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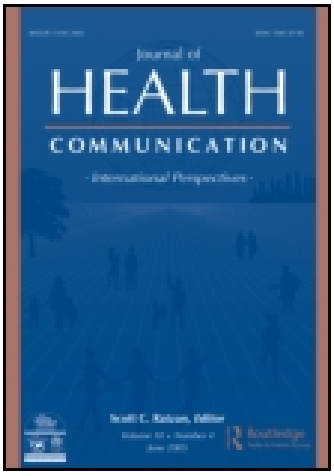

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The Relationship Between Health Information Sources and Mental Models of Cancer: Findings from the 2005 Health Information National Trends Survey

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The Relationship Between Health Information Sources and Mental Models of Cancer: Findings from the 2005 Health Information National Trends Survey

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*This study used data from the 2005 Health Information National Trends Survey, a national sample of U.S. households (*N = *5,586), to (1) explore the extent to which specific sources of health information are associated with certain beliefs about cancer; and (2) examine whether the relationship between health information sources and beliefs about cancer is moderated by psychological distress. Health information on the local news was associated with greater ambiguity about cancer prevention recommendations (OR 1.22, 95% CI 1.02–1.46,* $p < .05$*), while less ambiguity was associated with cancer-specific information (OR 0.81, 95% CI 0.69–0.94,* $p < .05$*), health information in the newspaper (OR 0.82, 95% CI 0.69–0.97,* $p < .05$*), and health information on the Internet (OR 0.71, 95% CI 0.61–0.84,* $p < .001$*). Health information on the local news was also associated with lower likelihood of higher perceived relative risk of cancer (OR 0.67, 95% CI 0.52–0.86,* $p < .01$*). No source of information was associated with the belief that cancer is primarily caused by behavior/lifestyle factors. Psychological distress greatly increased the optimistic bias of those who read health information in the news (OR 3.68, 95% CI 1.69–8.03,* $p < .001$*) but had no other moderating effect. Findings suggest that information seeking using active channels of health information decreases ambiguity and corrects for optimistic bias.*

Mass media play a key role in disseminating health information and promoting preventive behaviors, but the relationships between different types of media and health behavior are poorly understood. Health promotion is particularly important for diseases, such as cancer, because uptake of preventive behaviors may reduce mortality. As health communication researchers explore the role of mental models in health decision making, the differential impact of media on such models is an important consideration in planning and implementing public health education campaigns. The goal of this study is to explore the relationship between health information sources and mental models of cancer, using data from the 2005 Health Information National Trends Study (HINTS) sponsored by the National Cancer Institute. The specific aims are to (1) explore the extent to which specific sources of health information are associated with certain beliefs about cancer; and (2) examine whether this relationship is moderated by psychological distress.

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Background and Significance

Public Health and Health Communication

Public health relies heavily on population-based approaches to improving health and well-being. Educational campaigns are a key element of many public health initiatives, based on the assumption that knowledge is a necessary (but not sufficient) precursor to behavior change (Viswanath et al., 2006). Mass media sources are traditionally viewed as one of the most important ways to increase awareness and knowledge of health-related topics (Yanovitzky & Blitz, 2000). They have the potential to affect attitudes and behaviors in several ways: influencing which health topics people think about (agenda setting), shaping how people think about health topics (cultivation), and facilitating health-related behaviors (social learning) (Wang & Gantz, 2007). A national survey of women reported that 80% of respondents obtained most of their health information from general media sources (Covello & Peters, 2002). The revolution in health communication facilitated by the Internet has greatly expanded opportunities to disseminate health information at the same time as consumers have become increasingly proactive in obtaining health information (Hesse, Moser, Rutten, & Kreps, 2006; Niederdeppe et al., 2007).

Research on the impact of media campaigns is mixed, suggesting that the relationship among media, knowledge, and behavior is not linear. The explosion of health information has also led to concern that differential access to sources of information may contribute to a "knowledge gap" and in turn widen health disparities, because sociodemographic factors are associated with differing patterns of health information behaviors (Kakai, Maskarinec, Shumay, Tatsumura, & Tasaki, 2003; Viswanath et al., 2006). Mass media can play an important role for less advantaged groups. For example, mass media coverage of breast cancer screening was found to predict mammography only for women without regular access to a physician (Yanovitzky & Blitz, 2000).

Information Sources, Channels, and Health Communication Behaviors

Communication research typically differentiates between channel and source such that channel is the medium for delivering the information (e.g., mass media vs. interpersonal) and source refers to the producer of the information within a channel (Berlo, 1960; Johnson, Meischke, Grau, & Johnson, 1992; Schramm, 1955). Health-oriented individuals are more likely to engage in active information seeking using sources such as print media and the Internet, while less health-conscious individuals rely on passive sources such as television and radio as their primary sources of health information (Dutta-Bergman, 2004). Information-oriented media, such as newspapers, are generally considered to be more credible than entertainment-oriented media, such as television (Rains, 2007). Individuals who reported paying attention to health information in newspapers have shown greater knowledge of cancer prevention behaviors (Stryker, Moriarty, & Jensen, 2008). However, several studies suggest that health information in mass media is frequently ambiguous, inaccurate, misleading, or ineffective in promoting health-related behaviors (Brunner & Huber, 2010; Kline, 2006; Moriarty & Stryker, 2008). While consumers have rated television highly as a channel for learning about health in general (O'Keefe, Boyd, & Brown, 1998) and expressed a high level of trust in health information obtained

from television (Hesse et al., 2005), people who cited electronic media as the most useful source of health information were less knowledgeable about cancer screening methods compared with people who cited the doctor as the most useful source (Meissner, Potosky, & Convissor, 1992; O'Keefe et al., 1998). In contrast, television use in Europe increased knowledge about cancer, suggesting that there is an important distinction between channel and content (McMenamin et al., 2005).

Another paradigm distinguishes between information obtained through routine media consumption (information scanning) and information obtained through deliberate and nonroutine searches (information seeking). An important corollary to scanning and seeking is avoidance; individuals may choose to avoid health information in order to minimize anxiety or avoid challenges to optimistic beliefs and hope (Brashers, Goldsmith, & Hsieh, 2002). Niederdeppe and colleagues (2007) found that mass media was commonly used for cancer information scanning but rarely for cancer information seeking. Both scanning and seeking behaviors have been associated with increased knowledge about cancer, increased screening behaviors, and healthier lifestyle choices (Shim, Kelly, & Hornik, 2006).

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The Influence of Mental Models on Health Behavior

Recent research in health communication draws on decision theory (e.g., Han, Moser, & Klein, 2007) as well as traditional theories of health protective behavior (Turner, Rimal, Morrison, & Kim, 2006) to explore the complex relationship among health attitudes, beliefs, knowledge, and behavior. This research underscores the importance of affective and cognitive perceptions of self-efficacy, risk, and ambiguity associated with mental models of disease as predictors of health behaviors.

According to the Theory of Planned Behavior (Ajzen, 1991) and Self-Efficacy Theory (Bandura, 1977), one factor associated with behavior change is self-efficacy, or the belief that change is possible and under one's control (Weinstein, 1993). Beliefs about controllability of a disease have been found to predict health outcomes (Sullivan et al., 2010). Perceptions of risk may motivate a health behavior change to reduce risk and increase the use of preventive services (Moser, McCaul, Peters, Nelson, & Marcus, 2007). However, the influence of perceived risk on health behaviors may be moderated by perceived efficacy, in that people who believe they are at risk may act only if they believe their actions will have an effect (Sullivan, Burke Beckjord, Finney Rutten, & Hesse, 2008). Finally, ambiguity reflects the cognitive burden imposed by information that is complex, of uncertain reliability, or contradictory. Perceived ambiguity has been associated with greater pessimism about the preventability of cancer and with lower likelihood of engaging in preventive behaviors, the so-called ambiguity aversion phenomenon (Han et al., 2007). Given the potential impact of self-efficacy, perceived risk, and ambiguity on health protective behaviors, determining factors that influence these mental models could play an important role in crafting health communications.

Sources of Health Information and Mental Models of Cancer

Cancer is the second leading cause of death in the United States, but mortality rates are dropping as new treatments are developed and preventive efforts gain traction among the population (Shim et al., 2006). Health promotion efforts are particularly

salient for cancer due to the importance of both primary prevention such as lifestyle choices and secondary prevention such as screening (Hesse et al., 2006; Stein & Colditz, 2004). While health researchers have explored the relationship between mental models of disease and health protective behaviors (e.g., Han et al., 2007), and between sources of health information and health protective behaviors (e.g., Yanovitzky & Blitz, 2000), few studies have explored the relationship between sources of health information and mental models of disease.

Of the three mental models in HINTS (ambiguity, self-assessed risk, and the relationship between behaviors and disease), there is research only on the relationship between media and perceived risk. While one study found that attention to media in general showed no association with perceived risk (McQueen, Vernon, Meissner, & Rakowski, 2008), other studies suggest that print media increases the perception of personal and societal health risks (Dutta-Bergman, 2004; Morton & Duck, 2001). However, the study by Morton and Duck (2001) is limited by the use of a convenience sample of college students and its sole focus on newspapers as a source of information.

The present study expands on prior research to explore the relationship between sources of health information and mental models of cancer in a large national sample as a first step toward developing a model of health behavior that links mass media, mental models, and behavior change. Psychological distress was included as a moderating variable because distress has been shown to influence cognition (Beck, 2008; Blanchette & Richards, 2003) and to build on prior research relating psychological distress to perceived risk (Zajac, Klein, & McCaul, 2006).

The hypotheses to be tested follow:

1. Use of each of the four following types of information and sources: (a) cancer information from any source; (b) health information on the television; (c) health information in print media; and (d) health information on the Internet; is associated with
   i. ambiguity about following recommendations for cancer prevention;
   ii. self-assessed relative risk of cancer; and
   iii. belief that cancer is caused by an individual's behavior or lifestyle.
2. The relationships in hypotheses 1a–d above are moderated by psychological distress.

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Methods

Study Design

This is a secondary data analysis of HINTS 2005 (Cantor, Covell, Davis, Park, & Rizzo, 2005). The data are publicly available at www.hints.cancer.gov. Sponsored by the National Cancer Institute, HINTS is a biennial cross-sectional national telephone survey designed to measure public knowledge, attitudes, and beliefs about certain cancers, including access to and preferences for sources of information on both cancer and general health topics. Data used in the current analysis were collected using a computer-assisted telephone interview (CATI) between February and August 2005. Survey design, sampling, data collection, and quality assurance procedures used in the 2005 survey have been described elsewhere in detail (Cantor et al., 2005).

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Sampling Plan

The target population for HINTS 2005 is noninstitutionalized adults living in the United States. List-assisted random digit dialing (RDD) was used to obtain a nationally representative sample of households. The quantity of telephone numbers identified for initial contact attempts ($n = 75{,}462$) took into account projected estimates for business or nonworking numbers and response rates. Several techniques were used to maximize the response rate, including advance mailings to sampled households, interviews in English and Spanish, and random assignment to one of three financial incentive conditions. An algorithm was used to sample one adult from each responding household if there was more than one eligible adult. Of the 34% sampled adults who agreed to participate, 61.2% completed the interview, for a response rate of 20.8%. The sample size for the 2005 HINTS was 5,586.

Measures

Independent Variables

Source of health information was measured by asking respondents whether or not they had (1) ever looked for information about cancer from any source (respondents were prompted to consider all sources, including "the Internet, the library, friends, and health care professionals"; (2) watched health segments on the local news in the past 12 months; (3) read health sections of a newspaper or magazine in the past 12 months; and (4) read unsolicited health information on the Internet in the past 12 months (for the purpose of this analysis, people who do not use the Internet were coded as "no").

Dependent Variables

Mental models of self-assessed relative risk, beliefs about the causes of cancer, and ambiguity about recommendations for cancer prevention were measured by randomly assigning respondents to one of three types of cancer (colon, skin, or lung cancer). Self-assessed relative risk of cancer was measured by asking respondents, "Compared to the average person your age, would you say that for [colon/lung/skin] cancer you are more likely, less likely, or about as likely to get cancer?" Beliefs about causes of cancer were measured by asking respondents whether they agreed or disagreed that [colon/lung/skin] cancer "is most often caused by a person's behavior or lifestyle." Ambiguity about following recommendations for cancer prevention was measured by asking respondents whether they agreed or disagreed that "[There] are so many different recommendations about preventing [colon/lung/skin] cancer that it's hard to know which ones to follow." Responses from each cancer-specific subgroup were aggregated to create a composite variable for the mental models of self-assessed risk, beliefs about causes of cancer, and ambiguity about recommendations for cancer prevention. In order to maximize statistical power, the composite variable for each mental model was used.

Moderating Variable

Psychological distress was measured by a summated scale created from six items from the National Health Interview Survey (Pleis, Schiller, & Benson, 2003). Respondents were asked to rate how often in the past 30 days they had experienced the following: (1) feeling so sad, nothing could cheer [them] up; (2) feeling nervous;

(3) feeling restless or fidgety; (4) feeling hopeless; (5) feeling worthless; and (6) feeling that "everything was an effort." The response categories were none of the time, a little of the time, some of the time, most of the time, and all of the time, and were coded from 0 to 4. The theoretical range was 0 to 24. Higher scores indicate greater psychological distress. Internal reliability was acceptable in this sample (Cronbach's alpha = 0.81). The survey authors dichotomized psychological distress with scores from 0–12 classified as Not Serious Psychological Distress and scores 13 and greater classified as Serious Psychological Distress. In order to focus on respondents who were experiencing clinically significant distress, the present study uses the dichotomized variable.

Covariates

Respondents were asked their age and gender. Hispanicity was measured by asking respondents if they were Hispanic or Latino. Race was measured by asking respondents which one or more races they were from the following list: American Indian or Alaska native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, or White. Annual household income was measured by first asking the total pretax income of all household members in the past year. If the respondent did not know or refused to answer this question, they were asked into which of nine categories their household income fell, ranging from less than $25,000 to $200,000 or more. We used the categorical income measure because only 17.7% of respondents did not provide an answer for this question compared with 32.5% of respondents who did not respond to the first question. Educational attainment was measured by asking the highest level of school completed, with 11 response categories ranging from never attended or only nursery school/kindergarten to professional school or doctorate.

Health status was measured by asking respondents to rate their health in general as excellent, very good, fair, or poor. Having health insurance was measured by asking respondents whether or not they had any type of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare. Frequency of visiting a health care provider was measured by asking how often during the past 12 months respondents visited a health care provider, excluding emergency rooms, to get care for themselves.

Information about personal experience with cancer was measured in two ways. Respondents were asked whether or not they had ever been told by a doctor that they had cancer and whether or not a family member had ever had cancer. Those who reported having no family members were coded as "no" on the second variable. Because the intent of this analysis was to examine whether any personal experience with cancer was a confounding variable in the relationship between health information sources and mental models of cancer, respondents who indicated that they had been given a mistaken identification or misdiagnosis of cancer were coded as "yes."

Data Analysis Plan

The HINTS dataset includes statistical weights based on selection probabilities and response rates. Descriptive results are shown using both unweighted and weighted data as calculated by HINTS staff (2005 HINTS Extended Data, June 2, 2006, Public Version). However, in order to maximize statistical power, hypothesis testing was

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conducted using unweighted data (see, e.g., Shim, 2006). Chi-square analyses were used to test bivariate relationships between each of the three mental models of cancer and each of the four sources of health information, and between each of the covariates with each of the mental models of cancer and sources of health information.

Hierarchical binary logistic regression was used to examine the association between the four sources of health information and each of the two mental models of cancer that are dichotomous, specifically, ambiguity about following cancer recommendations and belief that cancer is caused by lifestyle or behavior. Multinomial logistic regression was used to examine the association between the four sources of health information and self-assessed relative risk of cancer, using belief that you are as likely as your peers to get cancer as the reference group.

All of the logistic regression models were built by entering the same blocks of variables to build the model, as follows: Block (1) sources of health information; Block (2) sociodemographic characteristics of age, gender, race/ethnicity, education, and household income; Block (3) health-related variables of self-assessed health status, health insurance coverage, and frequency of provider visits; Block (4) potentially confounding variables of having been diagnosed with cancer or having a family member diagnosed with cancer; and Block (5) psychological distress and the interaction terms of this variable with sources of health information. The final model was selected by including only variables significant in the last step of the hierarchical model.

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Results

Characteristics of HINTS 2005 respondents are shown in Table 1. A majority of respondents were female, identified themselves as White, and reported at least some college education. The majority rated their general health status as good or very good (64.6%). Over one-third had visited a health care provider more than five times in the past year (34.9%) and 16.5% had ever been diagnosed with cancer. Approximately 5% of respondents scored above the cutoff for serious psychological distress.

Traditional media were key sources of health information for HINTS 2005 respondents, with approximately three-quarters reporting that they watch health information on the local news or read the health section in newspapers, and a majority were interested in cancer, with 53% reporting that they had ever looked for cancer information from any source.

Bivariate analyses for sources of health information and each mental model of cancer are shown in Table 2. Self-assessed relative risk of cancer was associated with ever looking for cancer information from any source and reading health information on the Internet. Respondents who had looked for cancer information on the Internet in the past 12 months or who had read health information on the Internet in the past 12 months, as compared with those who had not, were more likely to report a lower risk of cancer than their peers, disagree with the statement that it is hard to know which recommendation to follow, and agree that cancer is most often caused by behavior or lifestyle. Respondents who had read the health section in a newspaper in the past 12 months were more likely to disagree with the statement that it is hard to know which recommendation to follow. There was no association between having read the health section in a newspaper and mental models of risk or of causes of cancer, nor was there any association between having watched health information on the news in the past 12 months and any of the three mental model of cancer measures.

Table 1. Respondent characteristics: Health Information National Trends Survey, 2005 ($N = 5{,}586$)

Respondent characteristics	*N*	Unadjusted % or M (SD)	Adjusted %
Female	3,657	65.5	51.9
Ethnicity			
White	4,103	76.9	69.1
Hispanic	496	9.3	12.9
Black	438	8.2	9.9
Asian	104	1.9	2.4
Multiple races	102	1.8	2.3
American Indian or Alaskan Native	81	1.5	1.9
Pacific Islander	12	0.2	0.4
Education			
Less than high school	687	12.8	14.5
High school graduate	1,447	26.9	29.8
Some college	1,545	28.7	32.0
College graduate	1,696	31.6	23.4
Annual household income			
Greater than $75,000	1,150	25.0	23.6
$50,000 to <$75,000	924	20.1	18.3
$35,000 to <$50,000	652	14.2	11.9
$25,000 to <$35,000	565	12.3	9.3
Less than $25,000	1,307	28.4	22.0
Age	5,568	52.2 years (17.9)	
Health insurance coverage	4,749	88.1	83.1
Self-assessed general health status			
Excellent	664	12.3	11.9
Very Good	1,678	31.1	28.8
Good	1,809	33.5	35.5
Fair	1,000	18.5	19.1
Poor	253	4.7	4.6
Ever looked for cancer information	2,925	52.5	48.6
Watched health information on news	4,091	75.5	71.9
Read health information in newspaper	3,626	74.1	67.7
Read health information on the Internet	2,099	37.6[a]	65.5[b]

[a]Unweighted percentage was calculated using all respondents in the denominator.
[b]Weighted percentage was calculated using only those individuals who reported using the Internet in the denominator.

For all of these nonsignificant associations, the direction of the relationship between the media source and mental model of cancer was in the same direction as for those associations that were significant.

The binary logistic model regressing ambiguity of cancer prevention recommendations on sources of health information is presented in Table 3. Results are shown both unadjusted for sociodemographic and health characteristics and adjusting for these variables. All sources of health information were associated with ambiguity

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Table 2. Bivariate association between sources of health information and mental models of cancer: National Health Information Trends Survey, 2005 ($N = 5,586$)

	Source of health information							
	Ever looked for cancer information from any source		Watched health information on news in past 12 months		Read health section in newspaper in past 12 months		Read health information on Internet in past 12 months	
Mental model of cancer	Yes % (*n*)	No % (*n*)	Yes % (*n*)	No % (*n*)	Yes % (*n*)	No % (*n*)	Yes % (*n*)	No % (*n*)
Self-assessed relative risk of cancer	$p \leq .000$		$p = .072$		$p = .753$		$p \leq .000$	
More likely to get cancer	12.3% (336)	9.7% (227)	10.5% (397)	12.8% (151)	11.1% (371)	11.8% (133)	11.7% (234)	10.7% (327)
About as likely to get cancer	39.1% (1,068)	36.0% (845)	38.3% (1,442)	36.0% (426)	37.2% (1,248)	36.4% (410)	40.6% (815)	35.9% (1101)
Less likely to get cancer	48.5% (1,324)	54.3% (1,274)	51.2% (1,926)	51.2% (605)	51.7% (1,736)	51.8% (584)	47.8% (959)	53.4% (1639)
Hard to know which recommendations to follow	$p \leq .000$		$p = .562$		$p \leq .000$		$p \leq .000$	
Agree	38.3% (1,050)	53.0% (1,275)	44.8% (1,705)	45.8% (554)	41.3% (1,395)	51.6% (595)	30.9% (614)	54.1% (1,709)
Disagree	61.7% (1,650)	47.0% (1,130)	55.2% (2,098)	54.2% (656)	58.7% (1,985)	48.4% (559)	69.1% (1,372)	45.9% (1,450)
Cancer most often caused by behavior/lifestyle	$p = .426$		$p = .981$		$p = .279$		$p = .693$	
Agree	67.3% (1,800)	68.4% (1,610)	67.8% (2,523)	67.9% (796)	68.1% (2,250)	66.4% (744)	67.5% (1,318)	68.1% (2094)
Disagree	32.7% (874)	31.6% (745)	32.2% (1,197)	32.1% (377)	31.9% (1,053)	33.6% (377)	32.5% (634)	31.9% (983)

Table 3. Logistic regression analysis of ambiguity regarding cancer prevention recommendations on sources of health information: Health Information National Trends Survey, 2005

	Difficult to know which cancer prevention recommendations to follow (Agree with this statement as compared with disagree)					
	Unadjusted model ($n = 3{,}622$)			Adjusted model ($n = 3{,}671$)		
Characteristic	OR	95% CI	*p*	OR	95% CI	*p*
Sources of health information						
Read health info on Internet	0.45	0.39–0.52	.00	0.71	0.61–0.84	.00
Ever looked for cancer info	0.70	0.67–0.81	.00	0.81	0.69–0.94	.01
Read health section in news	0.75	0.64–0.89	.00	0.82	0.69–0.97	.03
Watch health on TV	1.30	1.10–1.55	.00	1.22	1.02–1.46	.03
Sociodemographic characteristics						
Age				1.01	1.01–1.02	.00
Female gender				1.21	1.04–1.41	.01
Education (compared to college graduate)						
Less than high school				3.49	2.61–4.65	.00
High school graduate				2.48	2.03–3.03	.00
Some college				1.55	1.29–1.87	.00
Household income (compared with >= $75,000)						
Less than $25,000				1.65	1.31–2.07	.00
$25,000 to <$35,000				1.44	1.11–1.87	.01
$35,000 to <$50,000				1.38	1.09–1.75	.01
$50,000 to <$75,000				1.13	0.92–1.41	.25
Health						
Self-assessed health status (compared with poor)						
Excellent				0.61	0.40–0.92	.02
Very good				0.73	0.50–1.07	.10
Good				0.76	0.52–1.11	.16
Fair				0.94	0.64–1.39	.77
Ever had cancer diagnosis				0.79	0.64–0.98	.03
Psychological distress				1.24	0.88–1.76	.22
Model statistics	Unadjusted model			Adjusted model		
−2 log likelihood	4732.40			4510.10		
χ^2, *df*, *p*	217.84, *df* (4), $p < .001$			511.981, *df* (19), $p < .001$		
Nagelkerke R^2	0.08			0.18		

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regarding cancer prevention recommendations in both the unadjusted and adjusted models, but the direction of the relationship varied by source of information. In the adjusted model, the odds of agreeing that it is difficult to know which

Table 4. Multinominal logistic regression of self-assessed relative risk of cancer on source of health information: Health Information National Trends Survey, 2005 ($n = 4{,}166$)

	Self-assessed relative risk of cancer (compared to about as likely)			
	More likely to get cancer		Less likely to get cancer	
Variables in model	OR	95% CI	OR	95% CI
Source of health information				
Watch health on TV	0.67**	0.52–0.86	0.90	0.76–1.07
Read health info on Internet	1.04	0.82–1.31	0.86	0.74–1.00
Read health section in news	0.94	0.72–1.23	0.92	0.78–1.09
Ever looked for cancer info	1.16	0.92–1.47	0.91	0.79–1.06
Sociodemographic characteristics				
Age	1.00	1.00–1.01	1.02***	1.01–1.02
Race/ethnicity (compared with White non-Hispanic)				
Hispanic	0.80	0.52–1.23	1.17	0.89–1.51
Multiracial	1.97	0.96–4.02	2.09**	1.22–3.59
African American	1.44	0.92–2.24	3.00***	2.26–3.98
American Indian	1.29	0.59–2.85	1.08	0.62–1.89
Asian	0.30	0.07–1.27	2.01**	1.21–3.33
Pacific Islander	0.98	0.10–9.66	1.67	0.39–7.09
Health				
Self-assessed health status (compared with poor)				
Excellent	0.44**	0.25–0.77	2.56***	1.67–3.93
Very good	0.47**	0.30–0.76	1.89**	1.27–2.82
Good	0.51**	0.32–0.82	1.46	0.98–2.17
Fair	0.50**	0.31–0.80	1.02	0.68–1.54
Ever had cancer diagnosis	1.00	0.74–1.34	0.76**	0.62–0.92
Family member with cancer	1.25	0.95–1.65	0.83*	0.71–0.97
Psychological distress				
Psychological distress	1.97*	1.00–3.90	0.60	0.32–1.15
Interaction of psychological distress with reading health information in the news	1.16	0.48–2.80	3.68***	1.69–8.03
Model statistics				
−2 Log likelihood	6674			
χ^2, *df*, *p*	312.22, *df* (38), $p < .001$			
Nagelkerke R^2	0.09			

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recommendations to follow were 29% lower for respondents who read health information on the Internet, 19% lower for those who had ever looked for cancer information from any source, and 18% lower for those who had read the health section in the newspaper. Those who watched health information on the television were more likely to report ambiguity about cancer prevention recommendations, with 22% greater odds of agreeing that it is difficult to know which cancer prevention recommendations to follow. Respondents who were older or female, or who had lower educational attainment or lower income were more likely to agree that it is difficult to know which cancer prevention recommendations to follow, while those in excellent health and those who had ever had a diagnosis of cancer were less likely to agree. Psychological distress was associated with ambiguity about which recommendations to follow in the final block of the hierarchical model, but it was not significant in the final model that included only variables significant in the last block.

Results for the multinomial logistic regression of self-assessed relative risk of cancer on sources of health information are presented in Table 4. After controlling for sociodemographic and health-related variables, only watching health information on television was associated with self-assessed relative greater risk of cancer: those who watched health information on television had 33% lower odds of believing that they were more likely to get cancer than their peers. Those with serious psychological distress had almost twice as high odds of believing that they were more likely to get cancer than those who did not have serious psychological distress, but Psychological Distress did not moderate the association between source of health information and self-assessed risk of cancer. Self-assessed health was associated with self-assessed greater risk of cancer, with respondents in better health having lower odds of believing that they are more likely to get cancer. Age, ethnicity, and personal experience with cancer were not associated with believing you are more likely than others to get cancer.

None of the sources of health information were associated with the belief that you are less likely to get cancer. Respondents who were older, identified as multiracial, African American, or Asian, or rated their health as excellent or good, were more likely to believe they are less likely to develop cancer compared with their peers. Respondents with a personal or family history of cancer had lower odds of believing that they are less likely to develop cancer. The relationship between reading the health section of the newspaper and believing that you are less likely to get cancer was moderated by psychological distress. Those who were distressed and who read the health section of the newspaper had 3.7 times greater odds of believing that they are less likely to get cancer than their peers.

The belief that cancer is primarily associated with lifestyle or behavior was not associated with any source of health information even when controlling for sociodemographic characteristics, health-related variables, history of cancer, and psychological distress.

Discussion

Analysis of the 2005 HINTS data partially supports the study hypotheses. Sources of health information had different relationships with mental models of cancer after controlling for sociodemographic and health-related factors. Ambiguity about cancer prevention recommendations was associated with each of the sources of health information examined in this study. Those who actively sought out health information by searching for cancer information or reading health information in

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the newspaper or on the Internet perceived less ambiguity about cancer prevention recommendations, while those who watched health information on the local news perceived greater ambiguity. Self-assessed relative risk was influenced only by watching health information on the local news, which was associated with lower perceived risk of getting cancer. The belief that cancer is primarily caused by behavior or lifestyle was not associated with any of the sources of health information examined in this study. Psychological distress was associated with increased optimistic bias of those in distress who read health information in the newspaper, but did not moderate any of the other relationships between sources of health information and mental models of cancer.

These results confirm that mass media are an important channel for health communication, but their impact varies. The finding that seeking out information in print media and on the Internet, or on cancer specifically, is associated with less ambiguity about cancer prevention recommendations is congruent with earlier research on "ambiguity aversion" that suggests those with greater ambiguity may avoid health information (Han et al., 2007). The finding that watching health information on the news is associated with greater ambiguity is consistent with other research (Dutta-Bergman, 2004; Meissner et al., 1992). Although detailed analysis of sociodemographic factors were beyond the scope of this study, the association between mental models and age, gender, race/ethnicity, educational attainment, and health status is consistent with other research (e.g., McQueen, et al., 2008; Sullivan et al., 2008; Viswanath et al., 2006) and suggests important implications for the design and implementation of public health campaigns. In particular, despite actually having a higher risk of some cancers, we found that older respondents were more likely than younger respondents to rate their risk of developing cancer as less likely than their peers. This suggests an important gap between public perception and scientific evidence that could be addressed by targeted health education campaigns.

Strengths of this study include the use of a large, national sample of U.S. households and grounding in the literature on factors associated with health information and preventive behaviors. It represents an important first step in clarifying the relationship among sources of health information, mental models, and health behavior. However, there was response bias due to the low response rate and underrepresentation of people of color, and further analyses using weighted data are needed in order to generalize results to the broader U.S. population. Use of a combined measure of mental models of cancer may obscure important cancer-specific differences in perceptions of ambiguity, risk, and the role of behavior. The time period of past 30 days used to assess psychological distress, although appropriate and standard for this type of measure, is different from the time period of the past 12 months used to assess media consumption. The use of an unvalidated measure of psychological distress suggests that analyses with this variable must be viewed with caution. Finally, this cross-sectional study cannot establish a causal relationship between sources of health information and mental models of cancer.

The relationship between mass media and increased ambiguity and perceived risk has important implications for health communication. Health care providers should discuss sources of health information with their patients in order to provide corrective interventions as necessary for consumers whose consumption of television may be contributing either to increased ambiguity about cancer prevention recommendations or overly optimistic assessment of personal risk. In addition, public health educators may consider proactive strategies to influence health reporting in

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popular media, including advocating for more coverage of risk factors and prevention behaviors (Moriarty & Stryker, 2008).

A prospective design is needed to establish the temporal direction of the relationship between media consumption and mental models of disease, and to assess whether mental models mediate or moderate the influence of media on health behaviors. Research is needed to explore whether the relationship between source of health information and mental models of risk, ambiguity, and cause differs by type of cancer. Further exploration of the sociodemographic correlates of mental models and media use could inform development of information campaigns targeted to specific groups, thus potentially improving uptake and impact. The association between psychological and distress with two of the study outcomes should be replicated using a validated measure for this variable. Finally, future research would benefit greatly from refinement of health communication and behavior theory that incorporates mental models into a decision-making framework.

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