

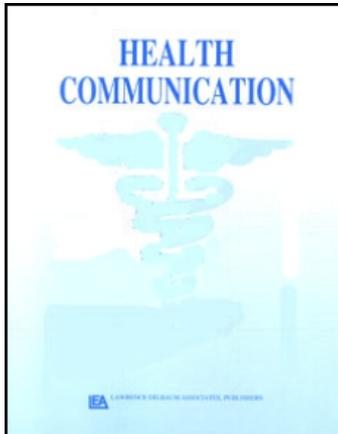
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Effects of Newspaper Coverage on Public Knowledge About Modifiable Cancer Risks

Jo Ellen Stryker ^a; Cortney M. Moriarty ^b; Jakob D. Jensen ^c

^a Department of Behavioral Sciences & Health Education, Rollins School of Public Health, Emory University, ^b Department of Communication, University of Illinois at Urbana-Champaign, ^c Department of Communication, Purdue University,

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Effects of Newspaper Coverage on Public Knowledge About Modifiable Cancer Risks

Jo Ellen Stryker

*Department of Behavioral Sciences & Health Education
Rollins School of Public Health, Emory University*

Cortney M. Moriarty

*Department of Communication
University of Illinois at Urbana-Champaign*

Jakob D. Jensen

*Department of Communication
Purdue University*

This study explores the relationship between cancer newspaper coverage and public knowledge about cancer prevention, confirming self-reported associations between news exposure and cancer prevention knowledge with descriptions of newspaper coverage of modifiable cancer risks. Content analyses ($N = 954$) revealed that newspapers pay relatively little attention to cancer prevention. However, there is greater newspaper attention to tobacco and diet than to exercise, sun, and alcohol. Survey analysis (the National Cancer Institute's Health Information National Trends Survey) revealed that after controlling for differences based on gender, race, age, income, and education, attention to health news was significantly associated with knowledge about cancer risks associated with food and smoking but not for knowledge about exercise, sun, or alcohol. These findings conform to the findings of the content analysis data and provide a validation of a self-reported measure of media exposure, as well as evidence suggesting a threshold below which news coverage may not generate public knowledge about cancer prevention.

Cancer is now the leading cause of death for Americans under the age of 85. In 2005, it was estimated that 1.7 million Americans would be diagnosed with cancer and of those, over 1,500 would die per day (Jemal, 2005). In addition, it is estimated that at least 50% of all cancer would be preventable if individuals adopted more healthy lifestyles (Colditz & Hunter, 2000).

As a primary source of health information in general and cancer information in particular (James, James, Davies, Harvey, & Tweddle, 1999; Johnson, 1997; Johnson, Meischke, Grau, & Johnson, 1992; Meissner, Potosky, &

Convissor, 1992), the news media may play an important role in educating the public about cancer prevention. The news media have the potential to influence cancer prevention knowledge, which is believed to be a precursor to attitude and behavior change (e.g., Finnegan & Viswanath, 2002).

Cancer news coverage may influence public knowledge of prevention by indirectly or directly priming certain risk factors (Roskos-Ewoldsen, 2002). Priming research tells us that media topics covered frequently and recently will be more likely to be salient in the minds of news consumers. Although the news media can contribute to public knowledge about cancer, this relationship is contingent on the news containing a substantial amount of cancer information. We should assume, therefore, that cancer knowledge about topics receiving prominent coverage should be more easily retrieved from memory

Correspondence should be addressed to Jo Ellen Stryker, Department of Behavioral Sciences & Health Education, Emory University, 1518 Clifton Road, NE, Room 572, Atlanta, GA 30322. E-mail: jestryk@sph.emory.edu

than those covered less frequently. The following study examines the relationships between cancer news coverage, attention to health news, and knowledge of cancer risks by comparing data from a comprehensive content analysis of cancer news coverage with self-reports of attention to health news in newspapers and knowledge of cancer prevention.

MEDIA'S IMPACT ON HEALTH KNOWLEDGE AND BEHAVIOR

Health news messages have become ubiquitous in mainstream media (Meissner et al., 1992). Physicians are viewed as a more credible and persuasive source, but interactions are infrequent or of limited duration (Meissner et al., 1992). As a result, the media have become the primary public health educator in present-day society (Johnson, 1997).

Research to date suggests that frequent media users are more informed about health issues than their counterparts that do not have the same levels of media exposure (Chew, Palmer, & Kim, 1995). For example, media exposure has been directly related to knowledge about prescription drugs (Peyrot, Alperstein, Van Doren, & Poli, 1998) and knowledge about nutrition (Charlton, Brewitt, & Bourne, 2004). In a study of adolescent knowledge of human papillomavirus, researchers found that media was one of only two sources of human papillomavirus information named by teens (Dell, Chen, Ahmad, & Stewart, 2000).

Beyond the informative dimension, media may also influence health behaviors (Brown & Potosky, 1990; Cates, Grimes, Ory, & Tyler, 1977; Fink et al., 1978; Jones, Beniger, & Westoff, 1980; Soumerai, Ross-Degnan, & Kahn, 1992; Southwell, Hornik, Fan, Yanovitzky, & Lazili, 2000; Viswanath & Finnegan, 2002; Yanovitzky & Bennett, 1999; Yanovitzky & Blitz, 2000; Yanovitzky & Stryker, 2001). With respect to cancer-prevention behaviors (CPBs), the bulk of this evidence pertains to secondary prevention or cancer screening. A compelling event, such as a celebrity diagnosis of cancer, can generate substantial news coverage capable of producing temporary changes in cancer screening practices (Brown & Potosky, 1990; Lane, Polednak, & Burg, 1989; Nattinger, Hoffmann, Howell-Pelz, & Goodwin, 1998). For example, screening rates increased immediately following Betty Ford's and "Happy" Rockefeller's surgeries for breast cancer in 1974 (Fink et al., 1978), and women reported stronger intentions to get a mammogram after Nancy Reagan's announcement that she had breast cancer in 1987 (Stoddard, Zapka, & Schoenfeld, 1990). More recently, Katie Couric's public crusade to educate the public about colon cancer after her husband's death, including her on-air colonoscopy on *The Today Show* in 2000, resulted in increased colonoscopy rates after the program aired (Cram et al., 2003).

There is also evidence that general media attention to an issue over time can affect long-term secular trends in CPBs.

For example, news coverage has been associated with changes in smoking cessation and initiation (Pierce & Gilpin, 2001) and mammography utilization (Southwell et al., 2000; Yanovitzky & Blitz, 2000). An important assumption underlying these studies is that the quantity of information in the news media affects the proportion of people who will adopt a healthy behavior; that is, the frequency of information affects its accessibility, which, in turn, affects behavior (Iyengar & Kinder, 1987, p. 64).

THEORETICAL MECHANISM OF EFFECTS: PRIMING

Over the years, health communication researchers have devoted considerable time and energy to identifying techniques for changing attitudes, beliefs, and/or behaviors (e.g., Fishbein & Azjen, 1975). Fishbein and Yzer (2003) recently argued that, in addition to traditional "change" models, communication researchers should consider priming models focused on the association between variables. Whereas change models suggest studying factors that yield change (e.g., does changing an individual's attitude toward cigarettes change that person's intention to smoke?), priming models suggest studying factors that affect the association between variables (e.g., does news coverage of lung cancer increase news readers' perceptions that there is an association between smoking and lung cancer?). That is, priming models encourage health communication researchers to investigate the oft-ignored question of why variables are associated (and not just how).

Communication scholars generally agree that media coverage acts as a prime (Roskos-Ewoldsen, 2002) and that the extent of a prime's effect is a dual function of the intensity (i.e., frequency or duration) and the recency (i.e., duration between prime and access) of the prime (Higgins, Bargh, & Lombardi, 1985). Considerable experimental research has demonstrated media priming in a number of different contexts, including political campaign coverage (Iyengar & Kinder, 1987), entertainment media (Brown Givens & Monahan, 2005), and health news coverage (Cappella, Lerman, Romantan, & Baruh, 2005).

Evidence is accumulating that media coverage may prime individuals to change their CPBs; however, little is known about the conditions under which people learn about cancer prevention from the news media. Assuming the legitimacy of traditional knowledge-attitude-behavior frameworks, knowledge is an important precursor to behavior change. This study is designed to test whether news coverage of cancer risks primes knowledge of certain health behaviors as cancer risks. Experimental research on media priming typically focuses on explicating priming itself, whereas this study utilizes media priming theory as a potential explanatory mechanism and as a guide for identifying meaningful targets for health communication efforts.

POSSIBLE BARRIERS TO LEARNING FROM THE MEDIA

Certain divisions within society jeopardize broad social views on, and comprehension of, cancer and cancer news coverage. Low scientific literacy in the United States (Miller, 1998) serves as one of the primary inherent barriers to learning from cancer news coverage. Where issues are complex, unclear, or under debate, evidence shows that the average citizen has difficulty with understanding or forming an educated opinion (Doble, 1995; Yeaton, Smith, & Rogers, 1990). Low levels of scientific literacy generally impair the public's ability to accurately understand and apply scientific concepts or issues to their own lives (Lunin, 1987; Miller, 1998). Public knowledge and attitudes about cancer may be further stratified by educational background (Meissner et al., 1992), socioeconomic status (MacDonald & Hoffman-Goetz, 2001; Wade & Schramm, 1969), or race/ethnicity (Wade & Schramm, 1969).

In sum, there is evidence to suggest that self-reported exposure to news, particularly in a print format, is associated with higher levels of public knowledge about cancer, with demographic variables such as income, education, and race/ethnicity moderating potential effects. Because what people learn is partly a function of available information, it is important to ascertain the extent to which the news media discuss cancer prevention.

MEDIA COVERAGE OF CANCER

Existing content analyses provide little guidance as to how the news media cover modifiable cancer risks. We have only a fragmented picture of recent cancer news coverage because studies have focused more narrowly on one cancer type or have chosen specific frameworks for analysis that do not include behavioral risk factors. For example, one study analyzed the news media's use of sporting and military language to describe persons with cancer (Seale, 2001). A separate study examined news coverage of environmental risks of cancer (Lichter & Rothman, 1999). Recent work has focused on news coverage of specific types of cancer, such as breast cancer (Andsager, Hust, & Powers, 2000; Andsager & Powers, 2001; Clarke, 1999; Corbett & Mori, 1999; Marino & Gerlach, 1999; Moyer, Greener, Beauvais, & Salovey, 1995; Stoddard et al., 1990; Wells, Marshall, Crawley, & Dickersin, 2001; Yanovitzky & Blitz, 2000) and skin cancer (Stryker, Solky, & Emmons, 2005), but the last comprehensive cancer news study was conducted 25 years ago.

The National Cancer Institute (NCI) sponsored two comprehensive content analyses of cancer news coverage. In 1977, NCI's Office of Cancer Communications conducted a baseline assessment of newspaper cancer coverage, and subsequently replicated the study in 1980 (Freimuth, Greenberg, DeWitt, & Romano, n.d.; Freimuth, Greenberg, DeWitt, & Romano, 1984). In 1977 and 1980, cancer news stories were

mostly about cancer causes, famous people with cancer, and cancer treatment. The majority of cancer news coverage in both time periods was general and nonspecific. Cancer prevention was rarely the primary topic of a story; in 1977 and 1980 prevention was the topic of 1% and 3% of stories, respectively. Risk factors were discussed more frequently in 1980; almost half of all cancer news stories discussed specific cancer risk factors, compared to only 20% in 1977. However, modifiable cancer risks were discussed infrequently in both studies. In 1977, lifestyle risk factors (i.e., modifiable risks), combined with environmental risk factors, were discussed in 17% of all cancer stories. In 1980, modifiable and environmental risks were reported separately; 19% of cancer stories discussed modifiable risk factors.

RATIONALE

Because the only known content analyses examining preventable cancer risks were conducted more than 2 decades ago, we cannot assume that current coverage bears any relation to earlier findings. With updated information about the frequency with which the news media discuss modifiable cancer risks, we can understand how the content of cancer news coverage may be related to what news consumers know about cancer prevention. If priming is an appropriate theoretical mechanism of effect, then cancer knowledge about topics receiving prominent coverage should be more easily retrieved from memory than those covered less frequently. To best understand the relationship between news consumption and cancer-prevention knowledge requires an examination of people's attention to news, their knowledge about primary prevention, and an examination of the media messages themselves. This study compares data from a comprehensive content analysis of cancer news coverage with self-reports of attention to health news in newspapers and knowledge of cancer prevention.

RESEARCH QUESTIONS

RQ1: How often are specific CPBs discussed in newspapers?

Rather than a general exploration of preventive health behaviors, this research focuses specifically on the effectiveness of behaviors for reducing cancer morbidity and mortality risks. By comparing the relative prevalence of news coverage across behaviors, we can later use this information to explore the relationship between the prevalence of coverage of specific prevention behaviors and reported news consumers' knowledge of those behaviors.

RQ2: Is there an association between self-reported attention to health news and knowledge of CPBs as modifiable cancer risks?

Even controlling for spurious variables, the presence or absence of associations will be difficult to interpret. For example, null results could be interpreted in two ways: (a) individuals do not learn about health information from newspapers; or (b) there is not adequate cancer prevention information in the news. The first interpretation would be contrary to existing research, including people's self-reported reliance on the media as a source for health information, but a systematic examination of cancer news messages is the only way to sort through alternative explanations for results.

RQ3: Is the relative quantity of news coverage of specific CPBs consistent with associations between attention to health news and knowledge of CPBs?

By comparing news coverage data with observed associations between attention to newspaper health news and prevention knowledge, we may be able to provide explanations for results. For example, the magnitude of associations between news exposure and knowledge of specific CPBs may vary based on the prevalence of the news coverage. If associations are not found between attention to health news and cancer-risk knowledge, then this may be attributable to a lack of news media attention to modifiable cancer risk factors. We may also be able to determine a threshold effect, below which is an insufficient amount of cancer information to affect knowledge, or above which increased message repetition does not generate additional learning.

METHOD

Two sources of data were utilized. To understand the prevalence of cancer prevention in the news media, we rely on a content analysis of cancer news coverage. To understand its effects, we rely on data from the NCI's Health Information National Trends Survey (HINTS).

Media Data

The cancer news data comes from a content analysis of cancer news coverage in the major U.S. and ethnic/minority papers for the year 2003. The data reported here make use of only the major daily newspapers. The universe of texts for the top major U.S. papers consisted of any of the 50 highest-circulating newspapers contained within the Lexis-Nexis database that provided full-text continuous coverage for the study time period, resulting in 44 papers. All stories that contained a minimal amount of cancer information were identified through a search term that underwent rigorous validation procedures described elsewhere (Stryker, Wray, Hornik, & Yanovitzky, 2005), and were entered into a database for random selection. These stories were reviewed for a variety of different constructs by four

coders. Coders received extensive training, with reliability rechecked every 3 months. All variables reported here had a mean Krippendorff's alpha of $>.70$. The full major paper dataset contained 5,327 stories, which ranged from stories containing a minimal amount of cancer information ($N = 1,689$) to stories that were primarily about cancer ($N = 2,448$). Data presented are from all stories (a) for which cancer was at least a major theme of the article and (b) that overlapped with the HINTS data collection period, from January 1, 2003, through April 13, 2003; $N = 954$. For more details regarding the sample, search term procedures, and interrater reliability, please contact the authors.

Media Measures

Because earlier cancer content analyses reported only several general measures of cancer risks and did not provide information about specific CPBs, we developed our own more comprehensive measures of cancer risks and prevention. To conform to the survey data, we report the number of stories that discuss specific CPBs in the context of cancer: diet, smoking, exercise, sun exposure, and alcohol use. First we noted any mention of cancer risk associated with the specific behaviors. This risk could have been implicit (e.g., Sheila, a smoker, died of lung cancer), explicit but nonnumerical (e.g., smoking causes lung cancer), or numerical (e.g., smokers are 11 times more likely to develop lung cancer than nonsmokers). This measure was recoded into a dichotomous variable wherein a specific risk factor was either mentioned or not mentioned. We also measured the extent to which news stories provided detailed information about cancer prevention for each behavior. Beyond a mention of risk, stories could provide additional prevention information about the behaviors, such as strategies for quitting/starting a behavior; resources in the community for support; and additional consequences of the behaviors (other than causing cancer). By definition, any mention of a risk counted as a mention of prevention. The amount of prevention information was measured on an ordinal scale: mention only; additional information; major emphasis; and primary focus. The distinction between the categories was based on the quantity of information. For example, a story that mentioned excessive sun exposure causing skin cancer would be considered "mention only" if it proceeded to explain that a strategy for reducing excessive sun exposure is to avoid the sun between the hours of 10 a.m. and 2 p.m., it was assigned the category "additional information;" if at least three sentences discussed safe-sun practices, it was considered a "major emphasis;" if the story was primarily about ways to prevent skin cancer, it was considered a "primary focus." Even though we measured other CPBs (e.g., safe sexual practices), as well as other preventive methods (e.g., medication), we limit this report to measures conforming to preventive behaviors in the survey data.

Survey Data

The survey data come from a national sample of 6,369 U.S. adults who were interviewed as part of the NCI's first HINTS. The survey was conducted from October 31, 2002, to April 13, 2003, utilizing a random-digit dial telephone survey technique, with oversampling of exchanges with high numbers of Blacks and Hispanics. The final response rate for the survey was 62.8%. This analysis utilizes data collected from respondents in 2003; $N = 3,784$. (For more information regarding the survey design, see Nelson et al., 2004.)

HINTS Survey Measures

Attention to health news. Rather than rely on the average number of days spent reading a newspaper, we chose a more proximal measure of exposure to cancer information (Drew & Weaver, 1990; McGuire, 1989). Respondents were asked, "How much attention do you pay to information about health or medical topics in newspapers?" Response options included "none," "a little," "some," and "a lot." Answers were recoded into a dichotomous measure: a lot/some and little/none. To rely on the number of days per week reading a newspaper, like other general measures of media exposure, would introduce "error associated with not actually encountering the message of interest" (Slater, 2004, p. 169). For example, Graber (1988) found that 72% of newspaper reading consists of just reading the first section of the paper, which is typically heavy in national, international, and political news. Although the survey asked questions about exposure and attention to health news across a variety of channels (magazines, television, radio, and the Internet), we are focusing on attention to newspaper coverage because our media data come from newspapers. Preliminary analysis revealed that attention to health news in newspapers was highly correlated with attention to health news across different channels (as high as .50, for magazines), introducing problems of multicollinearity and diminishing the utility of controlling for attention to other media channels.

CPB knowledge. Respondents were asked the following open-ended question: "Can you think of anything people can do to reduce their chances of getting cancer? Anything else?" Responses were coded into different categories. For this analysis, we rely on the response codes that best represent primary preventive behaviors: eating better/better nutrition; don't smoke/quit smoking; exercise; sun avoidance/sunscreen; and reduce alcohol consumption. Several other response options included references to primary preventive behaviors but were not included because they could not clearly be attributed to a specific preventive behavior. For example, the response code "reduce weight" could be attributed either to physical activity or to diet (a very small fraction—less than 2%—of respondents listed this option). The response code "safe sex" was coded into a category that included "positive attitude," "yoga," "meditation," and "moderation."

Demographic data. Demographic variables were considered as potential confounders of the relationship between attention to health news and cancer prevention knowledge. These variables included gender, race, income, education, and age.

Analysis

The content analysis data were analyzed using SPSS version 13. To account for the complex sampling design of the HINTS survey, HINTS data were analyzed using SUDAAN version 9.0. To answer questions about the prevalence of cancer-prevention information in the news media (RQ1), we rely exclusively on univariate descriptions of the distributions of variables. Parameter estimates for univariate distributions are reported without 95% confidence intervals. Given the large sample sizes, all confidence intervals were less than $\pm 1\%$; hence, point estimates are fairly stable.

The fundamental analytical approach for RQ2 was static and cross-sectional. We were looking for evidence that self-reported attention to health news in newspapers was related to individual knowledge about specific CPBs. Because the data are cross-sectional rather than longitudinal, we cannot assume that any observed correlation between self-reported attention and any of the knowledge outcome measures is a function of learning from news coverage. However, we can minimize threats to causal influence by controlling for extraneous variables that might have influenced both attention and outcomes. All variables with multiple ordered or dichotomous categories assumed an interval level of measurement. Because cancer knowledge variables were dichotomous, we utilized logistic regression procedures to test multivariate models. Main effects of news attention were estimated before and after background variables were controlled.

The comparison of the media and survey data (RQ3) was qualitative. We were looking for patterns in the prevalence with which specific CPBs were discussed in the media that might provide explanations for observed associations between attention to health news and specific CPB knowledge.

RESULTS

RQ1: How Often are Specific CPBs Discussed in Newspapers?

Preventive behaviors were rarely discussed as cancer risks. Tobacco cancer risks were discussed the most often, in 9.2% of cancer news stories. Diet was discussed slightly less often, appearing in 6.5% of all cancer news stories. Exercise, sun, and alcohol were all discussed in fewer than 3% of stories (2.5%, 1.9%, and 1.8% for exercise, sun, and alcohol, respectively).

The quantity of information about specific CPBs varied widely (Table 1). Stories about alcohol were the least likely to contain any detailed prevention information. Of the stories that

TABLE 1
Amount of Attention to Prevention Behaviors and Weighted N Based on Amount of Detailed Information

Topic	Mention Only		Additional Prevention Information		Major Emphasis on Prevention Information		Primary Focus on Prevention Information		Weighted N ^a
	%	n	%	n	%	n	%	n	
Alcohol (N = 17)	58.8	10	29.4	5	11.8	2	0	0	21
Tobacco (N = 88)	53.4	47	25.0	22	13.6	12	8.0	7	155
Exercise (N = 24)	50.0	12	33.3	8	12.5	3	4.2	1	41
Diet (N = 62)	22.6	14	29.0	18	21.0	13	27.4	17	157
Sun (N = 18)	16.7	3	27.8	5	22.2	4	33.3	6	49

Note. Where mentioned only = 1; additional information = 2; major emphasis = 3; primary focus = 4.

^aN × attention.

mentioned alcohol as a cancer risk, none focused primarily on alcohol as a risk factor, and few provided detailed information. Although exercise was mentioned slightly more often than sun, news stories discussing safe-sun behaviors provided a much greater level of detail. Of the stories mentioning sun as a cancer risk, 33% focused primarily on skin cancer prevention throughout the article. In contrast, of the stories discussing exercise, only 4% focused exclusively on how exercise can prevent cancer. Similarly, although a greater number of stories discussed tobacco than diet, stories about diet provided more detailed cancer-prevention information. Of the stories mentioning diet as a cancer risk, approximately 27% were primarily about how changes in diet can prevent cancer. In contrast, of the stories that mentioned tobacco risks, only 8% focused primarily on quitting smoking as an effective cancer-prevention method.

If we assign an ordinal value to the amount of attention paid to each behavior, such that a “mention only” is assigned a value of 1, “additional information” a value of 2, “major emphasis” a value of 3, and “primary focus” a value of 4, then weighting the samples by the quantity of prevention information changes the relative prevalence of news coverage of the different prevention behaviors. In contrast to the raw mentions of a particular cancer risk, the weighted samples suggest that there is equal coverage of diet and tobacco (weighted $N = 157$ vs. 155, respectively). Even though mentions of exercise cancer risks appeared more often than sun risks, there was slightly more detailed information about safe-sun practices (weighted $N = 49$) than to exercise (weighted $N = 41$). Because few stories provided any detailed information about limiting alcohol consumption to reduce cancer risks, weighting the alcohol stories by the amount of information did little to change the amount of alcohol information.

RQ2: Is There an Association Between Self-Reported Attention to Health News and Knowledge of CPBs as Modifiable Cancer Risks?

Table 2 provides the distribution of responses for the survey variables. Approximately 55% of respondents reported paying

TABLE 2
Distribution of HINTS Variables

	Weighted %	Unweighted N
Attention to health news in newspapers (N = 3,764)		
None/a little	44.6	1,613
Some/a lot	55.4	2,161
Food/diet (% naming food/diet) (N = 3,784)	51.0	2,031
Smoking (% naming smoking) (N = 3,784)	59.8	2,246
Exercise (% naming exercise) (N = 3,784)	25.1	1,027
Avoiding sun/sunscreen (% naming sun) (N = 3,784)	8.9	362
Alcohol (% naming alcohol) (N = 3,784)	11.2	451
Gender (N = 3,784)		
Male	47.5	1,459
Female	52.5	2,325
Education (N = 3,634)		
Less than high school	17.3	452
High school	31.3	1,057
Some college	26.4	961
College degree or more	25.1	1,164
Age (N = 3,784)		
18–34	31.9	1,019
35–39	10.2	389
40–44	10.2	396
45+	47.7	1,980
Income (N = 3,308)		
<\$25,000	28.7	1,709
\$25,000–<\$35,000	13.2	787
\$35,000–<\$50,000	16.5	958
\$50,000–<\$75,000	17.0	955
≥\$75,000	24.5	1,214
Race/ethnicity (N = 3,588)		
White	70.9	2,492
Hispanic	11.8	466
Black	11.3	439
Other	6.1	191

attention to health information in newspapers. Unaided recall of specific CPBs varied greatly: smoking was most frequently mentioned by respondents (59.8%), followed by

food/diet (51.0%), exercise (25.1%), alcohol use (11.2%), and safe-sun practices (8.9%).

Bivariate analyses revealed a significant relationship between cancer-prevention knowledge and attention to health news, as well as between cancer-prevention knowledge and most of the demographic variables (see Table 3).

Attention to health news in newspapers was significantly associated with knowledge of all of the CPBs, with the exception of alcohol, with correlations ranging from .05 for sun ($p < .05$) to .14 for diet ($p < .001$). African Americans and Whites paid more attention to health news than did Hispanics and individuals of other races. Attention to health news also increased significantly with age ($r = .11, p < .001$), income ($r = .08, p < .001$), and education ($r = .17, p < .001$).

Women and men tended to know different CPBs. Women were more likely to know about the relationship between cancer and diet ($r = .09, p < .001$) and exercise ($r = .10, p < .001$), but men were more likely to know that smoking causes cancer ($r = -.04, p < .05$). There were no gender differences for knowledge about sun or alcohol.

Whites were most likely to know that quitting smoking can reduce cancer risks. Fewer African Americans and Hispanics knew that exercise can reduce cancer risks than did Whites and individuals of other races. Hispanics were the least likely to know about the link between diet and cancer. There was no relationship between race/ethnicity and knowledge of alcohol as a cancer risk factor.

Older individuals were more likely to know that dietary factors ($r = .15, p < .001$) and alcohol ($r = .04, p < .05$) can influence cancer risks, but they were less likely to know about safe-sun practices ($r = -.04, p < .05$). Age was not significantly associated with smoking or exercise knowledge.

Income and education were strong predictors of cancer-prevention knowledge. The higher one's income and

education, the more likely a respondent was to know about diet ($r = .25, p < .001$ and $r = .26, p < .001$, for income and education, respectively), smoking ($r = .14, p < .001$ and $r = .11, p < .001$, for income and education, respectively), exercise ($r = .22, p < .001$ and $r = .23, p < .001$, for income and education, respectively), and safe-sun practices ($r = .13, p < .001$ and $r = .16, p < .001$, for income and education, respectively) as being important CPBs. Income and education were not significantly associated with knowledge about alcohol risks.

In the multivariate model, attention to health news remained a small but significant predictor of knowledge about food and smoking. The confidence intervals for the association between news attention and knowledge of these health behaviors overlap considerably, suggesting that the adjusted odds ratios are not significantly different from each other. It must be assumed, therefore, that the magnitude of the relationships between attention to health news and knowledge of dietary factors and tobacco use are equivalent. There was no significant relationship between news attention and knowledge of the relationships between exercise, sun, or alcohol and cancer. Because alcohol knowledge was not significantly associated with news attention at the bivariate level, the multivariate model is included to provide an understanding of the relationship between demographic variables rather than as a test of spuriousness.

RQ3: Is the Relative Quantity of News Coverage of Specific CPBs Consistent with Associations Between Attention to Health News and Knowledge of CPBs?

Assuming that frequency of coverage primes knowledge about CPBs, we should be able to predict the results of the survey data based on the media data, and vice versa. From

TABLE 3
Logistic Regression Equations for Cancer-Prevention Behaviors

Variable	Food	Smoking	Exercise	Sun	Alcohol
	Adjusted Odds Ratio (95% CI)				
Attention to health news (No attention)	1.35 (1.11, 1.63)**	1.34 (1.10, 1.62)**	1.10 (.89, 1.36)	1.19 (.86, 1.66)	1.06 (.74, 1.51)
Gender (Female)					
Male	0.65 (.55, .78)***	1.21 (1.01, 1.45)*	0.55 (.44, .69)***	0.99 (.76, 1.29)	0.99 (.74, 1.31)
Race (Other)					
White	0.92 (.54, 1.56)	1.66 (1.11, 2.48)*	1.01 (.64, 1.57)	2.48 (1.00, 6.18)	0.77 (.45, 1.33)
Hispanic	0.48 (.27, .88)*	1.42 (.86, 2.34)	0.66 (.36, 1.20)	1.51 (.50, 4.62)	1.16 (.60, 2.24)
Black	0.73 (.42, 1.25)	1.25 (.83, 1.88)	0.72 (.44, 1.18)	0.55 (.16, 1.85)	0.66 (.33, 1.33)
Age	1.22 (1.13, 1.32)***	0.91 (.84, .98)*	1.01 (.94, 1.09)	0.90 (.81, .99)*	1.11 (.99, 1.24)
Income	1.24 (1.15, 1.33)***	1.15 (1.05, 1.25)**	1.25 (1.16, 1.35)***	1.12 (1.02, 1.23)*	0.99 (.90, 1.08)
Education	1.36 (1.24, 1.50)***	1.06 (.95, 1.19)	1.39 (1.25, 1.55)***	1.61 (1.34, 1.92)***	1.06 (.91, 1.22)
Cox & Snell R^2	.128	.033	.087	.043	.004

Note. Reference categories are shown in parentheses.

* $p < .05$. ** $p < .01$. *** $p < .001$.

the media data, we would expect to see greater effects for tobacco and exercise than for diet or sun, and no relationship between attention to health news and knowledge about alcohol as a CPB. Exercise was mentioned more than safe-sun practices in the raw data; however, the pattern was reversed when the data was weighted by the amount of detailed information included in the news article. Therefore, if the amount of detailed information matters more than the sheer number of mentions, we would expect to see a slightly larger relationship between attention to health news and knowledge of safe sun practices (which averaged fewer mentions, but more detailed information).

The results of the survey analysis revealed that news attention was significantly related to individuals' knowledge about dietary factors and tobacco use as related to cancer. News attention was not significantly associated with knowledge of exercise, alcohol, or sun at the multivariate level. Based on the survey data alone, we would have predicted less media information about exercise, alcohol, and sun practices. Because of overlapping confidence intervals of the adjusted odds ratios for diet and tobacco, we would have been unable to speculate about which preventive behavior had the most news coverage.

Comparing across datasets, there is consistency between CPB news coverage and associations between attention to health news and knowledge of CPBs. Smoking and dietary practices received substantially more news coverage than the other modifiable cancer risks. This could explain why there is a stronger association between attention to health news and knowledge of these particular cancer risks; people who pay attention to newspaper health coverage would be more likely to be exposed to information about the cancer risks associated with smoking and diet. The overlapping confidence intervals of the two behaviors for the measure of news attention suggests that there may be a differential impact of news stories containing more detailed information (where diet and tobacco were equivalent) than those containing mere mentions of risk (where tobacco was more prevalent than diet).

There was less news coverage of exercise, alcohol and sun practices, and that could explain why there is no association between attention to health news and knowledge of these cancer risks; with less information appearing in newspapers, newspaper readers are less likely to come across this information. It is possible that newspaper coverage was beneath the threshold required to prime learning.

DISCUSSION

Attention to health news was significantly associated with knowledge about cancer risks associated with food and smoking but not for knowledge about exercise, sun, or alcohol. These associations between news exposure and cancer knowledge, although small, remained even after considering differences based on gender, race, age, income, and education.

Content-analytic data revealed that U.S. newspapers infrequently discussed modifiable cancer risks. However, when newspapers did mention modifiable cancer risks, there was greater attention to tobacco and diet than to exercise, sun, and alcohol. These findings conformed to the findings of the survey data

This introduces a question about why the news media pay so little attention to sun exposure, alcohol, and lack of physical activity as cancer risks. Several possibilities come to mind. With respect to sun exposure, the likely explanation is that few cancer news stories discuss skin cancer. Although not reported here, our content analysis also measured attention to different types of cancers. Less than 5% of all cancer news stories were about skin cancer. It is possible that alcohol is underrepresented as a risk factor due to the commercial interests of the media. For instance, Price (2003) found that 7% of network news correspondents felt some pressure from advertisers to report or censor news stories. The alcohol industry is a major source of advertising revenue; therefore, the temptation to censor stories harmful to the industry may play a role in the editorial process. However, an alternative explanation is that news stories identifying alcohol as a risk factor are typically framed in terms of other noncancer illnesses, such as heart disease or other noncancer illnesses. For example, an informal scan of recent news coverage suggests that alcohol is typically depicted as good for the heart (e.g., red wine reduces risk of stroke) or bad for the liver (e.g., drinking more than 25 g of alcohol a day increases the risk of cirrhosis of the liver). This explanation would be consistent with the lack of news attention to exercise as a cancer preventive behavior.

With respect to the survey data, another interesting finding is that women were more likely than men to identify diet and exercise as cancer risk factors. Previous research has found that women's magazines contained more messages focused on dieting and fitness than did men's magazines (e.g., Anderson & DiDomenico, 1992; Guillen & Barr, 1994). Other studies have found that women who consume these materials are more likely to be concerned with their diet, weight, and general appearance, often to their own detriment (e.g., Field et al., 1999; Harrison & Cantor, 1997). Greater targeting and exposure to materials focused on diet and exercise may explain the gender differences observed in this study: women are primed to pay more attention to information about diet and exercise than are men, therefore they also retain cancer prevention information about these behaviors.

Limitations

This study focused on newspaper coverage only, both as a measure of attention to health news and for the media data. The limited focus across survey and media data is consistent; however, we cannot make any claims about the relationship between news exposure and knowledge acquisition across different media channels. Moreover, due to issues of

multicollinearity, we could not control for attention to health news across other media channels, and hence cannot rule out the possibility any observed associations between exposure to newspapers and cancer knowledge are not a function of exposure to information from other channels. However, the consistency of our findings across the media and survey data provide some credibility for our findings.

We also rely on speculative rather than statistical data to relate our content-analytic findings with the survey data, hence we cannot make definitive claims about the relationship between the two datasets, nor can we provide strong evidence of a priming effect. However, we were not trying to make causal claims based on the temporal order of the two datasets; the basis of inference was across behaviors rather than across time. By limiting the datasets to overlapping months, there is a plausible argument regarding the temporal precedence of news coverage to cancer knowledge.

Finally, the survey data suffered from a low response rate. Despite repeated call attempts, mailings, and small monetary incentives, the final response rate for the survey was only 62.8%. Although the low response rate is not atypical for random-digit dialing surveys (Nelson et al., 2004), it does raise concerns about a response bias of the sample.

Conclusions

Despite its shortcomings, this study makes a methodological and theoretical contribution to our understanding of how the public learns health information from the news. There is some evidence consistent with a priming effect, suggesting that the relative frequency of news coverage may influence individuals' knowledge of cancer prevention. The consistency of the findings across the survey and media data also provides a validation of self-reported attention to health news as a good approximation of media exposure. Both datasets contained large random samples, with methodologically rigorous attention to study design and variable construction. The utilization of open-ended measures of cancer-prevention knowledge eliminated the social desirability bias present in most forced-choice variables, and ensured that knowledge was not overestimated.

The results also introduce two directions for future research. More research is needed to explore the possible priming effect of noncancer-related prevention news coverage on cancer knowledge, attitudes, and behavior. Second, additional analyses will seek to understand if differences between the quantity (measured by sheer counts of mentions) and quality (measured by the amount of detailed information on a topic) of prevention news coverage affects learning acquisition. At the individual level, there is ample evidence that distinct frames can influence the ways people think about issues, ideas, and people (Cappella & Jamieson, 1997; Iyengar & Kinder, 1987; Iyengar & Simon, 1993). At the aggregate level, however, there is evidence that supports more simple media conceptualizations. The foundation of

priming and agenda-setting research is that quantity of coverage alone can affect the public salience of an issue. This may also be true for individual knowledge acquisition.

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