Comparison of Media Literacy and Usual Education to Prevent Tobacco Use:
A Cluster Randomized Trial

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ABSTRACT

BACKGROUND: Media literacy programs have shown potential for reduction of adolescent tobacco use.   We aimed to determine if an anti-smoking media literacy curriculum improves students' media literacy and affects factors related to adolescent smoking.

METHODS: We recruited 1170 9th grade students from 64 classrooms in 3 public urban high schools. Students were randomized by classroom to a media literacy curriculum versus a standard educational program. In an intent-to-treat analysis, we used multi-level modeling to determine if changes in study outcomes were associated with the curricular intervention, controlling for baseline student covariates and the clustering of students within classrooms.

RESULTS: Among participants, mean age was 14.5 years and 51% were male, with no significant differences in baseline characteristics between groups. Smoking media literacy changed more among intervention participants compared with control participants (0.24 vs. 0.08, p<.001). Compared with controls, intervention students exhibited a greater reduction in the perceived prevalence of smoking (-14.0% vs. -4.6%,

p<.001). Among those initially susceptible to smoking, intervention participants more commonly reverted to being non-susceptible post-intervention (24% vs. 16%, p=.08).

CONCLUSIONS: A school-based media literacy curriculum is more effective than a standard educational program in teaching media literacy and improving perceptions of the true prevalence of smoking among adolescents.

Keywords: Media literacy, media education, smoking, tobacco, school-based, social influences, attitudes, normative beliefs, youth, adolescents

Smoking is the leading cause of preventable morbidity and mortality in the United States, killing 443,000 people each year.[1] Because the vast majority of those who will die from smoking begin at age 18 or younger,[2] many counter-tobacco interventions appropriately focus on youth.[3] An excellent way to reach youth is in a school-based setting, because the vast majority of youth attend school. Historically, school-based anti-smoking programs have been designed using a "social influences" framework based on known risk factors, including demographic factors such as age and socioeconomic status, environmental factors such as parenting and supervision, and personal factors such as sensation seeking and rebelliousness.[3,4] However, these programs have not resulted in long-term reduction in tobacco use.[3,4]

One reason that these programs may have been ineffective is that they underestimated the influence of media on youth behavior. Youth aged 8-18 are now exposed to over 10 hours of media content each day,[5] including a substantial number of positive impressions of cigarette smoking.[6-10] Research has demonstrated that youth who are exposed to smoking in films are significantly more likely to smoke themselves, with 30-50% of smoking initiation directly linked to frequent exposure to smoking in movies.[11,12] Exposure to mass media promotions and advertisements also significantly increases the risk of smoking initiation in adolescents.[13]

"Media literacy" aims to buffer this impact of mass media on adolescents' smoking by empowering youth to actively analyze and evaluate these media messages

instead of being passive message targets.[14-21] According to the Theory of Reasoned

Action (TRA), a well-accepted, broadly-applied theory of health behavior that has been

used to predict adolescent smoking,[22-24] an individual's behavior is determined by his or

her intentions to perform the behavior, which is in turn predicted by his or her attitudes

toward the behavior and sense of subjective normative beliefs regarding it.[22] This

model may be particularly relevant for media literacy programs because of their

potential to reduce the impact of mass media messages on attitudes and normative

beliefs.

In addition to focusing the intervention material on media exposures strongly

associated with outcomes, media literacy programs tend to be different from traditional

social influences programs in terms of "heavy-handedness." Because traditional social

influences programs tend to focus on how to say "no" to smoking, they may be less

effective among those more rebellious individuals who tend to defy authority.[25]

However, media literacy programs try to focus this inherent rebelliousness against

corporate influences instead of their own families, friends, and teachers. This may be

why media literacy lessons have been not only well-liked by students[15,17,26,27] but also

associated with prevention of various harmful health behaviors, including alcohol use,

obesity, and aggression.[14,17,18] Furthermore, as with the more general concept of health

literacy, media literacy focuses on individual and social empowerment in decision-

making, which are increasingly considered of theoretical and empiric value for improving health outcomes.[28,29]

Although media literacy programs have also shown potential for prevention of tobacco use among youth,[15,17,19,20,26] these studies had methodological limitations, such as quasi-experimental designs and small sample sizes. While the Centers for Disease Control[30] and other institutions[31,32] have called for the use of media literacy to prevent harmful health behaviors such as smoking, more rigorous evaluation is necessary prior to making continued public health investments.

An important "great debate"[33] in the field of health-related media literacy relates to how specific media literacy should be regarding the health topic of interest. While some advocate that health-related media literacy programs should focus on media examples highly specific to the topic (eg, deconstruct only tobacco advertisements within an anti-tobacco program), others focus on the importance of changing a broader concept of media literacy that can be applied to many different types of messages.[17,33] Because few programs simultaneously assess their influence on separate constructs of general and topic-specific media literacy, we aimed to explore this important area.[14,17]

The purpose of this study was to determine if a theory-driven, school-based, three-session anti-smoking media literacy curriculum delivered to 9th grade students affects students' media literacy (both general and smoking-specific) and the factors mediating adolescent smoking according to our underlying conceptual model based on

the TRA. We hypothesized that, compared with those assigned to the standard tobacco educational program, students in classrooms randomly assigned to the media literacy curriculum would have increased smoking-specific media literacy (Hypothesis 1); increased general media literacy (Hypothesis 2); reduced positive attitudes toward smoking (Hypothesis 3); and reduced positive sense of smoking norms regarding both its popularity (Hypothesis 4a) and elite status (Hypothesis 4b). Our exploratory hypothesis was that exposure to the media literacy curriculum would reduce the intention to smoke among students with initial intention to smoke (Hypothesis 5).

METHODS

We conducted a cluster-randomized trial, with classrooms randomly assigned to either an experimental media-literacy curriculum or a standard educational program about smoking tobacco. This design was required as it was not feasible to allocate individual students to different interventions in the classroom-based setting. There were no important changes to methods or outcomes after trial commencement. The trial was officially registered with www.clinicaltrials.gov before it was begun and was assigned the registration number NCT00398190. A checklist outlining our compliance with CONSORT guidelines is available as Appendix 1.

Participants

We recruited 3 Pittsburgh, PA area high schools with the assistance of community agencies contracted to provide anti-smoking education in Allegheny County. We purposefully selected 3 schools from their complete list of schools to ensure that: our final student pool would be large enough to confer adequate power for analyses; schools had a history of working with community organizations on other research projects; schools were willing to include and randomize all 9th grade health classrooms; and the final pool of students would be at least 25% African-American. The African-American population was specifically targeted because it bears the greatest burden of morbidity and mortality due to smoking,[34] and the Surgeon General's report on tobacco use highlighted mass media messages as a key factor influencing tobacco use among minorities.[34]

We focused our trial on 9th grade students because their age is an ideal time for intervention (ie, smoking rates increase up to three-fold between the 8th and 12th grades). Ninth grade students are more cognitively able than younger students to assimilate the theoretical concepts of media literacy that require abstract thought.[16,35]

During the study period (September 2006 to May 2008), classrooms (clusters) were eligible to participate if they consisted primarily of 9th grade students in 1 of the 3

selected high schools. Students were eligible to participate if they were enrolled in the participating classrooms.

To have 80% power to detect a difference of 15% in smoking-specific media literacy scores (under two-sided testing with alpha = 0.05), and taking the variance inflation factor into consideration due to clustering, we estimated needing 429 students in each arm.

Instruments

Media literacy was assessed with 22 items modified from a validated 18-item scale (Appendix 2).[36-38] These 22 items were divided into two groups representing smoking-specific media literacy (11 items) and general media literacy (11 items), as the prior 18-item smoking media literacy scale combined smoking-specific and general items, which we deemed important to separate theoretically. The pool of items had to be expanded slightly so that items from each subscale represented each of the theoretical divisions of media literacy ("authors and audiences (AA)," "messages and meanings (MM)," and "representation and reality (RR)," Table 1). All media literacy measures were measured with a Likert-type response scale with 4 response categories ranging from "strongly disagree" to "strongly agree."

Outcomes of interest were mediators of smoking according to our underlying conceptual model based on the TRA, which included attitudes, normative beliefs, and

intentions related to smoking. Smoking attitudes was measured with 9 items from a

validated scale[39] via agreement or disagreement with statements such as "Smoking

cigarettes is enjoyable," "Smoking helps you deal with problems or stress," and "There

is no harm in having a cigarette once in a while (reverse-coded)." This study was based

on a composite theoretical model which included aspects of the TRA.[39] Attitude items

used a Likert-type response scale with 4 response categories ranging from "strongly

disagree" to "strongly agree."

Smoking normative beliefs was evaluated with a two-factor scale based on

previous validation founded on the TRA.[40] The first construct measured was "perceived

success of smokers," which was measured by agreement or disagreement with three

different statements such as "Cool people smoke cigarettes more than uncool people."

These items used a Likert-type response scale with 4 response categories ranging from

"strongly disagree" to "strongly agree." The second construct related to normative

beliefs was "perceived prevalence," which included three separate items asking

participants to estimate smoking prevalence among their peers.

Intention to smoke was assessed with Pierce's reliable and valid 3-item

susceptibility scale, which defines all participants as "susceptible" who do not indicate

a firm intention not to smoke in the future.[41]

Covariates measured the factors previously established as associated with

adolescent smoking. Demographics included age, sex, race, and parental education (as a

measure of socioeconomic status). Personal and environmental factors included self-report of grades, sensation seeking as measured by a brief, validated scale,[42] rebellious behavior as measured by three items from Smith and Fogg's validated scale,[43] and 6 items from Jackson's two-factor scale assessing parental style.[44]

Procedure

All 9th graders at participating schools were invited to participate. Parents were sent a note informing them of the project and a procedure for opting-out of consent if they desired. All participating students provided written assent.

A baseline survey was administered by study personnel trained in survey administration. Students were assigned identification numbers, with no names attached to the surveys. The data were collected in computer laboratories of the selected high schools.

Within each selected school, each health classroom was randomized to receive either the experimental media literacy curriculum (a 3-session version of the "AD IT UP" curriculum) or a control educational program (a 3-session standard anti-tobacco curriculum adapted from a commonly used health textbook). To ensure comparability of the intervention and control groups in terms of class time of day and classroom health teachers, we stratified random allocation according to these two variables. Randomization was conducted by a statistician (SRL) not associated with recruitment of

classrooms or development or presentation of curricula, and who was blinded to the identity of the intervention and control groups.   Allocations were concealed until interventions were assigned.

The experimental curriculum was a 3-session (120 minutes) version of the "AD IT UP" curriculum—a theory-based anti-smoking media literacy curriculum developed and pilot tested with foundation grant funding. This curriculum teaches youth to access, analyze, and evaluate mass media messages involving smoking, such as advertisements, promotions, or film product placements. Each letter of the title refers to one of the 6 lessons contained in the curriculum, which were associated with core concepts from a conceptual model of media literacy and a key question related to media literacy (Table 1).[16]

The control curriculum was based on the 3-session anti-smoking program (120 minutes) featured in the most widely used health textbook in the region. These 3 lessons, derived from a representative "social influences" program, describe both short- and long-term effects of smoking, support students' self-efficacy in saying "no" to smoking, and discuss social and psychological issues involving smoking.

The experimental and control curricula were implemented by experienced health educators who were not the students' regular classroom teachers. This was done to improve implementation fidelity and training procedures, both of which we felt we could standardize more easily with our own staff. They were given appropriate

training and practiced implementation on convenience samples of high school students from other (non-study) schools. Each teacher remained with the same cadre of students for each of the 3 sessions to maintain teacher-student rapport and continuity.

We implemented both the intervention and control curricula in a uniform manner. Each of the teachers taught both curricula, and all students were given the same pre- and post-intervention surveys. Each curriculum used a common format, with a slide presentation combined with activities and a 16 page workbook (with different content). The trial was stopped after all respondents completed post-test assessments 1 week following completion of the curricula, which was an average of 5 weeks following the pre-tests.

Data Analysis

For the intervention and control groups, we computed baseline and follow-up data for all outcome variables. We computed the effect size for all differences over time using Cohen's d, defined as the mean difference divided by the pooled standard deviation. We used multilevel modeling to account for clustering of individual students within classrooms. Hypotheses 1 through 4 were tested using a change score analysis, with each change score for the outcome of interest as the dependent variable, and the assignment to intervention or control as the independent variable, controlling for covariates. Outcome variables were media literacy, attitudes, and normative beliefs,

guided by the TRA. For the exploratory hypothesis, a one-sided Fisher's exact test was used to determine if intention to smoke at time 2 was associated with group assignment among those who intended to smoke at baseline.

We determined *a priori* to utilize these multilevel models controlling for age, sex, race, maternal education, grades, parenting style, rebelliousness, and sensation seeking, and accounting for clustering as our primary analyses in order to be highly conservative with our findings. However, because ultimately we determined that intervention and control participants were no different in terms of any measured covariates, we also conducted simple *T*-tests comparing differences in intervention and control groups' change scores. The primary analyses included all participants for whom follow-up data were obtained ("intention to treat" analyses). We tested interactions between basic sociodemographic data (ie, age, sex, and race) and outcomes, to determine whether any of these subgroups particularly drove score changes.

Because analyses focused on change scores, those who did not have complete data from both time points were not included in analyses; no imputation of data was used.

Implementation fidelity was assessed by each instructor using Likert-type items immediately after classroom sessions. Student satisfaction with and impressions of the intervention were also obtained at follow-up.

RESULTS

Of the 1170 potentially eligible students representing 64 classrooms, 578 (49.4%) students from 33 classrooms were randomized to the control educational program and 554 (47.4%) students from 31 classrooms were randomized to the intervention curriculum (Figure). Overall, 412 (71%) of the 578 students assigned to the control arm, and 388 (70%) of the 554 students assigned to the intervention arm completed the post-test assessment and were analyzed in the primary intention-to-treat analyses.

The study population was about half male (51%), half African American (50%), and had a mean age of 14.5 years (Table 2). There were no significant differences between the intervention and control groups in terms of any measured covariate (Table 2).

Internal consistency reliability was adequate for all scales at baseline and follow-up. At baseline, Cronbach's alpha was 0.76, 0.83, 0.84, 0.69, and 0.75 for general media literacy, smoking media literacy, attitudes, perceived success of smokers, and perceived prevalence of smoking, respectively. At follow-up, Cronbach's alpha values were 0.88, 0.87, 0.84, 0.71, and 0.81, respectively.

Smoking media literacy increased more among students in the intervention arm compared to those in the control arm (0.24 vs. 0.08, $p < .001$). Increases were present and

statistically significant for SML subscales 1 and 2 (AA and MM), but not for subscale 3 (RR). The changes in general media literacy by intervention arm exhibited a similar pattern, although levels of significance were smaller in magnitude. There were no significant differences between intervention arms in change scores for cigarette attitudes and perceived success of smokers (Table 3). Compared with students in the control arm, students in the intervention arm exhibited a significantly greater reduction in the perceived prevalence of smoking (-14.0% vs. -4.6%, p < .001).

Multivariable analyses, which controlled for clustering of students within classrooms and all covariates, demonstrated similar levels of significance compared with basic *T*-tests, except for overall improved general media literacy (Table 3). In summary, conservatively relying on the more complex analyses, these results upheld Hypothesis 1 and Hypothesis 4a, but not Hypotheses 2, 3, and 4b.

Among the 236 students who intended to smoke at baseline (121 in the intervention and 115 in the control arm), a larger proportion of intervention than control students changed to being non-susceptible to smoking at follow-up (24% vs. 16%, p = .08).

There were no significant interactions between basic sociodemographic data (ie, age, sex, and race) and outcomes, suggesting that none of these subgroups particularly drove score changes.

Implementation fidelity was self-reported by instructors at >90%. Regardless of program assignment, students were equally likely to agree with statements such as "the instructor was knowledgeable" and "I learned a lot during this program." However, compared with those assigned to the control condition, students assigned to the intervention had higher rating scores for "I enjoyed this program," "This program kept my attention," "I will look at smoking differently from now on," and "I will look at advertising differently from now on" (Table 3).

DISCUSSION

This study found that, compared with a standard school-based social influences anti-smoking program, students exposed to a media-literacy-based anti-smoking program had significantly improved smoking media literacy and improved perceptions of the true prevalence of smoking. However, assignment to the intervention was not associated with significant improvements in general media literacy, anti-tobacco attitudes, or assessment of perceived status of smokers. Finally, although a greater proportion of those who intended to smoke at baseline reverted to no intention in the intervention compared with the control, this difference was not statistically significant.

These findings are consistent with others who have found potential benefits for media literacy education as it may apply to substance use.[15,17,19,20,26] This study extends prior findings by utilizing a more rigorous experimental design. Additionally, this study uses a well-studied measure of media literacy. While no measure of this complex, multi-faceted construct is perfect, it is heartening that intervention assignment was associated with meaningful effect size changes in the measure.

Assignment to the intervention, which focused on smoking-specific media literacy, was associated with higher differences in smoking-specific media literacy versus general media literacy. Improvements in general media literacy did not have the same magnitude of change, and in complex models that controlled for clustering, the difference was short of reaching statistical significance. This overall pattern is consistent with prior work of others who have found that it may be easier to transfer subject-specific compared with general media literacy concepts.[14,15]

Exposure to the intervention was not associated with significant differences in smoking-related attitudes. This is not surprising, because the control curriculum strongly emphasizes anti-smoking attitudes such as those represented in our measure (eg, that smoking is not attractive, not pleasant, not relaxing). Consistent with what would be expected, both the intervention and the control curriculum were associated with moderate changes in attitudes (Table 3).

However, it still may be valuable to consider broadening the Theory of Reasoned Action (Figure 1) as an underlying model. For example, the Message Interpretation Process Model[14,15] suggests that behavior choices are influenced not only by logical processes emphasized by the Theory of Reasoned Action but also by emotional components such as desirability of, personal relevance to, and identification with portrayals. Thus, it is possible that, although traditional interventions may instill certain negative attitudes, media literacy programs may more subtly affect message interpretation which may be more affect-laden and associated with downstream behavioral changes. Similarly, the TRA does not emphasize the concept of empowerment in decision-making, which is hypothesized to link health literacy to health outcomes.[28,29] Thus, it will be valuable to assess a more complete set of theoretical constructs in future studies.

Perceived prevalence of smoking is related to smoking behavior; when youth over-estimate the proportion of their peers who smoke, they are more likely to smoke themselves.[40] This study suggested that individuals assigned to the media literacy intervention had a greater decrease in perceived prevalence of smoking. While the intervention was not designed for this, and "on paper" the control condition seemed to emphasize the actual prevalence of smoking even more than the media literacy intervention, it may be that the media literacy intervention, by calling into question the

reality of the many smoking-related media messages in the environment, actually decreased perceived prevalence more.

Although our primary purpose was to determine if the intervention taught media literacy as was expected, we also explored whether there were associations between intervention exposure and intention to smoke (Aim 5). A particularly clinically relevant question is how intentions changed among the highest-risk group who began the intervention intending to smoke. There was a meaningful difference in the proportion of participants initially intending to smoke who reverted to non-intending after the intervention vs. the control condition (24% vs. 16%). This study was not powered to detect this more exploratory outcome, and thus this difference was not statistically significant (p = .08). These preliminary results, which suggest that such media-literacy interventions may be particularly salient for youth initially intending to smoke, should be more deeply explored in future studies. Others have suggested that media literacy may be more effective than standard tobacco education among the very populations that are at greatest risk for smoking, such as rebellious and socio-economically disadvantaged youth.[30,34]

While the intervention was associated with increases in media literacy outcomes, these increases were associated with two of the subscales, "authors and audiences" and "messages and meanings," but not with "representation and reality." It is unclear as to why this was the case, because the intervention sought to emphasize the difference

between representation and reality. One possibility is that, by vilifying tobacco and smoking in general, the control curriculum engendered increased understanding of the stark differences between the way tobacco is often represented in mainstream media and its true effects.

It would be valuable for future research to explore different methods of curricular implementation. Although regular classroom teachers could be trained in conducting these curricula, it would introduce challenges with regard to standardizing training and implementation fidelity. An interactive Web-based approach may optimize curriculum standardization, but this approach may reduce in-person teacher-student interactions and spontaneity.

Limitations

This study involved 3 urban public schools in the same region of the U.S., thus the results may not generalize to other parts of the country. Similarly, because of selection bias, even within this community, respondents may have been different from non-respondents in ways we were not able to assess.

In addition, it is difficult to control for contamination in a study that used the same instructors for both the intervention and the control curriculum. By conducting the study in this way we biased our results toward the null, which we considered more conservative and preferable. Although we had limited information about non-

respondents, demographic data were not different between assignment groups and thus were not likely to have driven results.

The study also had limited statistical power. While we estimated that 429 participants were necessary in each arm to detect differences in our primary outcome, our final groups included 386 and 410 individuals, respectively. While there were significant differences in the primary outcome, results for other outcomes (eg, general media literacy, intention to smoke) were extremely close and may have achieved significance if we had been able to retain sufficient numbers.

It is also important to note that we selected a relatively aggressive control intervention. Because of the newness of media literacy, it may have been more appropriate to utilize a less robust (eg, "attention-type") control. However, we used an established and involved control curriculum in order to keep our conclusions about the potential efficacy of media literacy conservative.

Conclusions

This study breaks important ground in demonstrating that smoking-related media literacy can be taught via school-based interventions and is highly acceptable to students. While it suggests that media literacy may be associated with important clinically relevant outcomes, such as influencing intention to smoke among high risk

individuals, further study with more complex theoretical models and greater statistical power are needed.

IMPLICATIONS FOR SCHOOL HEALTH

Although tobacco smoking remains a leading cause of preventable U.S. morbidity and mortality, currently accepted school-based prevention programs are not associated with clinically meaningful long-term outcomes. This study suggests that media literacy programs aimed at preventing cigarette smoking present an alternative to standard programs. Furthermore, these programs are feasible to implement in the school-based setting in health classrooms, and they seem to be highly acceptable to students. However, although assignment to the media literacy group in this group was associated with improvements in certain mediators of smoking, further study will be necessary to determine if media literacy education is associated with longer-term behavior outcomes such as experimentation with smoking.

HUMAN PARTICIPANTS APPROVAL STATEMENT

IRB approval was obtained from the University of Pittsburgh (IRB #0606146) and all required school administrators.

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TABLES

Table 1: Relationships Between the "AD IT UP" Curriculum and a Conceptual Model of Media Literacy.

Media Literacy Domain	Related Media Literacy Core Concepts[45]	"AD IT UP" Lesson	"AD IT UP" Key Question	Skill Targets
AA: Authors and Audiences	AA1: *authors create media messages for profit and/or influence*	"Authority"	Who is the Author of this media message, and what is their motive/purpose?	Determine the author and purpose of a media message.
	AA2: *authors target specific audiences*	"Direct, Aim, Fire"	Who is this message Directed against? (That is, who is the target audience?)	Determine the target audience of a media message.
MM: Messages and Meanings	MM1: *messages contain values and specific points of view*	"The Big Idea"	What Ideas are they trying to get across through this message?	Describe ideas and feelings which message authors intend to convey.
	MM2: *different people interpret messages differently*			
	MM3: *messages affect attitudes and behaviors*	"Techniques"	What Techniques do they use to make this message in order to get those ideas across?	Identify specific production techniques used to convey those ideas and feelings.
	MM4: *multiple production techniques are used*			
RR: Representation and Reality	RR1: *messages filter reality*	"Speak the Unspoken"	What is Unspoken or omitted from this message?	Identify salient omissions from the media message.
	RR2: *messages omit information*			
	Facilitation of movement from altered *attitude and norms* toward *intention and behavior*	"Plan Your Escape"	What is your Plan now that you know what you know? Is this something you want to buy/do or not?	Engage in an evaluative process integrating personal perspectives with information from the media message.

Table 2: Comparison of Baseline Student Characteristics in the Intervention and Control Arms.

	Intervention N = 386	Control N = 410	p-value
Age			0.13
≤15	58%	52%	
>15	42%	48%	
Gender			0.90
Male	51%	51%	
Female	49%	49%	
Race			
White	43%	45%	0.46
Black	52%	48%	0.26
Other	16%	14%	0.45
Maternal Education			0.46
Did not graduate high school	24%	25%	
Graduated from high school but not college	35%	31%	
College degree or higher	41%	44%	
Grades			0.74
A's and B's	56%	57%	
Lower than B's	44%	43%	
Demanding Parenting			0.64
Lowest tertile	54%	51%	
Middle tertile	16%	16 %	
Highest tertile	30%	33%	
Responsive Parenting			0.17
Lowest tertile	38%	43%	
Middle tertile	42%	36%	
Highest tertile	20%	22%	
Sensation Seeking			0.17
Lowest tertile	46%	40%	
Middle tertile	35%	36%	
Highest tertile	20%	24%	
Rebelliousness			0.57
Lowest tertile	49%	49%	
Middle tertile	21%	18%	
Highest tertile	30%	33%	
Current Smoker			0.30
Yes	6%	5%	
No	94%	95%	
Parental Smoking			0.62
Yes	60%	59%	
No	40%	41%	
Friend Smoking			0.53

None	54%	53%	
Some	36%	39%	
Most or All	10%	8%	

Table 3: Comparison of Post-Intervention Impressions in Intervention and Control Arms.

Post-Intervention Perception*	Intervention (N = 410)	Control (N = 386)	Cohen's d	p-value
The instructor was knowledgeable	2.23	2.23	0.00	.94
I learned a lot during this program	2.21	2.11	0.13	.08
I enjoyed this program	2.05	1.91	0.18	.01
I would like more programs like this one	1.95	1.85	0.13	.08
I would recommend this program to a friend	1.92	1.86	0.07	.26
I participated in this program	1.94	1.83	0.14	.06
This program kept my attention	2.01	1.78	0.29	<.001
I am less likely to smoke now that I have seen this program	2.17	2.05	0.14	.06
This program would be effective in getting kids not to smoke	2.00	1.88	0.14	.04
I will look at smoking differently from now on	2.07	1.87	0.23	.001
I will look at advertising differently from now on	2.09	1.86	0.26	<.001

* Post-intervention perceptions were scored with continuous figures from 0 (strongly disagree) to 3 (strongly agree).

Table 4: Comparison of Outcomes in the Intervention and Control Arms

Outcome	Intervention (N = 410)				Control (N = 386)				p-Value *	p-Value †
	T1	T2	δ‡	d§	T1	T2	δ‡	d§		
Total Smoking Media Literacy (SML)‖	1.84	2.08	0.24	0.46	1.87	1.95	0.08	0.16	<.001	.001
SML Subscale 1	2.04	2.29	0.25	0.35	2.10	2.10	0.00	0.01	<.001	.001
SML Subscale 2	1.70	1.97	0.27	0.52	1.72	1.83	0.11	0.21	<.001	<.001
SML Subscale 3	2.00	2.15	0.15	0.24	2.03	2.10	0.07	0.10	.16	.26
Total General Media Literacy (ML)‖	2.04	2.12	0.08	0.16	2.09	2.07	-0.02	0.04	.01	.06
ML Subscale 1	1.87	2.04	0.17	0.24	1.93	1.93	0.00	0.01	.002	.01
ML Subscale 2	2.08	2.14	0.06	0.10	2.15	2.11	-0.04	0.08	.03	.12
ML Subscale 3	2.06	2.14	0.08	0.12	2.10	2.11	0.01	0.01	.19	.34
Total Cigarette Attitudes‖	0.58	0.80	0.22	0.41	0.58	0.78	0.20	0.38	.70	.69
Total perceived success of smokers‖	0.92	0.96	0.04	0.05	0.87	0.93	0.06	0.08	.61	.82
Total perceived prevalence (%)	64.0	50.0	-14.0	0.76	63.1	58.5	-4.60	0.25	<.001	<.001

*T-tests comparing differences between intervention and control outcomes.

†Controlling for clustering and age, gender, race, maternal education, grades, parenting style, sensation seeking, and rebelliousness.

‡Differences between follow-up and baseline.

§Cohen's d, a measure of effect size.

‖Media literacy (smoking-specific and general, as well as all subscales), attitudes, and the first normative beliefs scale ("perceived success of smokers") were scaled to continuous figures with a minimum of 0 and a maximum of 3.

¶The second normative beliefs scale ("perceived prevalence") utilized figures between 0 and 100 representing the average perceived prevalence for smoking.

FIGURES

Figure: Cluster-Randomized Trial Flow Diagram.