

SPECIAL ARTICLE

CIGARETTE ADVERTISING AND MAGAZINE COVERAGE OF THE HAZARDS OF SMOKING

A Statistical Analysis

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Abstract Background. Health professionals have charged that magazines that depend on revenues from cigarette advertising are less likely to publish articles on the dangers of smoking for fear of offending cigarette manufacturers. Special concern has focused on magazines directed to women. Restricted coverage of smoking hazards could lead readers to underestimate the risks of smoking in relation to other health risks.

Methods. Using logistic-regression analysis of a sample of 99 U.S. magazines published during 25 years (1959 through 1969 and 1973 through 1986), we analyzed the probability that the magazines would publish articles on the risks of smoking in relation to whether they carried advertisements for cigarettes and in relation to the proportion of their advertising revenues derived from cigarette advertisements. We controlled for other factors that might influence coverage.

Results. The probability of publishing an article on the risks of smoking in a given year was 11.9 percent for magazines that did not carry cigarette advertisements, as compared with 8.3 percent for those that did publish such advertisements (adjusted odds ratio, 0.73; 95 percent

confidence interval, 0.42 to 1.30). For women's magazines alone, the probabilities were 11.7 percent and 5.0 percent, respectively (adjusted odds ratio, 0.13; 95 percent confidence interval, 0.02 to 0.69). When the proportion of revenues derived from cigarette advertising was the independent variable, the probability of publishing an article on the risks of smoking in a given year was reduced by 38 percent (95 percent confidence interval, 18 percent to 55 percent) for magazines with the average proportion of total advertising revenues derived from cigarette advertising for the entire sample of magazines (6 percent) as compared with magazines with no cigarette advertising. This relation was particularly strong in the case of women's magazines. An increase of 1 percent in the share of advertising revenue derived from cigarette advertisements decreased the probability of covering the risks of smoking by three times as much as in other magazines.

Conclusions. This study provides strong statistical evidence that cigarette advertising in magazines is associated with diminished coverage of the hazards of smoking. This is particularly true for magazines directed to women. (N Engl J Med 1992;326:305-9.)

IN 1988, U.S. cigarette manufacturers spent \$3.27 billion on cigarette advertising and promotion, the equivalent of \$100 per second. Eleven percent of that amount, or \$355 million, was devoted to magazine advertising, making cigarettes the second most heavily advertised product in this medium.¹ Health professionals and critics of journalism have charged that magazines that depend on revenue from cigarette advertisements are less likely than others to publish articles dealing with the hazards of smoking for fear of offending cigarette manufacturers²; the greatest concern in this regard relates to magazines directed to women.³⁻⁶ Restricted coverage of the hazards of smoking could lead readers to underestimate the risks of smoking as compared with other risks to health,^{7,8} with adverse results for smoking behavior and health.²

The literature is replete with anecdotes about magazines' alleged advertising-induced self-censorship on the subject of smoking and its effects on health.² Only a small part of the evidence has included empirical analysis directly addressing the relation between advertising and editorial practices.^{3-5,9,10} These analyses have had serious limitations. Generally, they have re-

lied on small samples of magazines; none have included an explicit examination of the statistical strength of the relation between advertising and content; and none have isolated the relation between advertising and coverage of the risks of smoking by controlling for other relevant characteristics of the magazines studied. In this article, we report the findings of a rigorous statistical analysis of the relation between cigarette advertising and the publication of articles on the risks of smoking.

METHODS

The Model

We considered two hypotheses related to the relation between magazines' dependence on revenues from cigarette advertising and the frequency with which they publish articles on the health effects of smoking. In the first part of our analysis, we examined whether a magazine's acceptance of any cigarette advertising during a given year was negatively associated with the probability of the magazine's publishing any articles on the issue of smoking and health in that year. In the second, we examined whether a magazine's relative dependence on revenues from cigarette advertising (i.e., the proportion of its advertising revenues derived from cigarette advertising) was inversely related to its coverage of smoking.

To test our hypotheses, we modeled the probability of a magazine's covering the health effects of smoking in a given year as a function of the magazine's dependence on cigarette advertising. For both hypotheses, the dependent variable was set equal to 1 if a given magazine published an article on the risks of smoking during a given year and 0 if it did not. For the first hypothesis, a magazine's dependence on revenues from cigarette advertising was also modeled as a dichotomous variable, reflecting the presence or absence of any cigarette advertising in the magazine in a given year. For the

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second hypothesis, a magazine's dependence on revenues from cigarette advertising was expressed as the percentage of its total advertising revenue that was derived from cigarette advertising in a given year.

A simple regression of magazines' dependence on cigarette advertising and their coverage of smoking may falsely attribute lower coverage to advertising revenues, when coverage may instead be determined by other characteristics of the magazines. Therefore, we also tested a model in which other characteristics were included as independent variables. Some of these variables were specific to the individual magazines (such as the size of their readership and their propensity to cover health-related subjects in general); others related to groups of magazines (for example, the type of magazine — specifically, newsmagazines and women's magazines, the latter defined as magazines with at least 75 percent female readership); still others were time-period variables representing major national smoking-related "events" that affected all magazines in a similar manner (for instance, 1964 was the year of the surgeon general's first report on smoking and health)¹¹; decade variables were used to distinguish the periods before and after the 1971 ban on cigarette advertising on radio and television,¹² which produced an enormous flow of advertising revenues into the print media.⁹

Data Collection

We collected data on 99 U.S. magazines for the years 1959 through 1986 (excluding 1970 through 1972, when the magazine indexing service, described below, was inoperative). Inclusion of a magazine in the sample was dictated by the availability of essential data for any given year in each of the areas noted below, as well as the requirement that a magazine had to be included in our data sources during at least 5 of the 25 years for which we had data. The unit of observation for the study was a single magazine in a single year (a "magazine-year"). Most of the magazines were not published throughout the entire period, and some were not included in the data sources during particular years. As a consequence, the total number of magazine-years for which adequate data were available was 1303.

The principal elements of the data set and their sources were as follows: (1) annual data on cigarette-advertising revenues and total advertising revenues, provided by Leading National Advertisers-Publishers Information Bureau for up to 150 magazines; (2) data on magazines' coverage of 10 different health risk factors, including smoking, derived from the Magazine Index, a computerized index of the subjects covered by articles in 435 U.S. magazines; (3) demographic data on the readerships of magazines, provided by Simmons Market Research Bureau; and (4) data on yearly paid and unpaid subscriptions, from the Audit Bureau of Circulation. To determine whether a magazine covered the hazards of smoking in a given year, we searched the Magazine Index's menu of descriptive words and phrases for those pertaining to cigarette smoking. Using article titles and key words, we classified an article as on the topic of smoking and health if it specifically discussed the health effects of smoking or the political and social issues related to the dangers of smoking.

Statistical Analysis

We used logistic-regression analysis to assess the hypothesized relations. Pooling cross-sectional and longitudinal data allowed us to examine trends over time as well as differences among magazines at a given time. It is possible, however, that the probability of individual magazines' covering smoking is determined in part by unknown characteristics of the magazines that do not change over time; thus, the observations for the same magazines in different years may not be independent. Therefore, we also specified and tested a fixed-effects regression model that captures magazine-specific effects. This model, known as the covariance model, is equivalent to including a dummy variable for each magazine.¹³ In this article, we report primarily the quantitative results from the logistic regressions because, in addition to the principal hypotheses, we were also interested in selected effects that do not vary with time

(i.e., differences among magazines), such as the type of magazine and the time period. These cannot be considered in the fixed-effects model. We therefore used the fixed-effects model, the most restrictive statistical formulation, to confirm the findings from the logistic model.

RESULTS

Table 1 shows the numbers of observations and the estimated probability of covering the subject of smoking for magazines that carried cigarette advertisements and those that did not, both for all magazines and for women's magazines only. Also shown are odds ratios and 95 percent confidence intervals with and without adjustment for covariates (additional independent variables that might contribute to an observed relation between advertising and coverage). Each odds ratio compares the odds of covering the dangers of smoking for magazines with and without cigarette advertising. The results shown in Table 1 were derived from the regression analysis corresponding to the first hypothesis.

Table 2 presents the principal results from the regression analysis corresponding to the second hypothesis, which addressed the relation between magazines' relative dependence on cigarette-advertising revenues and their coverage of the hazards of smoking. This table includes the odds ratios and 95 percent confidence intervals, with and without adjustment for covariates, for all magazines and for women's magazines. In Table 2, the odds ratio represents the average effect of dependence on cigarette advertisements on the probability of coverage. For all magazines, the average proportion of advertising revenues derived from cigarette advertising was 6 percent; for women's magazines, it was 5 percent. Thus, the odds ratio compares the likelihood of publishing articles on the risks of smoking in magazines with the average proportion of revenues from cigarette advertising and in those with no revenues from cigarette advertising.

We hypothesized that magazines that carried cigarette advertising would be less likely to publish articles on the hazards of smoking than magazines that did not carry such advertising (hypothesis 1). As is evident in Table 1, the odds ratio for all magazines from the regression without covariates (0.88) is consistent with this hypothesis and almost significant at the 95 percent confidence level (0.60 to 1.03). Once covariates were introduced, however, even though the odds ratio became smaller still, the near-significance of the relation disappeared (probably because of correlation among the large number of covariates, which led to imprecision in the estimate). For women's magazines, by contrast, the relation between the presence of cigarette advertising and the probability of covering the hazards of smoking was statistically significant. This finding held whether or not covariates were included. Indeed, the inverse relation appeared to be strengthened by inclusion of the covariates.

The odds ratios in Table 2 provide strong support

Table 1. Odds Ratios for the Coverage of the Risks of Smoking by Magazines with Any Cigarette Advertisements, as Compared with Magazines with No Cigarette Advertisements.*

MAGAZINES	NO. OF MAGAZINE-YEARS	PROBABILITY OF COVERAGE (%)	ODDS RATIO (95% CI)	
			WITHOUT ADJUSTMENT	WITH ADJUSTMENT†
All magazines				
No cigarette advertising	403	11.9		
Any cigarette advertising	900	8.3	0.88 (0.60–1.03)	0.73 (0.42–1.30)
Women's magazines				
No cigarette advertising	104	11.7		
Any cigarette advertising	212	5.0	0.22 (0.05–0.90)	0.13 (0.02–0.69)

*A magazine-year is defined as a single magazine in a single year. CI denotes confidence interval.

†We adjusted for the following covariates: the number of subscriptions for each magazine in each year; the number of articles on nine health risk factors published in each magazine in each year and the square of this value; whether or not a magazine was a newsmagazine (for all magazines only); whether or not a magazine was a women's magazine (for all magazines only); an interaction term between women's magazine and the measure of cigarette advertising (for all magazines only); and the time-period variables for 1964, the 1970s, and the 1980s.

for the hypothesis that a magazine's proportion of cigarette advertising and its probability of covering the risks of smoking are inversely related. The relation is stronger for women's magazines than for magazines in general, and it is strengthened by the inclusion of the covariates.

For both hypotheses, the statistically significant relation between the covariates and the probability of coverage was as follows (data not shown). The odds of publishing articles on the hazards of smoking increased (1) as coverage of other health risks increased; (2) as the size of a magazine's readership increased; (3) for newsmagazines, as compared with all other magazines; (4) in 1964, the year of the surgeon general's first report on smoking and health¹¹; and (5) in the 1960s, as compared with the 1970s and 1980s.

Another way to evaluate the relation between the coverage of this subject and advertising revenue is to compare the average probabilities of coverage derived from our logistic regressions. Magazines that did not carry advertisements for cigarettes were more than 40 percent more likely to cover the hazards of smoking than were magazines that carried cigarette advertisements (Table 1). As compared with the 1960s, the difference was particularly striking in the 1970s and

1980s, when magazines that did not carry cigarette advertisements were almost twice as likely to cover the dangers of smoking as those that did (data not shown). In the 1970s and 1980s there was a dramatic shift in cigarette advertising revenues from the broadcast to the print media, caused by the banning of broadcast advertising of cigarettes as of January 1971.⁹

The most substantial effect of cigarette advertising on the probability of publishing articles on the risks of smoking was evident in women's magazines. As is clear in Table 1, women's magazines that

did not carry cigarette advertisements were 2.3 times more likely to cover the risks of smoking than were women's magazines that did accept cigarette advertising. In addition, coverage by women's magazines, as compared with other magazines, was more sensitive to changes in the degree of dependence on revenues from cigarette advertising. Using the logistic-regression coefficients, we calculated that an increase of 1 percent in cigarette advertising's share of total advertising revenue in women's magazines decreased the probability of their coverage of the risks of smoking by 1.9 percent — three times the decrease in other magazines.

Given the possible nonindependence of our observations, the confidence intervals reported in Tables 1 and 2 may not be accurate. However, the results of the fixed-effects model, which provides an upper bound on significance tests, confirmed our key findings. For example, as in the logistic-regression analysis, in the fixed-effects model an increase in a magazine's proportion of revenues from cigarette advertising significantly decreased the probability that the magazine would cover the risks of smoking. The probability of such coverage for a magazine with the same proportion of total revenues from cigarette advertising as the average for the entire sample was estimated to be 4.7 percentage points below that of a magazine with no cigarette advertising.

Technical details on this and other analyses are available elsewhere.*

DISCUSSION

Our findings provide strong statistical support for the belief that magazines in the United States have restricted their coverage of the dangers of smoking out

Table 2. Odds Ratios for the Coverage of the Risks of Smoking by Magazines with the Average Proportion of Revenues from Cigarette Advertisements, as Compared with Magazines with No Revenues from Cigarette Advertisements.*

MAGAZINES	ODDS RATIO (95% CI)	
	WITHOUT ADJUSTMENT	WITH ADJUSTMENT
All magazines	0.79 (0.65–0.97)	0.62 (0.45–0.82)
Women's magazines	0.41 (0.17–1.01)	0.50 (0.32–0.78)

*To illustrate the interpretation of the odds ratios, the odds ratio of 0.62 for all magazines, with adjustment for covariates, means that the probability of covering smoking was reduced by 38 percent (from 1.00 to 0.62) for magazines with an average proportion of revenues from cigarette advertisements as compared with magazines with no cigarette advertising. CI denotes confidence interval. The covariates for which we adjusted are the same as those listed in Table 1.

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of fear of economic reprisals by cigarette manufacturers. The degree of restriction appears to be a function of the magazine's degree of dependence on revenues from cigarette advertising. Our results are also consistent with the widespread perception that the restriction of coverage associated with the acceptance of cigarette advertising is particularly important in the case of women's magazines.³⁻⁶

A weakness of the conventional wisdom concerning such censorship is that it has been derived solely from anecdotes and simple correlations of cigarette advertisements and coverage of the risks of smoking. We found, however, that not only did the relation persist when we controlled for the other variables, but it was even strengthened.

Statistical findings do not in themselves constitute proof of a causal relation. It is conceivable, for example, that editors or publishers of magazines that have a relatively low likelihood of covering the risks of smoking simply do not believe that smoking entails a serious health hazard. They might be more willing than others to accept cigarette advertising and simultaneously less inclined to discuss the dangers of smoking in print. Conversely, editors or publishers who are convinced of the hazards of smoking could be both more reluctant to accept cigarette advertising and more inclined to publish articles on the subject of smoking and health.

We interpret the results of this study as inconsistent with this alternative explanation, particularly since the relation between advertising and coverage reflects the proportion of revenues from cigarette advertising, rather than its presence or absence, and because we controlled for the coverage of other health-related issues. Editors or publishers who were uninterested in or ignorant about the dangers of smoking would probably be similarly ill-informed about other major health risks.

If editors and publishers fear economic reprisals if they cover the hazards of smoking, are their fears warranted? Although a few anecdotes suggest that they are,^{2,5} whether magazines have been systematically "punished" by the withdrawal of advertisements remains unknown. We examined this question by developing an additional model to test the hypothesis that revenues from cigarette advertising fall in the year after the publication of an article on the hazards of smoking. The results of an ordinary least-squares regression supported this hypothesis, but the relation was not significant in a fixed-effects model, the most restrictive statistical formulation. Thus, we cannot rule out the possibility that we may be observing magazine-specific effects repeated annually, as well as, or instead of, the loss of cigarette advertisements by magazines in the year after they cover the hazards of smoking.

If the principal relation documented in this study is causal — that is, if dependence on revenues from cigarette

advertising has caused magazines to restrict their coverage of smoking and health — one might assume that a reversal of that dependence, through a ban on tobacco advertising, for example, would end or at least greatly mitigate the restriction of coverage of smoking and health. This assumption is problematic, however. The cigarette manufacturers have become huge conglomerates, especially since the mid-1980s. Recent anecdotal literature on the "censorship phenomenon" describes instances in which the media have allegedly restricted their discussion of smoking out of fear of losing revenues from advertisements for the nontobacco products of the cigarette-producing conglomerates.¹⁴ Such fears may have been heightened by RJR/Nabisco's cancellation in 1988 of an \$80-million annual contract with Saatchi and Saatchi for advertising food products, after that agency prepared advertisements touting the no-smoking policy of another client, Northwest Airlines.¹⁵

Since the period covered by this study, media coverage of tobacco-related issues appears to have increased, as has these issues' social salience. At the same time coverage has expanded, there has been a decrease in cigarette advertising in magazines aimed at a white-collar readership; the relative share of cigarette advertising has increased substantially in magazines targeted to blue-collar readers and in those with predominantly minority readerships.^{16,17} Whether there is a connection, other than the temporal one, between expanded coverage and the redistribution of advertising dollars is unknown. It is certainly plausible, however, that the shift in advertising has been motivated primarily by the cigarette manufacturers' decision to target minorities and blue-collar workers as their best chance of maintaining, if not expanding, their domestic market.¹⁸

In the absence of meaningful alternative hypotheses, our study provides strong statistical evidence for the conventional wisdom that cigarette advertising in U.S. magazines has been associated with restricted coverage of the hazards of smoking. The implications for the integrity of journalism are obvious.¹⁹⁻²¹ Less obvious have been the implications for public health. Americans substantially underestimate the dangers of smoking as compared with other risks to health.^{7,8} If the media bombard the public with frightening stories about health risks, ranging from toxic dumps to the use of Alar on apples, and fail to accord smoking its proper position in the constellation of risks, the public will confuse the important with the trivial. People who might not smoke if full and balanced coverage of the risks of smoking were available will continue to smoke. Avoidable suffering and premature death are the inevitable consequences.

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