Likert scale on which a higher score indicates higher agreement with reasons not to smoke (Hudmon et al., 1997; Velicer et al., 1985). Temptations to smoke were assessed using the *Temptations to Try Smoking Inventory*, a previously validated 10-item scale on which a lower score indicates fewer temptations to smoke (Hudmon et al., 1997; Velicer et al., 1985). *Self-efficacy* was assessed using a 10-item scale that asks respondents "how confident are you to resist?" in various situations (Bandura, 1977). Also, *aids to smoking resistance* were assessed using a 14-item questionnaire on which each item was rated on a scale from 0 ("doesn't help at all") to 5 ("helps a lot") (Lloyd-Richardson et al., 2002). The effect of *peer smoking* was assessed by asking students how many of their best friends smoked (Killen et al., 1997). *Parental smoking* was assessed by asking students, "Does your mother, step-mother, or female guardian smoke?" and "Does your father, step-father, or male guardian smoke?" (Flay et al., 1998).

Statistical methods

Differences between the intervention and comparison groups in baseline sociodemographic variables and determinants of smoking were examined using two-sample *t*-tests for continuous variables and the chi-square test for categorical variables. To test the effectiveness of the intervention, we used generalized linear mixed model regression to detect group differences in smoking initiation at 18-month follow-up (PROC Glimmix in SAS). Smoking initiation and cessation were analyzed as separate outcomes. For nonsmokers at baseline the intervention group and baseline smoking status were entered as fixed effects. School was the unit of randomization and was modeled as a random effect nested within treatment condition to adjust for potential correlation of measurements within school. The sample was stratified by baseline smoking status (never smoker, experimenter, or former smoker) for comparisons between these groups. Covariates (including age, gender, Hispanic ethnicity, and baseline smoking status) were included in the final model when related to the outcomes. Pre-post test analysis of MSI scores at 18 months was conducted using mixed-model ANCOVA controlling for the baseline score. Between-group change in decisional balance, temptations to smoke, self-efficacy, and resistance skills at 18-month follow-up was assessed using mixed-model ANCOVA (PROC mixed in SAS). The intervention condition was modeled as a main effect and the baseline value of the determinant as a covariate. School was modeled as a random effect nested within

the intervention condition. Because of the differential effect of the intervention with respect to smoking initiation rates on Hispanic and non-Hispanic students, results are also reported stratified by Hispanic ethnicity.

To evaluate whether intervention had a differential effect on smoking initiation at 18 months for high-risk students, risk factor approaches (Baron & Kenny, 1986; Kraemer, Wilson, Fairburn, & Agras, 2002) were utilized. These analyses are secondary because the sample size estimates were not based on effects on subgroups. As such these analyses were considered hypothesis generating. Risks for smoking related to peer pressure and parental smoking were dichotomized as high and low risk and analyzed using linear mixed model regression with smoking initiation at 18 months as the dependent variable and school of origin as a random effect. The model included fixed effects for intervention condition and risk factors and the interaction of these two effects. A significant interaction effect indicates that the effect of the intervention is enhanced in one subgroup compared with the other subgroup. Post-hoc subgroup analysis was conducted to assess whether there were differences in these subgroups in the effect of the intervention. The percentage of smokers at 18 months in each category and estimated odds ratios (*OR*) and 95% confidence intervals (*CI*) were used to summarize the results and to compare smoking initiation rates in the different categories of the risk factors. All statistical analyses were performed using SAS 9.1 (SAS Institute Inc.) or SPSS version 12.0 (SPSS).

Results

Participants

A total of 2500 students (target recruitment number) at the 16 selected high schools were invited to participate. Informed consent was received for 1935 students. Baseline surveys were completed by 1608 of these students, for a participation rate of 64.3% (1608/2500) overall and 83.1% (1608/1935) among students for whom informed consent was received. Thirty-four of the 1608 students who completed baseline surveys were excluded from the analyses because they did not report their smoking status. Thus, the results were derived from 1574 participants.

A total of 1160 students completed 18-month follow-up and thus were eligible for inclusion in the analyses reported in this paper. Of these students, 1098 were categorized as nonsmokers at baseline, 697 as never smokers, 360 as experimenters, and 41 as former smokers. Sixty-two of the students who completed 18-month follow-up were current smokers at baseline. We initially recruited 111 current smokers to the study, but there were high rates of attrition of smokers in both the intervention and comparison groups—almost 50% in each group. There were no differences between those who completed the intervention and those who dropped out on age, gender, ethnicity, or determinants of smoking.

In this paper, we address our primary hypothesis concerning overall smoking prevalence at the 18-month follow-up. We do not report on 6- or 12-month follow-up because one of the schools temporarily dropped out of the study because of an unforeseen circumstance not related to the project. We did regain the school's participation at 18-month follow-up, thereby enabling us to report our results on all schools at 18-month follow-up.

Baseline characteristics

At baseline, there were significantly more Hispanic students (58.9% vs. 41.6%, $p<.01$) and significantly higher decisional balance scores ($p<.01$) in the intervention group than in the comparison group. Table 1 shows the distribution of Hispanic students by school across intervention condition. The groups did not differ significantly on other behavioral, psychosocial, or demographic variables.

Primary outcomes

Smoking initiation. Tables 2 and 3 display results of the final regression model. Covariates including age, gender and Hispanic ethnicity were not significantly related to the outcomes and were not included in the final model. The interaction between ethnicity and intervention condition was tested for significance but was not found to be significant. After controlling for all covariates, the intervention condition significantly predicted smoking initiation ($OR=2.87$, 95% *CI* 1.06–7.78, $p<.05$) with students in control reporting higher initiation. Intervention condition and baseline smoking status were significantly related to the outcome and were included in the final model. The results are summarized in Table 2 using parameter estimates, *p* values, *OR* and 95% *CI*. Fit statistics using pseudo-likelihood measure for the final model were higher compared with the unconditional model. Among baseline nonsmokers, significantly fewer students in the intervention group than in the comparison group initiated smoking by 18-month follow-up (1.9% vs. 5.8%, $p<.05$). In both the intervention and comparison groups, experimenters and former smokers had significantly higher smoking initiation rates than never smokers.

Among males, students in the intervention group had significantly lower smoking initiation rates than students in the comparison group (2.2% vs. 7.9%, $p<.05$). All initiators in the intervention group were

Table 1. Distribution of Hispanic ethnicity by school and intervention condition for nonsmokers at baseline.

			Hispanic		Total
Group			No N (%)*	Yes N (%)*	N
Comparison	School	1	28 (90.3%)	3 (9.7%)	31
		2	12 (22.2%)	42 (77.8%)	54
		3	17 (38.6%)	27 (61.4%)	44
		4	26 (34.7%)	49 (65.3%)	75
		5	39 (61.9%)	24 (38.1%)	63
		6	66 (69.5%)	29 (30.5%)	95
		7	6 (14.3%)	36 (85.7%)	42
		8	97 (100%)	0 (0%)	97
		Total	291 (58.1%)	210 (41.9%)	501
Intervention	School	9	72 (64.3%)	40 (35.7%)	112
		10	7 (6.9%)	95 (93.1%)	102
		11	37 (71.2%)	15 (28.8%)	52
		12	33 (68.8%)	15 (31.3%)	48
		13	3 (4.2%)	68 (95.8%)	71
		14	10 (17.2%)	48 (82.8%)	58
		15	40 (51.3%)	38 (48.7%)	78
		16	42 (80.8%)	10 (19.2%)	52
		Total	244 (42.6%)	329 (57.4%)	573

*Percentage within school.

Table 2. Results of final model (Proc Glimmix); smoking initiation rates among nonsmokers at 18-month follow-up by baseline smoking status (n=1098).

Parameter	Estimate	p value	*OR* (95%CI)	Higher initiation associated with …
Intervention group	1.0526	.0349	2.87 (1.08–7.61)	Being in control group
Smoking status				
Never smoker vs. former smoker	−2.6224	<.001	0.07 (0.03–0.21)	Being former smoker
Experimenter vs. former smoker	−1.0460	.0315	0.35 (0.14–0.91)	Being former smoker

of Hispanic origin. Compared with noninitiators, initiators in the intervention group had higher baseline temptations to smoke than noninitiators (21.7 vs. 13.7, $p<.05$), were more likely to have close friends who smoked (73% vs. 42%, $p<.05$), had lower decisional balance scores (−1.8 vs. 4.2, $p=.108$), and were more susceptible to smoking at baseline (100% vs. 32%, $p<.001$). Significant differences in the level of acculturation among Hispanic participants in initiating smoking were detected in the intervention group. Initiators were more likely to read and speak in Spanish than were noninitiators (67% vs. 27%, $p<.05$), to use Spanish language as a child (53% vs. 9%, $p<.05$), to speak Spanish at home (56% vs. 9%, $p<.05$), to speak Spanish with friends (74% vs. 9%, $p<.01$), to listen to radio programs in Spanish (67% vs. 18%, $p<.01$), and to prefer movies, TV and radio programs in Spanish (80% vs. 18%, $p<.01$).

Smoking cessation. Self-reported smoking cessation rates were not significantly different between the intervention and comparison groups (60.7% vs. 61.8%) (Table 2).

Minnesota Smoking Index. At 18-month follow-up, for all students, adjusted MSI scores were significantly lower in the intervention group than in the comparison group (Table 4). Baseline smokers in the intervention group had lower MSI scores than did baseline smokers in the comparison group, but this difference was not significant.

Table 3. Results of mixed model regression; smoking initiation and cessation rates at 18-month follow-up by baseline smoking status (N=1160).

Outcome	Comparison (n=550)	Intervention (n=610)	*OR* (95% *CI*)
Smoking initiation, % of students			
All nonsmokers (n=1098)*	5.8	1.9	2.9 (1.1, 7.8)
Never smokers (n=697)	2.5	0.5	4.7 (0.9, 25.9)
Experimenters (n=360)	9.0	4.4	2.2 (0.8, 5.7)
Former smokers (n=41)	28.6	5.0	6.2 (0.4, 102.0)
Smoking cessation, % of students			
Smokers (n=62)	61.8	60.7	1.0 (0.3, 2.7)

Note. *$p<.05$.

Table 4. Results of mixed model regression; Minnesota Smoking Index Score at 18-month follow-up by baseline smoking status, adjusted for baseline and school of origin (N=1160).

Group	Estimated mean score (95% *CI*), Comparison (n=550)	Estimated mean score (95% *CI*), Intervention (n=610)
All students*	1.7 (0.9, 2.5)	0.7 (0.0, 1.4)
Baseline smoking status		
Never smoker (n=697)	1.3 (0.1, 2.5)	0.3 (−0.8, 1.5)
Experimenter (n=360)	0.8 (0.2, 1.4)	0.2 (−0.4, 0.8)
Former smoker (n=41)	3.7 (4.2, 9.5)	0.1 (−4.2, 4.4)
Current smoker (n=62)	13.7 (4.5, 22.5)	7.7 (2.8, 12.6)

Note. *p<.05.

Secondary outcomes

Determinants of smoking. At 18-month follow-up, compared with students in the comparison group, students in the intervention group had significantly higher decisional balance against smoking and significantly lower temptations to smoke (Table 5). At 18-month follow-up, the comparison and intervention groups were similar with respect to self-efficacy and resistance skills. When results were stratified by ethnicity, however, these patterns did not apply to Hispanic students. Decisional balance scores between intervention and control groups were (1.6 vs. 2.2, p=ns) and temptations to smoke were (13.2 vs. 14.3, p=ns).

Risk factors for smoking initiation. Significant intervention group by risk factor interaction effects were seen for peer pressure to smoke and for parental smoking. Post hoc comparisons revealed that rates of smoking initiation were significantly lower in the intervention group than in the comparison group among students with baseline peer pressure to smoke and among students whose mother or father smoked at baseline (Table 6).

Discussion

This is one of the first studies to report positive longer-term outcomes of an interactive, computer-based smoking prevention and cessation intervention. The primary goal of the study was to test the effectiveness of a multicultural, interactive, computer-based smoking prevention and cessation intervention (ASPIRE) among high-school students. Results showed that the intervention was effective in preventing smoking initiation at 18-month follow-up: among baseline nonsmokers, only a small percentage (1.9%) in the intervention group initiated smoking, and this percentage was significantly less than the percentage of students in the comparison condition who initiated smoking (5.8%). In addition, smoking intensity at follow-up (measured by the MSI

Table 5. Results of mixed model regression; smoking-determinant scores at 18-month follow-up, adjusted for baseline and school of origin (N=1160).

Score	Estimated mean (95% *CI*), Comparison (n=550)	Estimated mean (95% *CI*), Intervention (n=610)
Decisional balance*	−1.8 (−3.0, −0.7)	0.5 (−0.5, 1.5)
Temptations to smoke*	14.3 (13.7, 14.8)	13.4 (12.8, 13.9)
Self-efficacy	50.4 (48.1, 52.8)	49.5 (47.2, 51.8)
Resistance skills	4.3 (3.3, 5.3)	3.7 (2.6, 4.7)

Note. *p<.05.

Table 6. Results of mixed model regression; smoking initiation rates at 18-month follow-up among baseline nonsmokers by peer smoking and parental smoking at baseline.

Determinant	Smoking initiation, % of students, Comparison (n=516)	Smoking initiation, % of students, Intervention (n=582)	Estimated *OR*, Comparison vs. Intervention (95% *CI*)
Peers smoke			
No (n=627)	2.4	1	2.8 (0.7, 10.8)
Yes (n=471)*	10.2	3.3	3.2 (1.2, 8.2)
Mother smokes			
No (n=878)	5.2	2.4	2.1 (0.8, 5.7)
Yes (n=220)**	8.2	0	
Father smokes			
No (n=742)	4.4	1.8	2.1 (0.6, 7.4)
Yes (n=356)**	9.1	2.0	5.1 (1.2, 20.8)

Note. *p<.05; **p<.01.

index) provided partial evidence that the intervention increased smoking cessation among the small sample of baseline current smokers, although this trend was not significant.

The ASPIRE intervention had a positive effect on changing decisional balance (pros and cons of smoking) and temptations to smoke among participants at 18-month follow-up (Table 3) and was particularly effective in reducing smoking initiation among students who were at highest risk, (i.e., those whose peers and/or parents smoked) (Table 4). In contrast, for students who were not exposed to ASPIRE, smoking initiation was higher among students with baseline peer pressure to smoke and among students whose mother or father smoked at baseline.

An interesting finding was that among the students who received ASPIRE, only Hispanic students initiated smoking. At baseline, Hispanic students exhibited higher baseline temptations, experienced greater peer pressure, and agreed more with reasons to smoke (lower decisional balance scores), and these patterns had not significantly changed at 18-month follow-up. These findings agree with previous findings that indicate that Hispanic adolescents who have ever smoked are significantly affected by environmental influences (household smoking and peers' smoking) (Flay, Phil, Hu, & Richardson, 1998).

The fact that all initiators in the intervention group were Hispanic is troubling because this ethnic group appears to be at greater risk than the general population for health-related problems (Borders, Brannon-Goedeke, Arif, & Xu, 2004). This underscores the challenge of effectively targeting interventions to a heterogeneous inner-city school district (Buttross, & Kastner, 2003). While preventive intervention programs often aim at the "typical" adolescent, without consideration for possible ethnic-cultural differences in the antecedents to and predictors of smoking (Landrine, Richardson, Klonoff, & Flay, 1994), ASPIRE was designed specifically with this population in mind. ASPIRE reduced rates of smoking initiation in other ethnic groups. It may be, therefore, that given the importance of the social environment in this group, further attention should be paid to addressing strong kinship bonds—for example, by addressing concepts such as *"personalismo"* (value of personal relationships) and *"familialismo"* (normative and behavioral influences of relatives), which are important in Latin American cultures (Marin, Marin, Perez-Stable, Otero-Sabogal, & Sabogal, 1990; U.S. Department of Health and Human Services, 1998). Also, a likely reason for Hispanic participants to not have responded to ASPIRE as much as other ethnic groups might have to do with their insufficient understanding of the program. To better respond to the needs of less acculturated subgroups of students, the next generation of smoking prevention and cessation programs should be offered in a bilingual fashion.

Conclusions regarding the effect of ASPIRE on smoking cessation were limited because of the small baseline sample of smokers and thus insufficient power to detect change. Other investigators have previously reported that recruitment of smokers is a significant problem because many high school smokers are not interested in smoking cessation programs, many report they can quit on their own, and, in the case of occasional smokers, many do not consider themselves addicted, leading them to falsely believe that it is easy to quit (Balch et al., 2004; Leatherdale, 2005; Mermelstein, 2003). In the current study, the requirement for active parental consent may have served as a treatment barrier because many adolescents do not want their parents to know that they smoke Mermelstein et al., 2002) or are trying to avoid suffering punitive consequences from the school, including fines, forced enrollment in smoking education and cessation classes, informing of students' parents, and suspension. Further, the smoking rates in this largely inner-city minority sample may simply be a reflection of the lower prevalence of smoking among Blacks and Hispanics. Given the high attrition of smokers in the sample (almost 50%), meaningful group comparisons of cessation are limited.

The findings of this study should be considered in the light of measurement limitations—namely, that outcome variables such as number of cigarettes smoked per week were determined by self-report. The MSI has shown to be correlated with biochemical measures among adolescents (Murray et al., 1994), but the accuracy of self-reporting among teenagers in smoking prevention and cessation studies requires additional research.

ASPIRE was developed to address the increasing need for effective smoking interventions that can be delivered both to nonsmokers and to smokers and that investigates the potential for computer-based methods that are more motivating for adolescents (Pallonen et al., 1998; Tortu & Botvin, 1989). Rigorously designed and implemented studies, such as the Hutchinson Smoking Prevention Project, that evaluated the social-influences approach to school-based smoking prevention have fallen short in demonstrating a significant impact on smoking rates (Clayton et al., 2000; Peterson et al., 2000). Despite the limitations of the current study, the findings are encouraging. They suggest that the ASPIRE curriculum provides an efficacious computer-based preventive option for schools, most of which do not currently offer effective curriculum-based interventions aimed at smoking prevention (McCormick, Steckler, & McLeroy, 1995; Murray et al., 1988;

Wiehe et al., 2005). Because of the small sample of smokers in the current study, conclusions regarding the impact of the program on smoking cessation are limited. Further evaluation of the impact of ASPIRE cessation effects is indicated. Theoretically grounded computer-based interventions have been used successfully to impact attitudes and behaviors regarding smoking and other dependent behaviors (Shiffman, Paty, Rohay, Di Marino, & Gitchell, 2000; Strecher, Greenwood, Wang, & Dumont, 1999). Translating such approaches to the context of school-based smoking prevention and cessation remains challenging in terms of recruitment, dissemination, and implementation.

Acknowledgments

This investigation was supported by NCI grant R01 CA81934-01A2 (Alexander V. Prokhorov, M.D., Ph.D., Principal Investigator; Steven H. Kelder, Ph.D., Co-Principal Investigator). The authors would like to thank Ms. Stephanie L. Deming for her outstanding assistance in preparation of the manuscript for publication. The authors had no conflict of interest in the preparation of this manuscript.

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