The Influence of Three Mass Media Campaigns on Variables Related to Adolescent Cigarette Smoking: Results of a Field Experiment

ABSTRACT

Background: This paper reports findings from a field experiment that evaluated mass media campaigns designed to prevent cigarette smoking by adolescents.

Methods: The campaigns featured radio and television messages on expected consequences of smoking and a component to stimulate personal encouragement of peers not to smoke. Six Standard Metropolitan Statistical Areas in the Southeast United States received campaigns and four served as controls. Adolescents and mothers provided pretest and posttest data in their homes.

Results and Conclusions: The radio campaign had a modest influence on the expected consequences of smoking and friend approval of smoking, the more expensive campaigns involving television were not more effective than those with radio alone, the peer-involvement component was not effective, and any potential smoking effects could not be detected. (*Am J Public Health* 1991; 81:597–604)

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Introduction

There is general agreement that cigarette smoking is the major preventable cause of death in the United States and that efforts to prevent smoking onset should be directed toward young people.[1]

Few studies have evaluated the influence of broadcast media on adolescent smoking.[2] Lewitt, Coate, and Grossman concluded that youth smoking rates were reduced by messages broadcast on radio and television.[3] The awareness of negative personal and social consequences of smoking increased among Minnesota adolescents after the introduction of campaigns that involved television, radio, and billboards.[4] Worden, *et al.*, found fewer reports of friend smoking, but no less smoking, among adolescents in a rural Vermont county that received a television campaign than in four matched control counties.* Flay, *et al.*, found no effects on smoking intention or behavior by a coordinated television and school-based prevention program.[5] Research on mass media campaign effects for behaviors other than smoking rarely involves adolescents (see, for example, Rice and Atkin[6]).

The purpose of this research was to evaluate the impact of mass media campaigns intended to prevent adolescent cigarette smoking.

*Worden JK, Flynn BS, McAuliffe TL, Sweeney RR, Secker-Walker RH: Using television to reach rural children with non-smoking messages. Paper presented at the American Rural Health Association Conference, Jeffersonville, VT, June 1982.

Methods

The Mass Media Campaigns

The three mass media campaigns evaluated in this research are described in detail elsewhere.[7,8] They were developed with the guidance of behavioral science theory and research, one year of extensive formative research, and the principle that they could be implemented readily throughout the United States.

One campaign used eight 30-second radio messages that focused on seven expected consequences of smoking that are related to whether young people become regular smokers. We identify this campaign, and the areas in which it was implemented, as RADIO.

The second campaign (RPEER) was similar but also included a 60-second radio message that invited persons 12 to 15 years old to enter the "I Won't Smoke Sweepstakes." The purpose of the sweepstakes was to obtain names and addresses. We mailed entrants a brochure that asked them to talk to their friends about not smoking, to encourage their friends to pledge not to smoke, and to have their friends enter the sweepstakes. We offered a $20 incentive for recruiting five or more

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entrants. The brochure also was mailed to friends they recruited.

The third campaign (RTVPEER) was similar to the second but included television broadcast of the sweepstakes offer and only three of the expected consequences messages.

The expected consequences messages were broadcast throughout November 1985, January 1986, and April 1986. The sweepstakes offer was broadcast during November 1985 and the brochures to encourage personal peer contact were mailed from January 1986 through February 1987. To simulate implementation of a national campaign, an advertising agency purchased broadcast time. The agency placed the messages at times expected to reach 75 percent of the intended audience four times during each of three four-week periods.

Design

The study design involved ten Standard Metropolitan Statistical Areas (SMSAs). Two SMSAs received each treatment condition and four served as CONTROL.

To minimize heterogeneity among study areas, only the 81 SMSAs in the Southeast United States were eligible for study. Homogeneity was increased further by excluding SMSAs with populations of fewer than 200,000 (n = 22) and more than 500,000 (n = 21) inhabitants, median age above 36 (n = 4), more than 90 percent White (n = 12), more than 22 percent with four or more years of college and ages 25 or older (n = 4), and density less than 100 or more than 300 per square mile (n = 2). We randomly eliminated SMSAs with overlapping broadcast areas until 10 SMSAs, located evenly throughout the Southeast United States, remained. We divided the Southeast into north, middle, and south, and randomly allocated the SMSAs to treatment conditions within each area. Cost and legal restrictions required two reassignments within area after random allocation. The final distribution of study SMSAs by treatment condition is CONTROL (Chattanooga, Tennessee; Columbia, South Carolina; Jackson, Mississippi; Savannah, Georgia), RADIO (Lakeland, Florida; Macon, Georgia), RPEER (Montgomery, Alabama; Roanoke, Virginia), and RTVPEER (Lexington, Kentucky; Mobile, Alabama).

Data Collection

Cluster sampling procedures identified probability samples of households within each SMSA in 1985.** Households were screened for adolescents ages 12 to 14. For the pretest surveys, conducted from April 1, 1985 through October 13, 1985, interviewers attempted to obtain data from all eligible adolescents and their mothers in the households. When more than one adolescent age 12 to 14 resided in a household, one was randomly selected to serve as a subject. Of the 2,534 adolescent subjects eligible for study in all SMSAs, 2,102 (83.0 percent) participated at pretest. The same subjects were asked to provide data again from April 16, 1987 to October 29, 1987, 11 to 17 months after the broadcasts ended and two to eight months after the mailings for the peer-involvement component ended. Of those who participated at pretest, 1,637 also participated at posttest and are included in the analyses reported here. Some pretest subjects could not be located at follow-up or had substantial missing information and are therefore lost to study. The numbers of subjects across SMSAs range from 132 to 232.

To assess overall attrition bias, we compared subjects who provided data only at pretest with those who also provided data at posttest on the intervening and smoking variables measured at pretest. The two groups did not differ on variables measuring smoking experimentation, subjective expected utility, smoking intention, friend approval of smoking, or friend encouragement of not smoking. Subjects lost to study, compared to subjects who provided both pretest and posttest data, were significantly more likely to be recent smokers (5.0 versus 3.1 percent), to be regular smokers (5.6 versus 3.1 percent), and to have high mean smoking intensity (1.22 versus 1.16).

While collecting posttest data from the panel subjects, we also gathered data from a cross-sectional sample of adolescents 14 to 16 years old and their mothers. Procedures were similar to those used to select subjects at baseline for the panel sample but we used clusters other than those in the panel and fewer subjects. We refer to this as the cross-sectional sample to distinguish it from the panel sample. The cross-sectional sample increased sample size and allowed assessment of testing effects.[9] Of the estimated 1,759 subjects eligible for the cross-sectional sample, 1,216 provided data.

**Research Triangle Institute: Survey of Young Adolescent Smoking Behavior: Final report, 1986.

Adolescent subjects averaged one hour to complete a self-administered questionnaire in their homes and provided alveolar breath and saliva samples to measure tobacco use. The mothers of most adolescents also completed a 25-minute self-administered questionnaire and provided alveolar breath samples.

Measures

The variables are listed in the Appendix. Data from the mother questionnaire measured parent education. All other measures are from data provided by the adolescents. Their derivation follows.

Adolescent subjects indicated the likelihood they would experience each of the seven expected consequences of smoking featured in the campaigns (bad breath, difficulty concentrating, loss of friends, trouble with adults, loss of appetite, increased fun, and increased relaxation) and how much they would like or dislike each consequence. We multiplied the responses for each consequence and summed the products to indicate the degree to which more positive or negative consequences of smoking were expected, with the more positive score favoring smoking. This measures subjective expected utility (SEU) for smoking (smoking SEU).[10] SEU for not smoking (nonsmoking SEU) was measured in the same way but the consequences were for not smoking rather than for smoking; more positive scores favored not smoking. A combined SEU (total SEU) was derived by subtracting nonsmoking SEU from smoking SEU; more positive scores on total SEU indicate greater preferences for smoking.

Decreased friend approval of smoking and increased friend encouragement of not smoking were hypothesized to be direct consequences of the peer-involvement component. To measure friend approval, subjects were asked how many of their three best friends would approve of their smoking. To measure friend encouragement, subjects were asked how often someone their own age had encouraged them to be a nonsmoker; response categories ranged from never to 10 or more times. To measure smoking intention, subjects were asked how sure they thought they would smoke in the next two years, with response categories ranging from certain to smoke to certain not to smoke.

Subjects provided alveolar breath samples to measure carbon monoxide (CO); a value ≥ 9.0 ppm indicated recent smoking.[11] Subjects were asked whether they had ever puffed on a cigarette. Sub-

jects also were asked about their smoking intensity using a single questionnaire item that measured recency, frequency, and amount smoked.[12,13] The values ranged from never smoked a cigarette to currently smoke more than two packs a day. We also used the intensity measure to classify subjects as regular smokers if they usually smoked weekly or more often. To increase the validity of self-reports of smoking, subjects were told before beginning the questionnaires that the alveolar breath and saliva samples they gave would be used to measure their smoking.[14,15]

Analysis

Baseline data were used to create subsamples of subjects who were not regular smokers. Of the 1,637 panel subjects, the nine who did not report whether they had puffed on a cigarette were excluded from all analyses. The remaining subjects were divided into those who had not (N = 973) and those who had (N = 655) puffed on a cigarette. Of the adolescents who had not puffed on a cigarette, 22 with missing information on CO or with CO ≥ 9 ppm were excluded; the remaining 951 subjects are nonexperimenters. Of the adolescents who had puffed on a cigarette, 127 who were regular smokers, had CO ≥ 9 ppm, or had missing information were excluded; the remaining 528 are experimenters. The total sample includes experimenters (N = 528), nonexperimenters (N = 951), regular smokers (N = 48), and subjects with insufficient information for classification (N = 110).

Each SMSA was assigned average scores based on the information provided by subjects within the SMSA. Multiple regression analysis for repeated measures was the principal statistical method for inferences concerning treatment differences for changes over time by SMSA, i.e. treatment by time interaction.[16] We did not include control variables in analyses using the SMSA as the unit because these units had small sample size (n = 10), were randomized, and were relatively homogeneous with respect to previously stated population characteristics. Analyses with the individual as the unit used logistic regression for dichotomous dependent variables and linear regression for continuous dependent variables. These latter analyses examined effects for treatment, SMSA nested in treatment, and control variables from the pretest. We included the control variables related to an intervening or dependent variable and to pretest differences between treatments, attrition bias, or missing data substitution. For an intervening or dependent variable at posttest, we controlled for the corresponding pretest measure of the variable.

Results

Independent Variables

Message reach and frequency were estimated by the advertising agency using standard estimating procedures with Arbitron and Nielsen data for radio and television, respectively.[17] The expected consequences messages reached 81 percent of the intended audience an average of 4.5 times during each of the three four-week periods that they were broadcast. The sweepstakes offer in RPEER reached 79 percent of the audience an average of four times. In RTVPEER, messages reached 90 to 94 percent of the intended audience by a combination of radio and television, and they were seen or heard an average of 14 times during the entire period of broadcast. Young people ages 12 to 15 years surveyed by telephone the month after the final campaign messages were broadcast reported higher levels of reach.[18]

Based on sweepstakes entry and US Census data, 21 to 24 percent of the adolescents 12 to 15 years old in RTVPEER entered the sweepstakes; 97.8 percent of them responded to the encouragement of others rather than to the broadcast messages.[8] Nine to 15 percent of the adolescents in RPEER entered the sweepstakes, and 94.8 percent of them responded to their friends rather than to the broadcast.[8]

Intervening Variables

Between pretest and posttest, all intervening variables changed significantly in the expected direction of becoming more favorable toward smoking (Table 1). The p values in Table 1 for the time by treatment interactions indicate whether the change in the intervening variables between 1985 and 1987 varies significantly by treatment. There were significant time by treatment interactions for smoking SEU (nonexperimenters and total sample), nonsmoking SEU (experimenters only), and total SEU (nonexperimenters and total sample).

In Table 2, we show the 1985 and 1987 values of smoking SEU for the total sample, by treatment condition, and measures of treatment effect for change between 1985 and 1987. Smoking SEU increased less in RADIO and RTVPEER than in CONTROL, increased by the same amount in RADIO and RTVPEER, and increased by the same amount in RPEER and CONTROL. These findings suggest that RADIO and RTVPEER had the intended effects of decreasing smoking SEU. These effects of generally 4.0 correspond to about one-third of the baseline standard deviation of smoking SEU, which is comparable to a shift between the median and the 60th percentile. Thus, the campaign effect size is modest rather than large. The findings were similar for the other SEU measures and samples for the statistically significant treatment by time interactions shown in Table 1.

The findings in Table 2 suggest that the peer-involvement component in RPEER might have had undesirable effects, but this seems unlikely given the lower participation in the peer-involvement component in response to RPEER than to RTVPEER. However, to address the possibility of undesirable effects attributable to the peer-involvement component, we disaggregated subjects within RPEER and RTVPEER according to their participation in the peer-involvement campaign. Participants had entered the sweepstakes or reported on their posttest questionnaires that they had been personally contacted to enter the sweepstakes; all other subjects are nonparticipants. We conducted analyses similar to those shown in Tables 1 and 2 using the intervening variables as dependent variables because the campaigns were designed to influence them directly. Within both RPEER and RTVPEER areas, participants did not differ from nonparticipants in their 1985 to 1987 change in SEU or friend approval of smoking, but participants were more likely than nonparticipants to report an increase in encouragement by friends not to smoke. These findings suggest that the peer-involvement component did not produce undesirable effects. The absence of other treatment conditions, such as one with both radio and television broadcast of expected consequence messages and no peer involvement component, precludes analyses that might clarify these findings.

Changes in the SMSAs between 1985 and 1987 other than the campaigns might have produced the higher increase in smoking SEU in RPEER than in RTVPEER and RADIO shown in Table 2. For example, if adolescent use of smokeless tobacco increased more in RPEER than in RADIO and RTVPEER and adolescent use of smokeless tobacco is related to smoking SEU, then the differential change in smokeless tobacco use might explain the smoking SEU patterns. Using the individual as the unit of analysis, we identified intervening

TABLE 1—Multiple Regression Analysis for Repeated Measures of Time, Treatment, and Time by Treatment Effects for Intervening Variables

Variables	Subsample	Means		p		
		1985	1987	Time	Treatment	Time by Treatment
Smoking SEU	Nonexperimenters	−20.41	−16.41	.001	.540	.014
	Experimenters	−15.62	−12.61	.037	.896	.391
	Total sample	−17.88	−14.72	.004	.748	.061
Nonsmoking SEU	Nonexperimenters	21.79	17.79	.001	.928	.386
	Experimenters	18.27	12.91	.001	.107	.029
	Total sample	19.96	15.65	.001	.760	.321
Total SEU	Nonexperimenters	−42.21	−34.46	.001	.772	.028
	Experimenters	−33.89	−25.47	.002	.373	.120
	Total sample	−37.84	−30.33	.001	.632	.092
Friend approval of smoking cigarettes	Nonexperimenters	.33	.65	.001	.700	.003
	Experimenters	.90	1.14	.010	.836	.257
	Total sample	.60	.89	.001	.860	.078
Friend encouragement of not smoking cigarettes	Nonexperimenters	1.06	1.28	.023	.196	.742
	Experimenters	1.21	1.48	.002	.341	.288
	Total sample	1.14	1.39	.004	.240	.778
Intention not to smoke cigarettes	Nonexperimenters	4.62	4.42	.001	.975	.304
	Experimenters	4.23	3.91	.005	.865	.449
	Total sample	4.40	4.16	.001	.896	.248

Notes: SEU = subjective expected utility
n = 10
Source: Panel sample

TABLE 2—Descriptive Statistics, Measures of Effect, and Treatment Comparisons for Smoking Subjective Expected Utility for Total Sample

Treatment	n	Statistics	1985 Mean	1987 Mean	1985 vs 1987 Change	Treatment and Control Change	
						Difference	(95% CI)
CONTROL	4	Estimate	−18.74	−14.16	4.58	Reference	
		SE	.70	.62	.93		
RADIO	2	Estimate	−16.64	−16.28	.36	−4.22	(−8.16, −.28)
		SE	.99	.87	1.31	1.61	
RPEER	2	Estimate	−19.22	−13.80	5.42	0.84	(−3.10, 4.78)
		SE	.99	.87	1.31	1.61	
RTVPEER	2	Estimate	−16.08	−15.20	.88	−3.70	(−7.64, .24)
		SE	.99	.87	1.31	1.61	
Comparison among Groups	p-value		.14	.24	.06	.06	

SE = Standard Error

variables other than SEU, and the control variables as measured at pretest, that were related to nonsmoking SEU, smoking SEU, or total SEU at posttest. They were dependent variables in analyses conducted to identify statistically significant time by treatment interactions that parallel the findings involving smoking SEU and total SEU. There were only two statistically significant and parallel interactions, but control for the involved variables did not account for the patterns in Table 2. The greater increase in SEU in RPEER than in RADIO and RTVPEER remains unexplained.

There were significant time by treatment interactions for friend approval of smoking for nonexperimenters and for the total sample (Table 1). The 1985 and 1987 values of friend approval for the total sample, by treatment condition, and measures of treatment effect for change between 1985 and 1987 are in Table 3. These findings suggest that RADIO caused less increase in friend approval of smoking relative to the control condition. The estimated effect of RADIO corresponds to a modest reduction of 7 percent in the number who reported that one or more of their friends approve of smoking. The findings were the same for nonexperimenters.

There were no significant time by treatment effects that involved smoking intention or friend encouragement of smoking.

Cigarette Smoking

Table 4 shows the findings with cigarette smoking as dependent variables. The means of all smoking variables changed significantly between 1985 and 1987 in the expected direction of more smoking. However, none of the p values for the time by treatment interactions were statistically significant. The data are consistent with the conclusion that the campaigns did not influence smoking.

There were substantial within-treatment differences in smoking between SMSAs that must be recognized because they precluded the ability to identify campaign effects for smoking if there were any to be

TABLE 3—Descriptive Statistics, Measures of Effect, and Treatment Comparisons for Friend Approval of Smoking Cigarettes for Total Sample

Treatment	n	Statistics	1985 Mean	1987 Mean	1985 vs 1987 Change	Treatment and Control Change	
						Difference	(95% CI)
CONTROL	4	Estimate	.56	.87	.31	Reference	
		SE	.05	.06	.05		
RADIO	2	Estimate	.72	.81	.09	−.22	(−.43, −.01)
		SE	.07	.09	.07	.09	
RPEER	2	Estimate	.58	.99	.41	.10	(−.11, .31)
		SE	.07	.09	.07	.09	
RTVPEER	2	Estimate	.60	.90	.30	−.01	(−.22, .20)
		SE	.07	.09	.07	.09	
Comparison among Groups	p-value		.39	.56	.08	.08	

SE = Standard Error

TABLE 4—Multiple Regression Analysis for Repeated Measures of Time, Treatment, and Time by Treatment Effects for Dependent Variables

Variables	Subsample	Means		p		
		1985	1987	Time	Treatment	Time by Treatment
Smoking experimentation	Nonexperimenters	—	.37	—	—	.906
	Total sample	.40	.57	.002	.410	.637
Regular smoking	Nonexperimenters	—	.05	—	—	.782
	Experimenters	—	.18	—	—	.907
	Total sample	.03	.14	.001	.916	.148
Recent smoking	Nonexperimenters	—	.03	—	—	.563
	Total sample	.03	.08	.001	.762	.157
Smoking intensity	Nonexperimenters	—	1.23	—	—	.910
	Total sample	1.16	1.50	.001	.876	.778

Note: n = 10
Source: Panel sample

detected. We began the study with the assumption that 4 percent of adolescent subjects in each study SMSA would be regular smokers and that SMSA changes in smoking within treatment condition would be similar. About 4 percent of our subjects were regular smokers in 1985. However, the range across SMSAs was .6 percent to 5.2 percent. The variation across SMSAs in the other smoking measures, and changes in smoking, also varied substantially across SMSAs. Most importantly, smoking varied substantially among SMSAs within treatment condition. Table 5 shows the treatment-control differences in smoking and the intervening variables that would have been required to achieve statistical significance at the .10 level for powers of .50 and .80 given the SMSA variation in smoking within treatment conditions in our data; the actual differences are also shown. The relatively large error variance for SMSAs within treatment groups clearly precluded detecting campaign effects for smoking. Therefore, whether the campaigns influenced smoking cannot be determined with acceptable certainty from our data.

Related Findings

We also used the 1987 cross-sectional data to examine campaign effects. For each SMSA, we assigned pretest values of the intervening and dependent variables in the panel data to the cross-sectional data. We then conducted multiple regression analysis for repeated measures with a sample size of 20 for the analysis: 10 panel and 10 cross-sectional SMSAs. The main statistic of interest was time by treatment interaction. The conclusions about campaign effects were generally the same as those when only the panel data were used.

Having subjects with and without baseline measures allowed us to identify effects due to the pretest. To assess this, as part of the analyses described in the preceding paragraph, we evaluated the time by treatment by data source (panel versus cross-sectional) interactions involving each intervening and dependent variable. The findings suggest that there were no testing effects.

We also conducted analyses to determine whether campaign effects for smoking varied across selected subgroups by testing for time by treatment by subgroup interactions with multiple regression analysis for repeated measures. The 10 variables used to create the subgroups, each divided at the median except when categorical, were: gender, age, smoking by best friend, smoking by mother, school curricula on smoking, total SEU, alcohol use, parent education, number of hours spent listening to the radio, and number of hours spent watching television. This analysis revealed no pattern that could be interpreted as campaign effects for smoking, and the conclusions for intervening variables remained the same.

TABLE 5—Required and Observed Differences between Treatment and Control

Variables	Required[a] Power		Observed		
	.50	.80	RADIO	RPEER	RTVPEER
Nonexperimenters					
Smoking experimentation	.19	.25	.01	.06	.00
Regular smoking	.06	.07	.02	.02	.00
Recent smoking	.03	.04	.01	.02	.02
Smoking intensity	.21	.28	.01	.03	.06
Total SEU[b]	4.38	5.79	8.96	.13	5.07
Smoking SEU[b]	2.63	3.48	6.34	.60	4.22
Nonsmoking SEU	2.99	3.96	2.63	.37	.86
Smoking intention	.19	.25	.04	.21	.01
Friend approval of smoking[b]	.08	.10	.27	.04	.00
Friend encouragement of not smoking	.38	.50	.12	.21	.01
Total Sample					
Total SEU[b]	5.25	6.94	5.86	2.38	5.29
Smoking SEU[b]	3.05	4.04	4.04	.98	3.60
Nonsmoking SEU	3.04	4.02	1.73	1.44	1.66
Smoking intention	.19	.25	.02	.20	.02
Friend approval of smoking[b]	.16	.22	.21	.09	.01
Friend encouragement of not smoking	.29	.38	.01	.15	.05

Note: SEU = subjective expected utility
a) Differences required to identify effects 50 and 80 percent of the time given study inter-SMSA variance.
b) Overall ANOVAs significant at alpha = .10 (n = 10).

Finally, we conducted analyses of the relationship between treatment and the intervening and dependent variables when using individuals rather than SMSAs as the unit of analysis. This procedure could artificially increase statistical detection of differences by ignoring intra-SMSA correlation among subjects.[19] In these analyses, we controlled for the pretest value of each control variable that was related to the posttest value of the intervening or dependent variable, the pretest value of the intervening or dependent variable being examined, and variables indicating attrition bias and effects from missing-data substitution. The findings were generally the same as when the SMSA was the unit of analysis. SEU effects were limited to RADIO and RTVPEER and no effects for cigarette smoking were detected.

Discussion

SEU and friend approval of smoking appear to have been influenced by the media campaigns. RADIO was as effective for these variables as any of the other more expensive campaigns. The peer-involvement component was not effective. We detected no effect for reducing the onset of smoking, and any potential effect for smoking remains to be demonstrated.

The substantial variation in smoking within treatment conditions is a major methodological limitation of this research because it precluded determining whether the campaigns influenced cigarette smoking. A consideration supporting the possibility of some campaign influence on smoking is that the campaigns appear to have influenced SEU and friend approval of smoking, variables that are related to the onset of smoking.[7,8] In addition, the campaigns featured characteristics that media scholars consider necessary for campaign effects, such as extensive formative research, content based on behavioral science theory, high quality message production, actors with characteristics admired by the audience, and repeated exposure to the campaigns by most of the intended population.[20–22] Earlier studies have found that mass media campaigns can influence behavior.[6]

Some contend that substantial impact by mass media campaigns requires their implementation with other types of interventions, such as community organization efforts or school-based curricula.[2,23] Our study was designed to determine whether the media by themselves are influential. This is the most common and practical application of mass media in public health and, unlike multiple-component approaches, is capable of ready distribution on a national level. However, this also precludes our knowing whether adding other types of prevention programs to the campaigns we designed and implemented would have produced larger effects.

To increase homogeneity of SMSAs within and across treatment conditions, we limited our study to SMSAs in the Southeast US, included only SMSAs similar on social and demographic characteristics, stratified the Southeast by area, and randomly allocated SMSAs to treatment conditions within area. Still, substantial variation in adolescent smoking precluded our determining whether there were campaign effects for smoking. We might have avoided the problem by studying a much larger sample of SMSAs and perhaps matching them for baseline smoking behavior before random allocation to treatment conditions.

Information on other interventions that might have been implemented to influence adolescent smoking in our study areas would have been useful for attempting to explain and control the SMSA variation in smoking. We assume that school-based programs would have been the only potentially significant organized activities implemented to reduce adolescent smoking during the time of our study; we controlled for school curricula and many other variables at baseline when using the individual as the unit of analysis. The substantial variation in adolescent smoking by SMSA, and our findings on effect size for intervening variables, suggest that more powerful interventions than the mass media campaigns we implemented might be necessary to demonstrate community-level behavioral effects for programs designed to prevent adolescent smoking.

We designed the peer-involvement component to influence perception of

friend approval of smoking. However, the findings suggest that only RADIO, which did not have a peer involvement component, influenced friend approval. Perhaps RADIO influenced peer approval because two of the expected consequences messages focused on peers. Or, perhaps the radio messages were projected to their friends because they are like the young people who recorded them. The reason this effect did not also occur in response to RPEER and RTVPEER was not determined.

Given the centrality of personal influence to many behavioral science and mass communication theories, it is significant that the two campaigns with the peer-involvement component, RPEER and RTVPEER, were not more effective than RADIO. Perhaps the personal contact produced by the peer-involvement component was too superficial for impact, perhaps this approach is less powerful than commonly believed, or perhaps effects would have appeared for younger or older people. We do not have the data required to assess these possibilities.

Implementing the campaigns in 1985 for a broadcast reach of 75 percent of the United States population 12 to 17 years old under the conditions of our field experiment, excluding development and research expenses, would have cost $1,843,000 for RADIO, $12,866,000 for RPEER, and $28,944,000 for RTVPEER. Although radio is the less expensive medium, television is the broadcast medium that receives the most attention by those who design, implement, and evaluate mass media campaigns. Perhaps the glamour associated with television explains why there have been few recent studies of health-oriented radio campaigns. Radio use increases relative to television use during adolescence,[24] and our findings suggest that radio should be given more attention in campaigns to influence adolescent smoking and by research on campaign effectiveness.

Although findings that demonstrate program impact for intervening variables such as SEU and friend approval but not for behavior can sometimes be dismissed readily, one can also argue that they merit attention. SEU for smoking and friend approval for smoking have been considered by many to be precursors of smoking.[7,8] Our findings suggest that RADIO did influence SEU and friend approval. These findings, together with the capability of radio campaigns to be implemented readily on a national scale or to other large populations at lower cost than virtually any other type of intervention, support its potential role for health promotion among adolescents. Whether adolescent smoking would be influenced by our radio campaign or by others, however, has yet to be shown. The failure of the more expensive components, television broadcast and peer involvement, to influence the intervening variables suggests that these components might be unworthy of further consideration, at least as they were implemented in our research.

Our findings cannot be generalized to all applications of the mass media to smoking prevention. We might have found other effects if we had done things differently, such as focused on younger or older adolescents, implemented the campaigns in smaller or larger communities, or also implemented smoking prevention curricula in schools. The effects also might have been different if we had used other theories for guidance and if the style and format of our messages had been different. Flay, *et al*,[25] and Worden *et al*,[26] describe other approaches to using the mass media to prevent adolescent smoking. Finally, our findings cannot be generalized to the many public service campaigns that rely solely on donated broadcast time and fail to reach most of their intended audiences. □

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APPENDIX—Intervening, Dependent and Control Variables

Intervening

Smoking subjective expected utility
Nonsmoking subjective expected utility
Total subjective expected utility
Friend approval of smoking
Friend encouragement of not smoking
Smoking intention

Dependent

Smoking experimentation
Smoking intensity
Regular smoking
Recent smoking

Control: Background

Gender
Race
Age
Parent education
Years residence in area
Father presence

Control: Parent and Friend Smoking

Mother approval of adolescent smoking
Smoking by mother
Smoking by three best friends
Smoking by best friend

Control: General Social and Psychological

Popularity
Rejection
Egotism
Social passivity
Reputation
Femininity
Self-deprecation
Depression
Boredom
Sensation-seeking
Deviance
Rebelliousness
Religious involvement
Risk-seeking
Locus of control
Impulsivity
Closeness to mother
Peer versus parent influence

Control: Media Use

Number of hours listen to radio
Number of hours watch television

Control: Exposure to Antismoking Interventions

Advertisements
School curricula

Control: Other

Smokeless tobacco use
Alcohol use*

*Variable used only in analyses to determine if campaign effects varied across subgroups.