

Original article

Association of Cigarette Smoking and Media Literacy about Smoking among Adolescents

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Manuscript received February 13, 2006; manuscript accepted May 11, 2006

Abstract

Purpose: To determine whether media literacy concerning tobacco use is independently associated with two clinically relevant outcome measures in adolescents: current smoking and susceptibility to smoking.

Methods: We asked high school students aged 14–18 years to complete a survey that included a validated 18-item smoking media literacy (SML) scale, items assessing current smoking and susceptibility to future smoking, and covariates shown to be related to smoking. We used logistic regression to assess independent associations between the two outcome measures and SML.

Results: Of the 1211 students who completed the survey, 19% reported current smoking. Controlling for all potential confounders of smoking, we found that an increase of one point (out of 10) in SML was independently associated with an odds ratio for smoking of .84 (95% confidence interval [CI] .71–.99). Compared with students below the median score on the SML scale, students above the median had an odds ratio for smoking of .57 (95% CI .37–.87). Of the students who were nonsmokers, 40% were classified as susceptible to future smoking. Controlling for all potential confounders of smoking, we found that an increase of one point (out of 10) was independently associated with an odds ratio for smoking susceptibility of .68 (95% CI .58–.79). Compared with students below the median SML, students above the median SML had an odds ratio for smoking susceptibility of .49 (95% CI .35–.68).

Conclusions: In this sample of high school students, higher SML is independently associated with reduced current smoking and reduced susceptibility to future smoking. © 2006 Society for Adolescent Medicine. All rights reserved.

Keywords:

Smoking; Tobacco; Media; Advertising; Television; Media messages; Movies; Media literacy; Media education; Adolescence; Substance abuse; Education; School-based

In the United States, cigarette smoking is the leading cause of preventable death and disease [1]. About 90% of individuals with smoking-related deaths began smoking during their adolescence [2], and each day nearly 4400 American youth between the ages of 12 and 17 years initiate cigarette smoking [3]. Despite efforts to address this rapid

uptake of smoking among adolescents, traditional school-based smoking prevention programs have not been successful in affecting clinically relevant smoking behaviors [4–6].

Youth aged 8–18 years are exposed to 8 hours and 33 minutes of media content daily [7], including content offering a substantial number of positive impressions of cigarette smoking [8–10]. Studies have demonstrated an association between exposure to certain media messages and smoking in adolescents. Over half of the cases of smoking initiation during adolescence are linked to watching smoking in mov-

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ies [11,12], for instance, and the exposure to media messages such as tobacco promotions and advertisements also significantly increases the risk of smoking initiation during adolescence [2,13–16]. In light of these findings, media literacy may represent a promising framework for developing innovative school-based smoking prevention programs [17]. Acknowledging the effects of media on attitudes and behavior, media literacy teaches youth to understand, analyze, and evaluate advertising and other media messages, enabling them to actively process media messages rather than passively remain message targets [18,19]. Media literacy has been shown to be potentially useful in reducing other harmful health behaviors such as alcohol use, disordered eating, and aggression [20–22]. Additionally, media literacy's potential efficacy is grounded in health behavior theory. In particular, media literacy should reduce certain positive attitudes and norms that, according to the Theory of Reasoned Action, can lead to harmful intentions and behaviors [23,24].

It is not surprising, therefore, that organizations such as the American Academy of Pediatrics and the Centers for Disease Control and Prevention recommend media literacy to buffer the impact of media messages on adolescent smoking [17,25]. Indeed, antismoking media literacy lessons have been well liked by students and have shown initial promise [25–27], making media literacy attractive as an intervention. However, these studies focused on the outcomes such as student satisfaction, knowledge, and attitudes, and did not demonstrate that antismoking media literacy is associated with improvements in clinically relevant outcomes related to smoking. We therefore used a reliable, validated scale measuring the construct of smoking media literacy (SML) in youth [24] to determine the degree to which clinically relevant smoking-related outcomes are associated with SML scores in a large group of high school students. We hypothesized that higher media literacy scores would be associated with a decreased likelihood of current smoking and that, among current nonsmokers, those with higher media literacy would have a lower susceptibility to future smoking.

Methods

Participants and setting

The study population for our cross-sectional survey consisted of students attending a suburban public high school outside of Pittsburgh, Pennsylvania with a total enrollment of 1690. The community served by this high school is primarily Caucasian and middle-income. Male and female students were eligible to participate if they were 14–18 years old and were available to take the survey on the regular school day in January 2005 when it was administered. On this date, 79 students were absent and 86 were unavailable because of in-school suspensions, field trips, or

Table 1
Theoretical Model of Media Literacy

Media literacy domain	Media literacy core concept
AA: Authors and Audiences	AA1: Authors create media messages for profit and/or influence AA2: Authors target specific audiences
MM: Messages and Meanings	MM1: Messages contain values and specific points of view MM2: Different people interpret messages differently MM3: Messages affect attitudes and behaviors MM4: Multiple production techniques are used
RR: Reality and Representation	RR1: Messages filter reality RR2: Messages omit information

appointments with the nurse or guidance counselor; 1525 students were eligible to participate. The questionnaire was administered by classroom teachers that we trained in methods of minimizing bias and appropriately responding to student queries.

Approval to administer the study questionnaire was granted by the superintendent of the school district and the Institutional Review Board (IRB) of the University of Pittsburgh. Both the superintendent and IRB agreed to a waiver of parental informed consent, because students would not be asked to place their names or any other unique personal identifiers on the questionnaire. The students were invited to complete the questionnaire during their social studies classes, and those who did so were given a packet of trail mix as a reimbursement for their time.

Survey Instrument

We recently developed a scale to measure the independent variable, smoking media literacy (SML). We began with a pool of 120 potential items, tested and refined the scale, and assessed its reliability and validity [24]. The final 10-point SML scale consists of 18 items, representing the three domains and eight core concepts of media literacy listed in Table 1 [24]. The scale contains four items representing the Authors/Audiences domain, nine representing the Meanings/Messages domain, and five representing the Representation/Reality domain. Representative items include “Tobacco companies are very powerful, even outside of the cigarette business” (Authors/Audiences domain), “When people make movies and TV shows, every camera shot is very carefully planned” (Messages/Meanings domain), and “Advertisements usually leave out a lot of important information” (Representation/Reality domain). Each item was evaluated with a four-point Likert scale, and the resulting 54-point scale was divided by 5.4 to generate a value on a 10-point scale. The complete scale can be obtained from the first author at bprimack@pitt.edu

The survey also assessed two clinically relevant smoking

Table 2
Demographic and covariate characteristics of the total sample and of current smokers within the sample

	Range (For continuous variables)	Total sample ^a	Current smoker ^a
Age (years)			
14		186 (15.7)	18 (8.4)
15		277 (23.3)	36 (16.8)
16		328 (27.6)	66 (30.8)
17		301 (25.3)	75 (35.0)
18		95 (8.0)	19 (8.9)
Gender			
Male		572 (47.6)	100 (46.7)
Female		630 (52.4)	114 (53.3)
Race			
White		1092 (91.7)	203 (94.4)
Black		49 (4.1)	4 (1.9)
Other		50 (4.2)	8 (3.7)
Ethnicity			
Non-Hispanic		1199 (99.1)	214 (99.1)
Hispanic		11 (0.9)	2 (0.9)
Parental education ^b			
No more than one parent completed high school		64 (5.4)	22 (10.2)
One parent completed college or both parents completed high school		369 (31.0)	75 (34.7)
One parent completed college and one completed high school		328 (27.6)	64 (29.6)
Both parents completed college		430 (36.1)	55 (25.5)
Parental smoking			
Yes		467 (39.0)	127 (58.8)
No		731 (61.0)	89 (41.2)
Sibling smoking			
Yes		267 (22.7)	90 (42.7)
No		907 (77.3)	121 (57.4)
Friend smoking			
Yes		625 (56.9)	197 (96.6)
No		473 (43.1)	7 (3.4)
Responsive parenting	1–4	3.3 (.6)	3.1 (.6)
Demanding parenting	1–4	3.3 (.6)	3.1 (.7)
Self-reported electronic media use in hours per day	0–24	8.9 (5.2)	10.0 (5.7)
Stress	1–4	2.7 (.9)	2.9 (.8)
Grades	1–4	3.3 (.7)	3.0 (.6)
Depression	1–4	1.7 (.7)	1.8 (.7)
Self-esteem	1–4	3.1 (.6)	3.1 (.6)
Rebelliousness	1–4	1.9 (.6)	2.3 (.6)
Sensation seeking	1–4	2.7 (.7)	3.1 (.5)
Knowledge of harm and addictiveness of smoking	1–5	2.6 (1.0)	2.4 (1.0)

^a Number (%) for nominal variables; Mean (SD) for continuous variables.

^b This measure was used as a surrogate for socioeconomic status.

outcomes: current smoking, defined as having smoked at least once in the past 30 days, and susceptibility to future smoking, assessed with Pierce's reliable and valid three-item scale [28]. According to this scale, a person is considered "nonsusceptible" only if he or she answers "definitely no" to the following three items: (1) Do you think that you will smoke a cigarette soon? (2) Do you think you will smoke a cigarette in the next year? (3) If one of your best friends were to offer you a cigarette, would you smoke it?

We also assessed several covariates shown previously to

be related to current smoking. Demographic information included age, race/ethnicity, gender, and parental education (as a surrogate for socioeconomic status). We also assessed important elements of the students' environment (responsive parenting [29], demanding parenting [29], parental smoking, sibling smoking, friend smoking, electronic media use, and stress) and students' intrinsic characteristics (self-report of school grades, depression [30], self-esteem [31], rebellious behavior [32], sensation-seeking [33], and knowledge of the harm and addictiveness of tobacco). To mini-

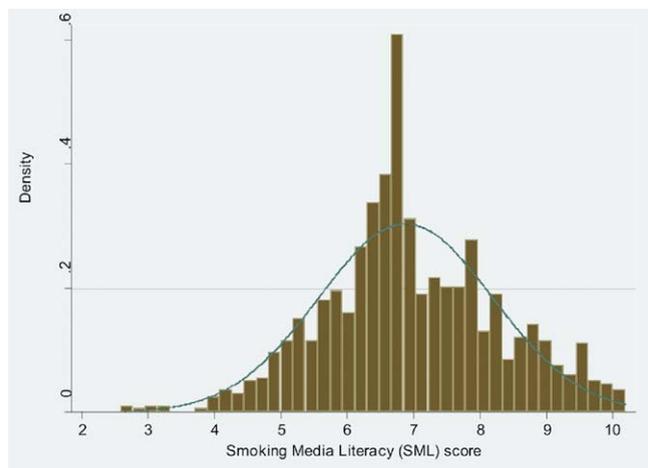


Figure 1. Distribution of smoking media literacy (SML) scores with overlaid normal curve.

minimize respondent burden for such a lengthy survey, we selected representative items from these surveys instead of including all items.

Survey Processing and Analysis

Before administering the survey, we established specific criteria to detect and eliminate questionnaires with inconsistent or inappropriate responses. We examined responses to nine specific open-ended items and flagged the data of students who provided impossible or extremely improbable responses (e.g., claims to smoke an average of six complete packs of cigarettes each day). These students’ complete data were further scrutinized, and if three or more total responses were deemed to be impossible or extremely improbable, we eliminated the questionnaire from the analysis. In addition, we included a final survey item asking the students to appraise their honesty in answering the survey questions, and we eliminated the surveys of those who admitted providing dishonest answers. We performed all analyses on data from the entire sample as well from the subset who said they were honest to ensure that elimination of data did not affect the overall results.

After performing a descriptive data analysis of the survey responses, we assessed the relationship between the SML scale score and each of the smoking outcomes graphically. We then used logistic regression techniques to determine the bivariate and multivariate associations between SML and current smoking. Finally, we used logistic regression techniques to determine the bivariate and multivariate relationship between SML and susceptibility to smoking among those students who were not current smokers. Our models included all of the potential confounders of current smoking or susceptibility to smoking except for Hispanic ethnicity, because we did not have a sufficient number of Hispanic subjects. We categorized SML in two different ways in these analyses: as a continuous variable and as a

dichotomous variable divided at the median SML score. This method of treating SML as a discrete variable was chosen for its simplicity and potential ease of clinical application.

To ensure appropriateness of each of the logistic models, we performed Hosmer-Lemeshow goodness-of-fit testing. We also computed the area under the receiver operating characteristic (ROC) curves associated with all models to determine their overall discriminating power [34].

Results

Of the 1525 students who were eligible for the study, 1402 (92%) completed the questionnaire. We eliminated 44 surveys that showed a pervasive pattern of impossible or improbable responses and 147 surveys in which students

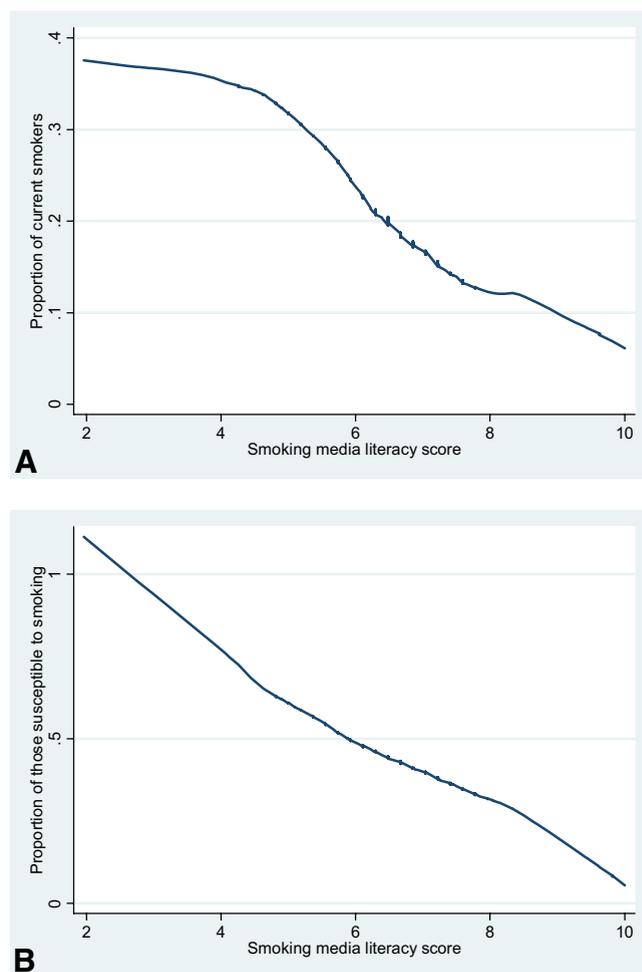


Figure 2. Association between smoking media literacy (SML) score and current smoking (top panel) and association between SML score and susceptibility to smoking (bottom panel) in adolescents. Data are based on raw scores in the 18-item SML scale, on self-report of current smoking (smoking in the past 30 days), and on responses to the three-item smoking susceptibility scale. Plots were created using LOWESS (locally-weighted scatter-plot smoothing) techniques in Stata 9.0.

Table 3
Bivariate and multivariate relationships between predictors and current smoking^a

Predictor	OR (95% CI) for current smoking, bivariate	OR (95% CI) for current smoking, multivariate
Demographic characteristic		
Age	1.33 (1.17, 1.51) ^c	1.34 (1.11, 1.62) ^c
Gender	1.02 (.76, 1.38)	1.14 (.73, 1.76)
African-American race	.43 (.15, 1.23)	.27 (.07, 1.10)
Other race	.97 (.44, 2.13)	.99 (.31, 3.13)
Parental education ^b	.71 (.60, .83) ^c	.94 (.75, 1.18)
Environmental factor		
Parent smoking	2.86 (2.11, 3.88) ^c	1.97 (1.28, 3.02) ^c
Sibling smoking	3.58 (2.59, 4.95) ^c	1.90 (1.21, 2.98) ^c
Friend smoking	33.7 (15.7, 72.6) ^c	13.33 (5.94, 29.9) ^c
Responsive parenting	.52 (.41, .66) ^c	1.00 (.66, 1.51)
Demanding parenting	.48 (.38, .62) ^c	1.16 (.79, 1.73)
Electronic media use	1.05 (1.03, 1.08) ^c	1.02 (.98, 1.06)
Stress	1.44 (1.20, 1.73) ^c	1.24 (.92, 1.66)
Intrinsic factor		
Grades	.32 (.25, .42) ^c	.57 (.40, .82) ^c
Depression	1.49 (1.22, 1.83) ^c	1.04 (.75, 1.46)
Self-esteem	.88 (.68, 1.14)	.99 (.67, 1.46)
Rebelliousness	4.77 (3.59, 6.33) ^c	2.48 (1.63, 3.76) ^c
Sensation seeking	3.47 (2.64, 4.56) ^c	1.63 (1.08, 2.43) ^c
Knowledge of harm and addictiveness of smoking	.79 (.69, .92) ^c	.74 (.60, .91) ^c
SML level ^d		
SML as a continuous variable (1 point on a 10-point scale)	.68 (.60, .77) ^c	.84 (.71, .99) ^c
SML above median (vs below median)	.37 (.26, .51) ^c	.57 (.37, .87) ^c

^a OR = odds ratio; CI = confidence interval; SML = smoking media literacy.

^b Parental education was used as a surrogate for socioeconomic status.

^c Result is statistically significant ($p < .05$).

^d SML was measured in 3 different ways: as a continuous variable and as a dichotomous variable.

admitted to providing dishonest answers. The number of surveys available for analysis was therefore 1211 (86% of the surveys completed). Those eliminated from the analysis were no different than those included in terms of age, race, or reported parental education, respectively. However, those eliminated were more likely to be male (71% vs. 48%; $p < .001$).

The mean age of the 1211 respondents with valid data was 15.9 years, about half (48%) were male, and 92% were white (Table 2). With regard to the smoking-related measures, 19% reported current smoking, and 40% of the non-smokers were classified as susceptible to future smoking.

The mean SML score was 6.8 with a standard deviation of 1.3, and the scores followed a roughly normal distribution (Figure 1). As has been reported previously [24], in this sample SML was positively associated with socioeconomic status, responsive parenting, demanding parenting, and self-report of grades. It was negatively associated with rebelliousness and sensation-seeking. The level of SML was also lower in those with siblings, parents, and friends who smoke. With regard to the two primary outcome measures for this study, the SML score had a nearly linear relationship with each (Figure 2).

In bivariate analyses, SML and the vast majority of the

covariates were associated with the outcome of current smoking (Table 3). Only race, gender, and self-esteem were not significantly associated with current smoking. In multivariate analyses, we found an independent association between SML and current smoking (Table 3). A one-point decrease on the 10-point SML scale was associated with an odds ratio for smoking of .84 (95% CI .71–.99). Compared with individuals with SML below the median, the odds ratio for smoking for individuals with scores above the median of smoking was .57 (95% CI .37–.87).

Several variables other than SML were also independently associated with current smoking. Better grades and higher knowledge of the harm and addictiveness of smoking had an independent inverse association with smoking (Table 3). Increasing age, parental smoking, sibling smoking, friend smoking, rebelliousness, and sensation-seeking all independently increased the odds ratio for smoking.

Analyses on susceptibility to smoking were performed only with students who were not current smokers, because this construct was validated in that population [28]. The majority of measured covariates had significant bivariate associations with susceptibility to smoking (Table 4). However, in multivariate models, only friend smoking, depression, self-esteem, rebelliousness, sensation-seeking, and

Table 4
Bivariate and multivariate relationships between predictors and susceptibility to smoking^a

Predictor	OR (95% CI) for susceptibility to smoking, bivariate	OR (95% CI) for susceptibility to smoking, multivariate
Demographic characteristic		
Age	1.00 (.90, 1.11)	.91 (.79, 1.05)
Gender	.90 (.70, 1.17)	1.12 (.78, 1.61)
African-American race	1.11 (.58, 2.11)	.66 (.26, 1.68)
Other race	1.41 (.70, 2.84)	1.59 (.60, 4.18)
Parental education ^b	1.02 (.88, 1.17)	1.10 (.91, 1.33)
Environmental factor		
Parent smoking	1.36 (1.03, 1.79) ^c	.92 (.64, 1.33)
Sibling smoking	1.94 (1.39, 2.72) ^c	1.14 (.73, 1.79)
Friend smoking	4.28 (3.19, 5.73) ^c	3.28 (2.30, 4.68) ^c
Responsive parenting	.61 (.48, .77) ^c	1.15 (.79, 1.68)
Demanding parenting	.50 (.40, .64) ^c	.72 (.51, 1.03)
Electronic media use	1.04 (1.01, 1.06)	1.00 (.96, 1.03)
Stress	1.07 (.92, 1.25)	1.11 (.88, 1.40)
Intrinsic factor		
Grades	.57 (.46, .71) ^c	.91 (.67, 1.23)
Depression	1.05 (.87, 1.27)	.72 (.54, .96) ^c
Self-esteem	.63 (.50, .80) ^c	.54 (.39, .76) ^c
Rebelliousness	2.72 (2.09, 3.53) ^c	1.60 (1.09, 2.33) ^c
Sensation seeking	2.25 (1.80, 2.81) ^c	1.66 (1.22, 2.27) ^c
Knowledge of harm and addictiveness of smoking	1.03 (.90, 1.16)	1.00 (.85, 1.18)
SML level ^d		
SML as a continuous variable (1 point on a 10-point scale)	.64 (.57, .71) ^c	.68 (.58, .79) ^c
SML above median (vs below median)	.42 (.32, .55) ^c	.49 (.35, .68) ^c

^a OR = odds ratio; CI = confidence interval; SML = smoking media literacy. For this analysis, the sample includes only those individuals who were not current smokers.

^b Parental education was used as a surrogate for socioeconomic status.

^c Result is statistically significant ($p < .05$).

^d SML was measured in two different ways: as a continuous variable and as a dichotomous variable.

SML retained independent associations with susceptibility to smoking. A one-point decrease on the 10-point SML scale was associated with an odds ratio for susceptibility to smoking of .68 (95% CI .58–.79). Compared with individuals with SML below the median, the odds ratio for susceptibility to smoking for individuals with scores above the median of smoking was .49 (95% CI .35–.68).

Each of the final logistic regression models in which both current smoking and smoking susceptibility were used as dependent variables showed excellent ability to predict the outcomes with Hosmer-Lemeshow goodness-of-fit testing and ROC curve analysis [34]. When data from all students were included (even from those whose data was eliminated from the final analysis because of having had poor data quality), the results were similar.

Discussion

In our analysis of surveys completed by adolescents in a large suburban high school, we found that higher levels of SML were independently associated with decreased odds ratios for current smoking and smoking susceptibility. In our logistic regression analysis, the association between

smoking and SML scores was similar to the association between smoking and many other factors traditionally thought to be important predictors of smoking. Friend smoking, rebelliousness, and sensation-seeking were the only other variables independently associated with both current smoking and susceptibility to smoking. This may be particularly important because SML has been shown in other studies to be practical to teach [18,24,35], unlike characteristics such as rebelliousness and sensation-seeking.

Different methods of categorizing SML scores may be appropriate for different settings. In research settings, investigators may favor the analysis of scores as a continuous variable, because this will allow them to retain the most statistical information and make finer distinctions. In clinical settings, when encounters with patients are brief, however, it may not be feasible to determine a specific numerical SML score. It may be possible, however, to estimate whether an adolescent's level of SML is high or low and then to counsel or intervene as appropriate. As the results of our study indicate, adolescents with SML above the median are about half as likely to smoke and to be susceptible to smoking as those with SML below the median, even when controlling for all measured covariates.

Because media messages have been shown to affect not only smoking behavior but also eating behavior, aggression, sexual behavior, and alcohol use [36–38], it may be useful to conduct similar studies to determine whether media literacy may also be useful in buffering harmful health behaviors other than smoking. Although it is important to continue to attempt to reduce the amount of exposure to potentially harmful media messages during adolescence, it is not always feasible to do so. Media literacy may therefore be a practical and empowering co-intervention.

Our study had several limitations that deserve mention. First, the study population was drawn from a single large high school. Although the adolescents in the study were homogeneous in terms of their racial and ethnic backgrounds, their baseline values for smoking and for susceptibility to smoking are, in fact, similar to values previously reported [28,39,40]. Nevertheless, our findings should be confirmed in more diverse populations. Second, although a cross-sectional study can show associations between SML and smoking, the more clinically relevant question would be whether individuals with different levels of SML will have different rates of initiating the use of cigarettes. This question could ideally be answered with a prospective cohort study, which would be the next logical step. Third, we relied on self-report of smoking, rather than biochemical verification of smoking. We did not verify smoking behavior, however, because of (1) the potential to introduce selection bias; (2) the fact that this would have necessitated active informed consent; and (3) the fact that only a very small proportion of the students were daily smokers in whom cotinine would be detected.

In summary, this study is the first of which we are aware that provides evidence for an independent association between smoking media literacy and both smoking behavior and susceptibility to future smoking among adolescents. Media literacy may therefore represent a promising tool for smoking prevention in this population.

Acknowledgments

We gratefully acknowledge the financial support of the Maurice Falk Foundation and Tobacco-Free Allegheny. Although each of these agencies provided financial support, they were not involved in the design and conduct of the study; the collection, management, analysis, and interpretation of the data; or the preparation, review, or approval of the manuscript. Dr. Fine was supported in part by a K-24 career development award from the National Institute of Allergy and Infectious Diseases (5K24 AI01769). Dr. Primack had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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