The Impact of an Antismoking Media Campaign on Progression to Established Smoking: Results of a Longitudinal Youth Study

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ABSTRACT

Objectives. We examined the impact of a statewide antismoking media campaign on progression to established smoking among Massachusetts adolescents.

Methods. We conducted a 4-year longitudinal survey of 592 Massachusetts youths, aged 12 to 15 years at baseline in 1993. We examined the effect of baseline exposure to television, radio, and outdoor antismoking advertisements on progression to established smoking (defined as having smoked 100 or more cigarettes), using multiple logistic regression and controlling for age; sex; race; baseline smoking status; smoking by parents, friends, and siblings; television viewing; and exposure to antismoking messages not related to the media campaign.

Results. Among younger adolescents (aged 12 to 13 years at baseline), those reporting baseline exposure to television antismoking advertisements were significantly less likely to progress to established smoking (odds ratio = 0.49, 95% confidence interval = 0.26, 0.93). Exposure to television antismoking advertisements had no effect on progression to established smoking among older adolescents (aged 14 to 15 years at baseline), and there were no effects of exposure to radio or outdoor advertisements.

Conclusions. These results suggest that the television component of the Massachusetts antismoking media campaign may have reduced the rate of progression to established smoking among young adolescents. (*Am J Public Health*. 2000;90:380–386)

Preventing smoking is a public health priority.[1] Public health practitioners have begun to use counteradvertising to prevent smoking initiation.[2–11] Antitobacco media campaigns are being conducted in at least 7 states,[2,3] and with the recent settlement of state tobacco lawsuits, money may soon be available for campaigns in other states.

Despite the growing use of antismoking media campaigns, little is known about their effectiveness. Existing research has focused on their impact on adult smoking cessation or overall cigarette consumption.[12–20] The few studies of the impact of these campaigns on youth smoking had mixed results. Community- and school-based interventions highlighted by a mass media campaign reduced smoking initiation rates among adolescents in Vermont, New York, and Montana,[21–25] Minnesota,[26] North Karelia,[27] and Norway,[28] but they failed to influence smoking behavior among youths in southern California[29] or the southeastern United States.[30]

Existing studies have evaluated the results of research demonstration projects; it is not clear whether similar results could be expected from government-funded statewide media campaigns, which tend to target more homogeneous populations, provide less control over individual exposure, and introduce political factors that influence a program's effectiveness.

Only 2 studies, both using repeated cross-sectional survey designs, have examined the impact of government-funded, statewide mass media antismoking campaigns on youth smoking. Murray et al. found no significant change in the prevalence of youth smoking associated with a statewide mass media–based intervention in Minnesota.[31,32] Popham et al. found a small but significant decrease in the prevalence of youth smoking in California[33]; however, the absence of a control group makes it impossible to attribute this effect to the media campaign.

This study is the first to examine the relationship between exposure to a statewide antitobacco media campaign and changes in smoking status among youths by using a cohort design. We report the results of a 4-year longitudinal study of a cohort of Massachusetts youths. To assess the independent effect of the statewide antismoking media campaign on youth smoking behavior, we compared the rate of progression to established smoking among youths who recalled exposure to television, radio, and outdoor antismoking advertisements at baseline and among youths who failed to recall such exposure, controlling for exposure to antismoking messages from sources not related to the media campaign.

Methods

The Massachusetts Antismoking Media Campaign

In 1992, Massachusetts voters approved a ballot initiative that increased the cigarette excise tax and established a comprehensive antismoking intervention that includes a media campaign.[34] The tax increase went into effect on January 1, 1993, and the media campaign was initiated in October 1993. The media campaign was conducted primarily through advertisements on television, on the radio, in newspapers, and on billboards.

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However, the aspects of the media campaign aimed at youths were almost entirely restricted to television, radio, and outdoor advertisements.

Of the $735 000 spent on advertisements that targeted youth during the first 6 months of the media campaign (the time during which our baseline survey took place), 80% was allocated for television advertisements, 14% for radio spots, 5% for billboards, and only 1% for newspaper advertisements.[35] It should be noted that the goal of the early part of the Massachusetts antismoking media campaign was to expose a broad cross-section of the population, rather than to specifically target high-risk youths.

Design Overview

We conducted a 4-year follow-up telephone survey of a cohort of Massachusetts youths, aged 12 to 15 at the time of the initial survey in 1993, to examine the relationship between baseline exposure to the statewide antismoking media campaign and subsequent rates of progression to established smoking. Exposure to the 3 major channels of the media campaign was measured by ascertaining whether a respondent recalled having seen an antismoking advertisement on television or on billboards or having heard one on the radio.

We compared rates of progression to established smoking between groups on the basis of their reported baseline exposure to television, radio, and outdoor antismoking advertisements, using multiple logistic regression and controlling for age; race; sex; baseline smoking status (baseline susceptibility to smoking); smoking by parents, friends, and siblings; hours of television viewing; and baseline exposure to antismoking messages not related to the media campaign.

Sample

The 1993 Massachusetts Tobacco Survey, conducted by the Center for Survey Research, University of Massachusetts, Boston, was based on a probability sample of Massachusetts households drawn by random-digit dialing.[36] On the basis of initial interviews with adult household informants in 11 463 households, a representative sample of youths was selected. Between October 1993 and March 1994, extended interviews were completed with 75% of eligible youths, yielding a final baseline sample of 1606 youths, 1069 of whom were between the ages of 12 and 15.

Between November 1997 and February 1998, we attempted to contact these 1069 youths for a follow-up interview. We were unable to locate 328 (30.7%) and completed interviews with 618 (57.8%). The primary analyses in this study are based on the 592 youths in this cohort who were not established smokers (as defined below) at baseline.

Measures

Progression to established smoking. Following Pierce et al.,[37] we defined progression to established smoking on the basis of the number of cigarettes respondents reported having smoked in their lifetime. Youths who had smoked 100 or more cigarettes were classified as established smokers. The theoretical rationale and validation of this measure of adolescent smoking have been established previously.[38–40] This measure avoids the problem of the irregularity of smoking during adolescence and the problem of unreliable adolescent recall of smoking behavior during the past 30 days by establishing a defined threshold of total lifetime cigarettes smoked to measure regular smoking behavior. Self-reports of smoking behavior could not be validated, because the survey was conducted via telephone.

Exposure to antismoking media campaign. We assessed baseline exposure to the statewide antismoking media campaign by ascertaining whether respondents recalled exposure to any antismoking messages or advertisements on television, the radio, or billboards in the past 30 days.

We validated the baseline exposure measures by comparing them with respondents' recall (at follow-up) of 9 specific antismoking television advertisements that had aired during the previous 4 years and also to the frequency of their reported exposure (at follow-up) to television, radio, and outdoor antismoking advertisements.

Exposure to antismoking messages not related to the media campaign. At baseline, respondents were asked whether they recalled any antismoking messages during the past 30 days in posters or pamphlets, in newspapers or magazines, at sporting events, or at school. These sources most likely do not reflect exposure to the media campaign, since these channels were not major ones used in the youth component of the media campaign. We controlled for these exposures by including a variable in the analysis reflecting whether a respondent reported exposure to antismoking messages in more than 1 of these 4 media.

Potential confounding variables. We examined the effects of several potential confounding variables: (1) age group (12–13 years vs 14–15 years), (2) sex, (3) race (non-Hispanic White vs other), (4) baseline smoking status, (5) average hours of television viewing per day (measured at follow-up only), (6) presence of at least 1 adult smoker (a parent or sibling) in the household (at baseline), and (7) presence of at least 1 close friend who smoked (at baseline).

Baseline smoking status was classified into 3 categories: (1) nonsusceptible nonsmokers, (2) susceptible nonsmokers; and (3) experimenters. Nonsmokers were defined as respondents who had smoked no more than 1 cigarette in their lives. Experimenters were those who had smoked more than 1 cigarette (but fewer than 100). Nonsmokers were classified as nonsusceptible to smoking if they answered "no" to the question "Do you think that you will try a cigarette soon?" and "definitely not" to the questions "If one of your best friends were to offer you a cigarette, would you smoke it?" and "At any time during the next year do you think you will smoke a cigarette?" This measure of susceptibility to smoking has been shown to reliably predict progression to established smoking.[37–40]

Television viewing behavior at follow-up was assessed by asking respondents how many hours of television they usually watched on weekdays and on Saturdays. We averaged a respondent's answers to these 2 questions and coded the result into 3 categories: no television viewing, up to 2 hours of television viewing per day, and more than 2 hours of television viewing per day.

Mediating variables. To identify differences in knowledge or attitudes that might mediate the effect of an antismoking media campaign, we asked 8 questions in the follow-up survey that reflected specific knowledge or attitudes that were addressed by the statewide media campaign: (1) Does smoking low-tar and low-nicotine cigarettes reduce people's risk of illness? (2) Can inhaling someone else's cigarette smoke cause lung cancer? (3) Do cigarettes contain poisonous chemicals? (4) Do cigarettes cause permanent wrinkles? (5) Do tobacco companies purposely advertise to get young people to start smoking? (6) Do nonsmokers prefer to go out with smokers or nonsmokers? (7) Does smoking make it harder or easier to do well at sports? (8) What proportion of kids at your high school are smokers?

Data Analysis

We performed logistic regression analyses, using baseline exposure to antismoking messages on television, on the radio, and on billboards as 3 independent variables and progression to established smoking as the

dependent variable. All of the potential confounding variables were entered simultaneously into the model. Ninety-five-percent confidence intervals for odds ratios were calculated with standard errors estimated by the Wald test.[41] All analyses were conducted with the SAS statistical package.[42]

We explored the possibility of interactions between television, radio, and outdoor advertising exposure and 3 of our covariates (age group, sex, and race) by adding (each in a separate regression) the relevant interaction terms to the model. We used the likelihood ratio test[41] to determine whether the addition of an interaction term improved the overall fit of the regression model. Following Hosmer and Lemeshow, we used a likelihood ratio test significance level of .15 as the criterion for inclusion of interaction terms.[41] Thus, interactions that were found to improve the overall model fit at the .15 level were included in the final regression model.

To investigate the effect of exposure to the antismoking media campaign on the mediating variables, we compared the knowledge and attitudes at follow-up of respondents who were exposed and respondents who were not exposed to television, radio, and outdoor antismoking messages at baseline. We conducted 3 sets of logistic regression analyses, using exposure to television, radio, and outdoor antismoking messages as the independent variables and the 8 specific knowledge and attitude variables as the dependent variables and controlling for the effects of age; sex; race; baseline smoking status; baseline exposure to smoking by parents, siblings, and friends; television viewing; and exposure to antismoking messages unrelated to the media campaign.

The baseline survey data set included weights that reflected each respondent's initial probability of selection. Because the primary objective of this study was to draw conclusions about the impact of exposure to the antismoking media campaign on progression to established smoking among members of this specific cohort, rather than to generalize to the state as a whole, we conducted unweighted analyses. Estimated standard errors do not account for design effects in the original baseline survey.

Results

Exposure to Antismoking Television Advertisements and Validation of Exposure Measure

Among the 592 youths in our sample, 422 (71.3%) reported baseline exposure to antismoking messages on television. At follow-up, the mean number of television advertisements recalled by youths who had reported baseline television exposure (5.5) was significantly higher than the mean number recalled by youths who had not reported baseline television exposure (4.6) ($P=.001$). Youths who reported baseline exposure to the television advertisements were also significantly more likely to report a higher frequency of exposure at follow-up ($P=.027$).

In the cohort, 195 youths (32.9%) reported baseline exposure to antismoking messages on the radio and 339 (57.3%) reported baseline exposure to antismoking messages on billboards. Youths who reported baseline exposure to radio advertisements and outdoor advertisements were significantly more likely to report higher exposure to radio ($P=.001$) and outdoor ($P=.002$) antismoking advertisements at follow-up.

Characteristics of the Study Population

There were no significant differences in age, sex, race, or baseline smoking status between youths who were exposed to antismoking messages in each of the 3 media and those who were not. However, youths who reported exposure to antismoking messages in 1 medium were significantly more likely also to report exposure in the other media (Table 1).

Youths exposed to television antismoking messages at baseline were significantly less likely to have an adult smoker in the household, but there was no significant difference between the exposed and unexposed youths in having at least 1 close friend who smoked (Table 1). Youths exposed at baseline to radio and outdoor antismoking messages were significantly more likely to have a close friend who smoked, but there was no significant association between exposure to radio or outdoor antismoking advertisements and having an adult smoker in the household.

Examination of Interaction Effects

Only 1 interaction was found to significantly improve the overall fit of the regression model (when a .15 level of statistical significance was used): that between exposure to television antismoking advertisements and age group; therefore, this interaction term was included in the final regression model. Because of the presence of this interaction effect, the relationship between exposure to television antismoking advertisements and progression to established smoking is reported separately for the 2 age groups.

Predictors of Progression to Established Smoking

The overall rate of progression to established smoking among the 592 youths in the cohort was 25.3% (95% confidence interval [95% CI]=21.8%, 28.8%). Among youths aged 12 to 13 years at baseline, those who had reported exposure to antismoking television advertisements at baseline were significantly less likely to have progressed to established smoking than those who had not reported such exposure, after control for the simultaneous effects of exposure to antismoking radio and billboard advertisements, exposure to antismoking messages not related to the media campaign, television viewing, age, sex, race, baseline smoking status, and baseline exposure to smoking by parents, siblings, and friends (odds ratio [OR]=0.49; 95% CI=0.26, 0.93) (Table 2). However, among youths aged 14 to 15 years at baseline, there was no significant effect of exposure to television antismoking advertisements on progression to established smoking (OR=0.94; 95% CI=0.48, 1.83).

Baseline exposure to antismoking advertisements on the radio (OR=0.86; 95% CI=0.55, 1.37), on billboards (OR=0.85; 95% CI=0.55, 1.31), and in other media (OR=1.37; 95% CI=0.83, 2.27) was not significantly associated with subsequent progression to established smoking (Table 2).

Effects of Baseline Exposure to Antismoking Advertisements on Mediating Variables

Baseline exposure to antismoking advertisements on television was not associated with subsequent differences in 7 of the 8 specific smoking-related knowledge and attitude variables we tested (Table 3). However, youths who were exposed to antismoking advertisements on television at baseline were more than twice as likely to report at follow-up that fewer than half of the students at their high school were smokers (OR=2.34; 95% CI=1.40, 3.91). The relationship between exposure to television antismoking advertisements and this outcome—an accurate as opposed to an inflated perception of youth smoking prevalence—differed by age group. Among youths aged 14 to 15 years at baseline, 26.9% of exposed youths had an accurate perception of youth smoking prevalence at follow-up, compared with 18.2% of unexposed youths ($P=.13$). Among youths aged 12 to 13 years at baseline, 30.8% of exposed youths had an accurate perception of youth smoking prevalence at follow-up, compared with 13.3% of unexposed youths ($P=.001$).

TABLE 1—Baseline Characteristics of Massachusetts Youth Cohort[a] by Exposure to Antismoking Messages on Television

	Exposed to Antismoking Messages on Television at Baseline,% (n = 422)	Not Exposed, % (n = 170)	Full Cohort, % (n = 592)
Age at baseline, y			
12–13	51.2	53.5	51.9
14–15	48.8	46.5	48.1
Sex			
Male	50.0	48.2	49.5
Female	50.0	51.8	50.5
Race/ethnicity			
Non-Hispanic White,	69.0	64.1	67.6
Other	31.0	35.9	32.4
Baseline smoking status			
Nonsusceptible nonsmoker	56.2	60.2	57.3
Susceptible nonsmoker	35.1	28.9	33.3
Experimenter	8.8	10.8	9.4
Baseline exposure to antismoking messages on the radio*			
No	60.0	84.7	67.1
Yes	40.0	15.3	32.9
Baseline exposure to antismoking messages on billboards or big signs*			
No	39.1	51.8	42.7
Yes	60.9	48.2	57.3
Baseline exposure to antismoking messages in other media[b]*			
None or 1 medium only	21.6	45.3	28.4
More than 1 medium	78.4	54.7	71.6
Average hours of television viewing per day[c]*			
None	3.6	7.7	4.8
Up to 2 h	56.0	46.2	53.1
More than 2 h	40.5	46.2	42.1
At least 1 adult smoker in household*			
No	64.7	54.1	61.7
Yes	35.3	45.9	38.3
At least 1 close friend smokes			
No	36.0	38.2	36.7
Yes	64.0	61.8	63.3

[a]Cohort includes only youths who were not established smokers (i.e., had smoked fewer than 100 cigarettes in their life) at baseline.
[b]Exposure to antismoking messages (1) in newspapers or magazines, (2) in posters or pamphlets, (3) at sporting events, and (4) at school.
[c]Television viewing was measured at follow-up only.
*$P < .05$ for overall χ^2 test (test for significance of differences in distribution of variable for youths exposed vs unexposed to antismoking messages on television at baseline).

Baseline exposure to radio and outdoor antismoking advertisements was not associated with subsequent differences in any of the 8 smoking-related knowledge and attitude variables (data not shown).

Discussion

To the best of our knowledge, this is the first longitudinal study to examine the effect of a statewide antismoking advertising campaign on smoking initiation among youths. We found a significant effect of exposure to television antismoking advertising on progression to established smoking during a 4-year period that was specific to younger adolescents. We found no significant effect of exposure to radio or outdoor advertisements. We also found that youths exposed to antismoking television advertisements were more likely to have an accurate as opposed to an inflated perception of youth smoking prevalence; this effect was significant only for younger adolescents.

There are several reasons why we believe this observed effect represents a true association between television antismoking advertising and smoking initiation, rather than an effect due to bias or confounding. First, the observed effect is not explained by differences in susceptibility to smoking between the exposed and unexposed youths. Second, the observed effect is not explained by baseline differences in peer, sibling, or parental smoking. Third, the results are not explained by baseline differences in the educational status of the adult informant; after adding this variable to the model, the effect of television antismoking advertisements on progression to established smoking among young adolescents was unchanged (OR = 0.52; 95% CI = 0.27, 0.99). Fourth, we would have expected that the confounding effects of an unknown variable would have appeared after control for baseline susceptibility to smoking, peer, parental, and sibling smoking, and baseline educational status of the adult informant. The odds ratio for the association between television antismoking advertisements and progression to established smoking among young adolescents was virtually unchanged after addition of all of the above covariates.

Fifth, the results of this study are not explained by differential loss to follow-up. The response rate for youths who were exposed to television antismoking advertisements at baseline (58.7%) was only slightly higher than that for unexposed youths (55.6%). Moreover, the proportion of experimenters and susceptible nonsmokers among all exposed nonsmokers at baseline who were successfully followed was identical to that among the exposed nonsmokers who were not followed (43.8%). In other words, had we been able to successfully follow the entire cohort of exposed youths, we would not have expected to find any different rate of

TABLE 2—Adjusted Odds Ratios[a] for Progression to Established Smoking Among Massachusetts Youth Cohort,[b] 1993–1994 to 1997–1998

	Adjusted Odds Ratio	95% Confidence Interval
Baseline exposure to antismoking messages on television[c]		
No	1.00	
Yes	0.49	0.26, 0.93
Baseline exposure to antismoking messages on the radio		
No	1.00	
Yes	0.86	0.55, 1.37
Baseline exposure to antismoking messages on billboards or big signs		
No	1.00	
Yes	0.85	0.55, 1.31
Baseline exposure to antismoking messages in other media[d]		
None or 1 medium only	1.00	
More than 1 medium	1.37	0.83, 2.27
Average hours of television viewing per day[e]		
None	1.00	
Up to 2 h	1.38	0.48, 3.98
More than 2 h	0.98	0.34, 2.89
Age at baseline, y		
12–13	1.00	
14–15	0.64	0.30, 1.37
Sex		
Male	1.00	
Female	1.11	0.73, 1.67
Race/ethnicity		
Non-Hispanic White	1.00	
Other	0.69	0.44, 1.09
Baseline smoking status		
Nonsusceptible nonsmoker	1.00	
Susceptible nonsmoker	1.87	1.19, 2.92
Experimenter	8.53	4.29, 16.96
At least 1 adult smoker in household		
No	1.00	
Yes	1.63	1.07, 2.49
At least 1 close friend smokes		
No	1.00	
Yes	2.70	1.58, 4.59
Exposed to television antismoking messages and in 14- to 15-year-old age group (interaction term)		
No	1.00	
Yes	1.92	0.78, 4.75

[a]Odds ratios are adjusted for all other variables in the table.
[b]Cohort includes only youths who were not established smokers (i.e., had smoked fewer than 100 cigarettes in their life) at baseline (n = 592).
[c]Represents effect on youths aged 12 to 13 years, since older youths are represented in the interaction term.
[d]Exposure to antismoking messages (1) in newspapers or magazines, (2) in posters or pamphlets, (3) at sporting events, and (4) at school.
[e]Television viewing was measured at follow-up only.

initiation based on baseline susceptibility, the strongest predictor of smoking initiation in our model.

There are 2 potential explanations for why we found an effect of exposure to television but not radio or outdoor antismoking advertisements. First, it is possible that television is a more powerful medium for reaching adolescents. Second, it is possible that the exposure of Massachusetts youths to radio and outdoor antismoking advertising was not extensive enough to affect their smoking behavior.

Our finding that the Massachusetts antismoking media campaign was effective in reducing smoking initiation only among younger adolescents may indicate that older adolescents are resistant to antismoking messages. It is also possible that the specific messages used in the Massachusetts media campaign were most salient among young adolescents. Others have noted that interventions targeted toward older adolescent experimenters must be carefully crafted to address their high risk of smoking initiation.[39]

Our findings suggest that the effect of the media campaign on smoking initiation may be mediated, in part, by its effects on perceived youth smoking prevalence. Youths with baseline exposure to antismoking television advertisements were more likely 4 years later to have an accurate (as opposed to inflated) perception of the prevalence of youth smoking. Perceived smoking prevalence is known to have a strong influence on youth smoking initiation.[1,43–46] The Massachusetts advertisements aimed to denormalize tobacco use by showing youths that smoking by their peers is not the norm. The first advertisement featured a crowd of youths mobilizing to "make smoking history in Massachusetts." Subsequent advertisements attempted to show adolescents that smoking among peers their age was not the norm in Massachusetts.

Although our baseline exposure measure indicates exposure that occurred between October 1993 and March 1994, the effect observed in this study is probably due to the cumulative impact of the media campaign over the entire study period. Baseline exposure to television antismoking advertisements correlated strongly with later recall and frequency of exposure to advertisements.

TABLE 3—Adjusted Odds Ratios[a] Associated With Baseline Exposure to Antismoking Television Advertisements for Smoking-Related Knowledge and Attitude Variables at Follow-Up Among Massachusetts Youths, 1993–1994 to 1997–1998

Smoking-Related Knowledge and Attitude Variable[b]	Adjusted Odds Ratio	95% Confidence Interval
Smoking low-tar and low-nicotine cigarettes does not reduce people's risk of illness	0.81	0.49, 1.33
Inhaling someone else's cigarette smoke can cause lung cancer	0.94	0.35, 2.50
Cigarettes contain poisonous chemicals	0.72	0.30, 1.70
Cigarettes cause permanent wrinkles	1.01	0.51, 1.99
Tobacco companies purposely advertise to get young people to start smoking	1.02	0.55, 1.88
Nonsmokers prefer to go out with nonsmokers	1.03	0.68, 1.57
Smoking makes it harder to do well at sports	0.94	0.40, 2.22
Fewer than half of kids at your high school are smokers	2.34	1.40, 3.91

[a]This table reports results for a model in which baseline exposure to antismoking advertisements on television is the predictor variable. Odds ratios are adjusted for age, sex, race, baseline smoking status, presence of at least 1 adult smoker in the household at baseline, presence of at least 1 close friend who smoked at baseline, television viewing (measured at follow-up only), and baseline exposure to antismoking messages on the radio, on billboards, or in other media (posters or pamphlets, newspapers or magazines, sporting events, school).
[b]Measured at follow-up survey.

Thus, the independent variable is actually high vs low exposure, rather than exposure vs no exposure.

There are several limitations to this study. First, the exposure measure we used assesses recall, not actual exposure to advertisements. We cannot tell whether exposed and unexposed youths differed in terms of actual exposure or if the youths differed only in terms of their attentiveness to the advertisements. Attentiveness to advertisements and recall of exposure may reflect some underlying variable that relates to risk of smoking initiation and could confound the study results. However, we were not able to identify such a variable.

Second, the baseline survey (October 1993 through March 1994) ran concurrently with the opening of the media campaign (October 1993), and it is possible that some early respondents who said they were not exposed had little chance to be exposed. Such an effect (misclassification of exposure status among "unexposed" early responders) would have blurred the true differences between the exposed and unexposed groups, leading to a bias toward the null hypothesis.

Third, our results do not imply that any antismoking media campaign is likely to be effective. Massachusetts spent more than $50 million, or about $8 per capita, on its campaign during the first 4 years.[35] This is a particularly high per capita expenditure on counteradvertising, even when compared with other states with similar campaigns.[3] One would not expect less intense campaigns to have the same effect.

Fourth, one should not necessarily conclude that radio and outdoor antismoking advertisements are not effective. These were not the predominant media used in the Massachusetts campaign. One should also not necessarily conclude that media campaigns cannot be effective in reaching older adolescents. We found a substantial difference (in the right direction) in perceived youth smoking prevalence between exposed and unexposed youths. With a larger sample size, this difference might have been statistically significant.

Finally, it is always possible that some unknown confounder could explain the observed association between exposure to antismoking television advertisements and reduced rates of progression to established smoking.

Despite these limitations, this study provides evidence that antismoking media campaigns may reduce smoking initiation among youths, especially among younger adolescents. Future research should attempt to confirm these findings in other populations and, using study designs that specifically quantify media exposure, further explore the age-specific effects of media campaigns, identify possible mediating variables, and examine the relative effectiveness of different types of advertising messages. A study design that used a comparison group that had no exposure to antismoking advertisements would be ideal; however, this may be increasingly difficult, given the sharing of media across states and the upcoming national media campaign. □

Contributors

M. Siegel and L. Biener planned the study and prepared the survey instrument. L. Biener supervised survey administration and data collection. M. Siegel and L. Biener contributed equally to the data analysis and the writing of the paper.

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