

Cancer Knowledge and Disparities in the Information Age

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Increasing information flow often leads to widening gaps in knowledge between different socioeconomic status (SES) groups as higher SES groups are more likely to acquire this new information at a faster rate than lower SES groups. These gaps in knowledge may offer a partial but robust explanation for differential risk behaviors and health disparities between different social groups. Drawing on the Health Information National Trends Survey (HINTS 2003), a national survey of communication behaviors conducted by the National Cancer Institute (NCI), we examine the relationship between publicity and knowledge gaps on two cancer topics that received different levels of publicity: knowledge about tobacco and sun exposure and their respective links to cancer. Analyses of the HINTS 2003 data suggest that differential knowledge levels of causes of cancer between SES groups are one potential explanation of cancer disparities that have been extensively reported in the literature. It is evident that high income and high education are associated with awareness about causes of major cancers such as lung and skin, and may allow people to protect themselves and minimize their risks. The data also show that heavier media attention could attenuate the knowledge gaps though moderate publicity or lack of news coverage may actually widen them. Last, the findings in this article suggest that it is necessary to take into account the SES variation within different racial and ethnic groups rather than mask them by treating the groups as one.

Cancer is a global disease burden that claims more than six million lives every year (IARC Working Group, 2002). In addition, about 10 million people are diagnosed with cancer annually and another 22 million are living with cancer. Yet the burden of cancer is borne unequally with certain countries, social classes, and racial and ethnic groups suffering disproportionately compared with others. Individual level indicators of SES, including education, occupation, and income are strongly associated with prevalence of and mortality from certain cancers (Kawachi & Kroenke, in press; Singh, Miller, Hankey, & Edwards, 2003; Ward et al., 2004). Additionally, SES is associated with higher prevalence of risk factors such as tobacco use, obesity, and infections that are more prevalent in lower SES groups and with protective health behaviors such as regular screening and sun screen use that are more prevalent in higher SES groups (National Center for Health Statistics, 2004). Individuals in higher SES groups more often have a usual source of care and access to health insurance, which is highly predictive of having received cancer screenings such as mammography, pap smear, and colonoscopy (Hewitt, Devesa, & Breen, 2004; Meissner, Breen, & Yabroff, 2003; Rakowski et al., 2004; Yabroff et al., 2004). Some evidence also exists that geography-based SES measures are strongly associated with disproportionate burden of cancer (Barry & Breen, 2005; Krieger et al., 2002; Singh, Miller, & Hankey, 2002; Singh, Miller, Hankey, Feuer, & Pickle, 2002).

Despite strong evidence for a relationship between SES and cancer, the *reasons* behind the relationship are complex and the precise mechanisms are unclear (Kawachi & Kroenke, in press). One explanation is that differential access to information and knowledge could help explain the persistent disparities in health consistently observed among social groups (Viswanath, 2005). Knowledge about health, especially under conditions of extensive information flows, is unequally distributed, with people from higher SES groups knowing more than those from lower SES groups, a condition characterized as the "knowledge gap" (Tichenor, Donohue, & Olien, 1970; Viswanath & Finnegan, 1996). If so, differences in knowledge in cancer risks and holding inaccurate information potentially could be a critical contributor to the continuing cancer health disparities.

In this paper we will examine the extent of cancer-related knowledge gaps among the American public by drawing on the HINTS, a national survey of cancer communication behaviors conducted by the NCI.

Background and Significance

An estimated one third to one half of cancers are preventable, and another one third can be considered "clinically cured" with early diagnoses and effective treatments (Stein & Colditz, 2004; Stewart & Kleihues, 2003). Addressing known, modifiable risk factors such as tobacco consumption, diet and physical activity, alcohol, occupational exposures, and infections can go a long way in easing the cancer burden (Hiatt & Rimer, 1999; Stein & Colditz, 2004). To prevent these cancers, however people need to know what constitutes healthy behaviors and how they must act on them.

Communicating knowledge and potential actions that could reduce exposure to known risk factors is a critical cancer prevention strategy (Hiatt & Rimer, 1999; Kreuter, 1999). Across the cancer control continuum, knowledge plays a critical role in both primary and secondary prevention. For example, communication campaigns on knowledge about genetics and cancer risk have promoted public understanding of

risk and the importance of screening especially for persons at higher risk of cancer due to family history (Piniewski-Bond et al., 2003). Knowledge is also related to safer sun protection behaviors (Douglass, McGee, & Williams, 1997). Although we know that knowledge plays a critical role in cancer prevention, we do not know the magnitude of the role it plays.

There is evidence that public education about health risks increases awareness and facilitates healthy behavior (Hornik, 2002). Although the knowledge-behavior link is tenuous in some studies, it is widely accepted that knowledge and awareness are important steps in the causal chain leading to health behaviors. Knowledge is a necessary, even if not a sufficient, condition for behavioral adoption and maintenance. Moreover, there is a great deal of interest among the American public for health information to acquire knowledge (Chen & Siu, 2001). As a result of the American thirst for it, the amount of information available in the media and the Internet on health in general and cancer in particular has increased steadily over the last few years (Viswanath, 2005). On the World Wide Web, for example, even a casual search of the term "health information" on Google, the popular search engine, comes up with more than 15 million hits. The term "cancer information" yielded almost eight million hits. Attention in mainstream mass media to cancer and other health topics is not far behind. The news media have paid increasing attention to revolutions in biomedical sciences in the areas of human genome (Smart, 2003) and other genetics-associated discoveries, innovations in cancer detection, medical breakthroughs (Cooper & Yukimura, 2002; Ooi & Chapman, 2003; Viswanath, 2005), and cancer screening (Anhang, Stryker, Wright, & Goldie, 2004; Randolph Steele, Mebane, Viswanath, & Solomon, 2005). Mass media are an important source of learning about a variety of topics including health, and there is evidence that such learning influences behaviors of both individuals and institutions (Meissner, Potosky, & Convisser, 1992; Rakowski et al., 1990; Robinson & Levy, 1986; Viswanath & Finnegan, 2002; Yanovitzky, 2002; Yanovitzky & Blitz, 2000).

Yet, benefits from the increasing availability of information will not necessarily accrue equally among all social classes, as the knowledge gap work has documented (Tichenor, Donohue, & Olien, 1970; Viswanath & Finnegan, 1996). Increasing information flow sometimes may actually lead to widening gaps in knowledge between different SES groups because higher SES groups will acquire this new information at a faster rate than lower SES groups will. These wide gaps in knowledge may explain some of the differential risk behaviors among people and thus partially explain health disparities between different groups. A number of factors are potentially likely to lead to knowledge gaps between different SES groups (Gaziano, 1983; Viswanath & Finnegan, 1996). Critical among them include differences in attention to health information in different media, ties to community groups, interest in and engagement with the topics, presence or absence of controversy, saturation news coverage, size and complexity of the community as they influence the nature of information available in that community, and when a particular topic is defined as important to a community (Donohue, Tichenor, & Olien, 1975; Gaziano, 1983; Rucinski, 2004; Viswanath & Finnegan, 1996; Viswanath et al., 2002).

Differential knowledge and awareness levels among SES groups have been documented on other topics such as genetic testing (Wideroff, Vadaparampil, Breen, Coyler, & Freedman, 2003). Lower SES African American groups hold more myths about cancer risks and have more fatalistic views about cancer compared with higher SES white groups (Scroggins & Bartley, 1999). Formal education was found to be

positively associated with correct responses about gynecological cancers (Carlsson & Strang, 1997). Sometimes, knowledge of cancer risk may coincide with myths such as the belief that a good "base tan" could protect them against risks associated with sun exposure. The differences in knowledge may also impact upon the recent movement in health that expects people and patients to make informed and rational choices about medical decisions and maintain healthy lifestyles (Rimer, Briss, Zeller, Chan, & Woolf, 2004).

In this article we examine knowledge gaps about cancer between different SES groups, testing a partial explanation about existing health disparities by drawing on a national survey of cancer communication behaviors. The research question guiding this article revolves around the amount of attention received by cancer topic in the information environment. In general, the fundamental assumption behind the knowledge gap hypothesis is that media publicity is more likely to lead to greater knowledge gaps between different SES groups than on topics that received less attention. Yet, as previous research has shown, knowledge on topics that received extensive attention in the media, that is, saturation flows, is likely to be more evenly distributed across social groups (Viswanath & Finnegan, 1996). That is, there is a line between topics that receive some publicity as opposed to those that receive extensive publicity and its effect on the knowledge gaps. What is not clear is how this differential publicity among different topics affects knowledge levels on those topics between different SES groups. In this article we examine this relationship in the context of two cancer topics that received different levels of publicity: knowledge about tobacco and sun exposure and their respective links to cancer.

Methods

While there are several national databases that examine health behaviors such as the National Health Interview Survey (NHIS), the Behavioral Risk Factor Surveillance System (BRFSS), and NHANES among others, few national surveys of cancer communications exist that include cancer knowledge. The data for this study come from the NCI HINTS, based on a random-digit-dial (RDD) sample of all working telephones in the United States. One adult was selected at random within each household using the most recent birthday method in the case of more than three adults in a given household. Special efforts were made to over sample African Americans and Hispanics. Vigorous efforts were made to increase response rates through advanced letters and \$2 incentives to selected households.

Interviews were conducted in English and Spanish with trained interviewers between October 2002 and April 2003. The final sample size was 6,369, yielding a response rate of 55%, calculated according to the guide of "*Standard Definitions*" published by the American Association for Public Opinion Research (AAPOR, 2005). The response rate for the extended interview—that is, the rate at which sampled persons voluntarily completed the full HINTS interview—was 62.8%.

The HINTS questionnaire covered a variety of topics including questions on cancer-specific personal risk beliefs, and cancer screening, health communication, primary cancer-related risk behaviors, cancer history, general cancer knowledge, household screener, and health status/demographics. More details on HINTS methods and questions can be found in the article by Nelson and colleagues (2004).

Measures

Cancer knowledge was measured by asking the respondents to say whether exposure to certain “risk” factors will affect a person’s chances of getting cancer: “I am going to read things that may affect a person’s chances of getting cancer. Do you think that (FILL EXPOSURE) increase(s) a person’s chances of getting cancer a lot, a little, not at all, or do you have no opinion?” For this article, we focused on two risk factors that are related to cancer: tobacco use and exposure to the sun.

We used two indicators for SES. Education was measured by asking the “highest grade of school they have completed.” The responses were classified into two groups: high school graduate or less, some college or more.

The median U.S. household income in 2003 was \$43,318. We therefore used \$50,000 as the cut-off point for income. We also measured race/ethnicity: Hispanic, non-Hispanic White, Non-Hispanic Black or African American, and non-Hispanic (other or multiple).

Attention was measured by asking how much attention respondents paid to health from different sources such as television, newspapers, and the Internet and were classified as “some or a lot” or “a little or not at all.”

Other covariates included age (18–44, 45–64, 65+), health care coverage (yes or no), and confidence about getting cancer information (very confident versus somewhat confident or less).

In order to establish the population’s potential differential exposure to media coverage, we searched major news databases for the amount of attention given tobacco use and sun exposure and their link to cancer. We looked at the number of stories published on national television news, major ethnic newspapers and major mainstream newspapers between January 1, 2002, and December 31, 2003, to coincide with the HINTS data collection between October 2002 and April 2003. Media attention to cancer risk factors was assessed as the number of stories published/broadcast mentioning tobacco or sun exposure and cancer. The print and television media environment was assessed using Lexis Nexis’s U.S. news publications; Vanderbilt University’s TV News Archive of national broadcasts from ABC, CBS, NBC, and CNN; and Ethnic NewsWatch’s database of about 300 English- and Spanish-language ethnic publications. The following search terms entered into each of these databases/archives: tobacco or smoking or cigarettes and cancer and sun or tanning and cancer or melanoma. As the data in Figures 1–3 indicate, the link among tobacco use, smoking, and cancer garnered much more attention in the media of all types compared with sun exposure and cancer. In fact, there were no stories on sun exposure and skin cancer on national television newscasts in the years 2002 and 2003.

Analysis

For our analysis, we chose outcome measures from HINTS for which scientific evidence provides correct answers. We examined knowledge about whether respondents thought that their chances of getting cancer were “increased a lot or some” by two outcomes: (1) smoking and (2) sun exposure. To test the knowledge gap hypothesis, we included household income and educational attainment in our model controlling for other covariates including age, race/ethnicity, kind of health care coverage, confidence about getting cancer information, and whether respondents paid at least some attention to medical sources about health or medical topics.

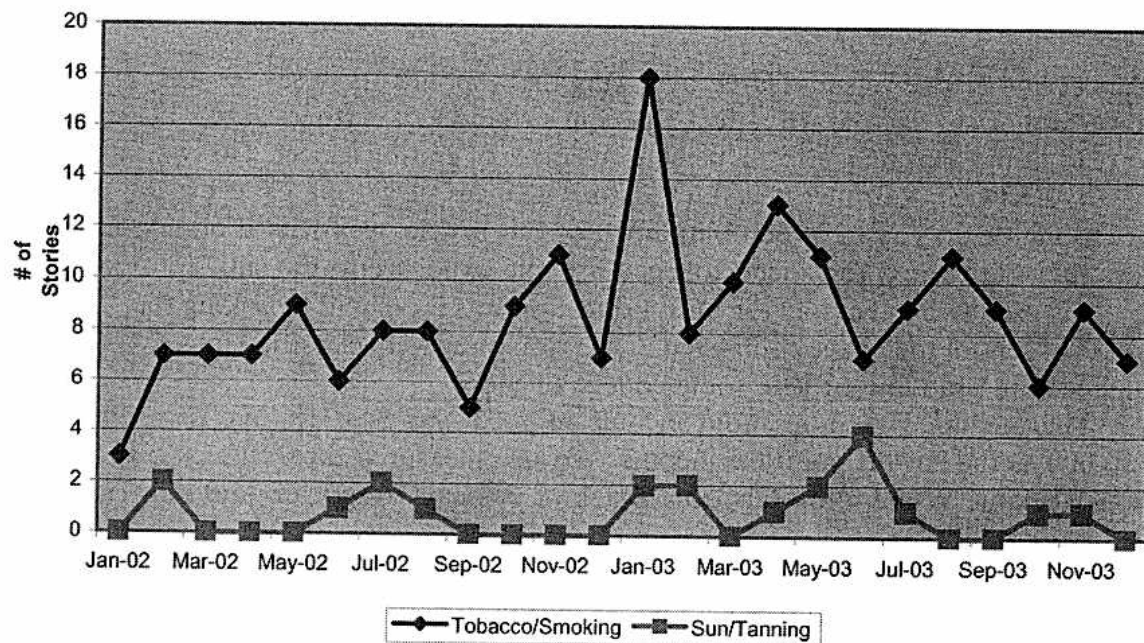


Figure 1. Ethnic print coverage of tobacco, sun exposure, and cancer, 2002–2003.

We examined the characteristics and responses to information about health and medical information reported by the respondents in our study. We then used logistic regression analysis to examine predictors of our two different outcomes. We first examined variables that the literature suggests would shape our outcomes independently. We then examined them using the same set of variables; however, instead of measuring the independent effects of all variables, income and education as well as race/ethnicity and education were included as interactions in this second model. Logistic regression results are presented as predicted marginals. Predicted marginals

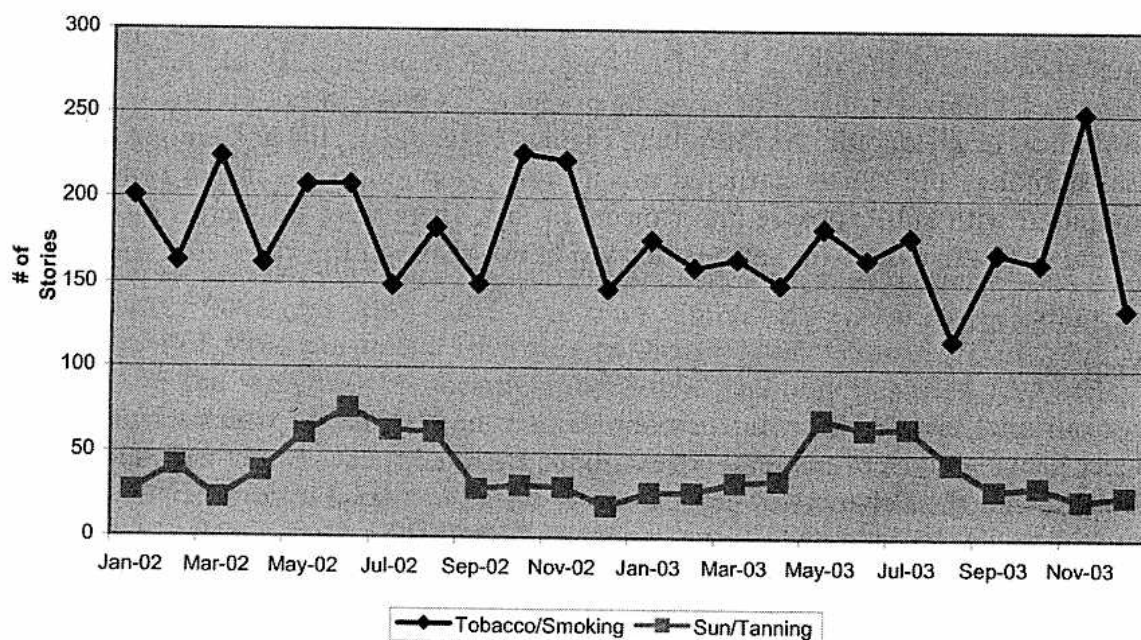


Figure 2. U.S. print coverage of tobacco, sun exposure, and cancer, 2002–2003.

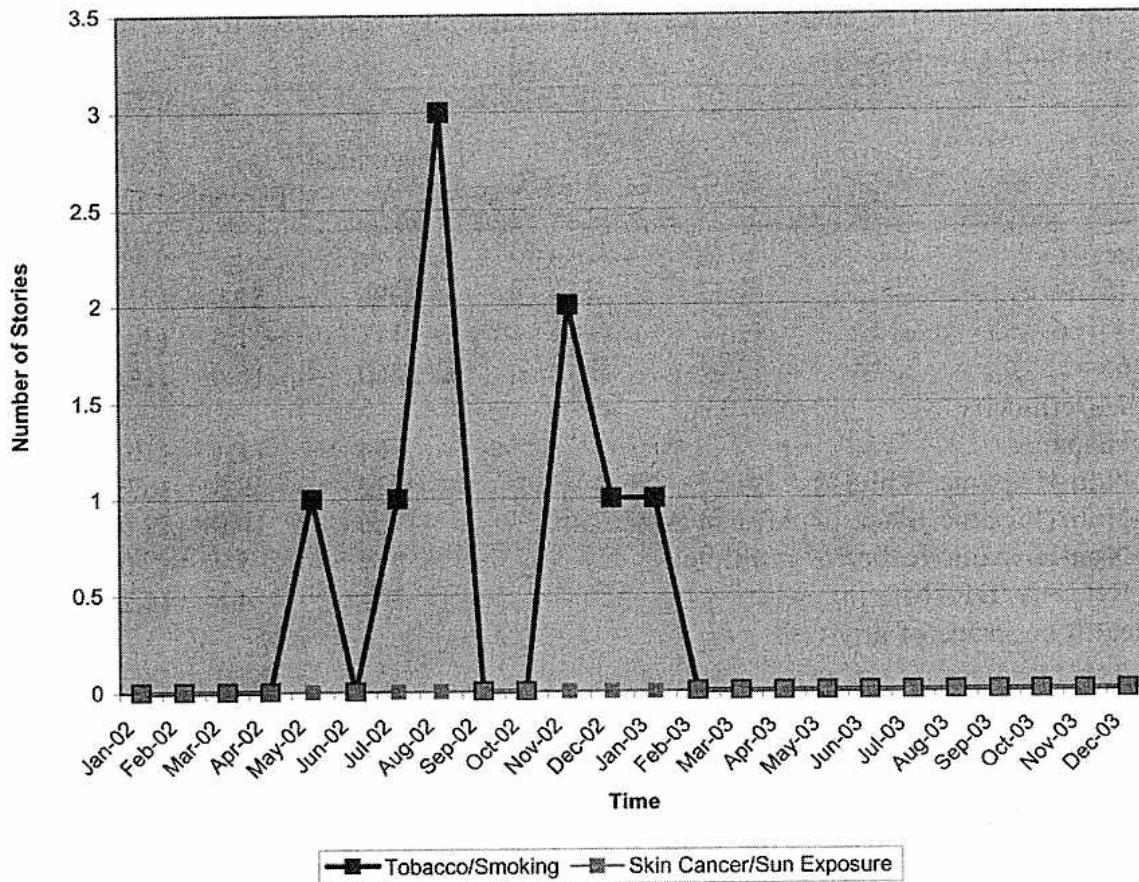


Figure 3. Television news coverage of tobacco, sun exposure, and cancer, 2002–2003.

are standardized results calculated from odds ratios (Graubard & Korn, 1999) that can be interpreted and compared as if they were percentages. Ninety-five percent confidence intervals and *P* values for the Wald contrast analysis are shown.

Results

Table 1 shows respondent characteristics and their responses for information about health and medical information. More than half (52%) of respondents were under age 45 and only 16% were 65 or older. Most were non-Hispanic White (68%). Similar proportions reported Hispanic (11%) and black (10%) race/ethnicity. The vast majority (85%) of respondents reported having health care coverage, and 82% had seen a health care professional in the past year. The majority (63%) was very confident that they would be able to find cancer information. Most paid at least some attention to information about health or medical topics including 70% to television, 55% to newspapers, and 28% to the Internet. Almost 60% of the sample reported an annual household income of \$50,000 or less per year. Almost 50% of the sample had not graduated from high school.

Multivariate Analyses

Table 2 shows how correctly responding to the two outcome variables are associated with each predictor in the model. Both having more than a high school degree and

Table 1. Descriptive characteristics of the sample and responses to selected communication variables

	Unweighted <i>N</i>	Percent	95% Confidence interval
Age			
18–44	2996	51.9	(51.2–52.7)
45–64	2113	31.6	(30.9–32.4)
65+	1260	16.4	(16.0–16.8)
Race/ethnicity			
Hispanic	764	11.1	(10.9–11.4)
Non-Hispanic White	4276	68.3	(67.3–69.2)
Non-Hispanic Black or African American	716	10.0	(9.6–10.4)
Non-Hispanic (other or multiple)	312	5.7	(5.0–6.5)
Ref/NA/DK/Missing	301	4.8	(4.2–5.5)
Health coverage of any type			
Yes	5357	85.4	(84.3–86.4)
No	777	14.6	(13.6–15.7)
Confident that you would find cancer information?			
Very confident	3956	62.6	(61.1–64.1)
Somewhat confident or less	2359	37.4	(35.9–38.9)
Saw a doctor or other health care professional in the past 12 months			
Yes	5313	81.6	(80.3–82.9)
No	1026	18.4	(17.1–19.7)
Paid “some” or “a lot” of attention to information about health or medical topics			
TV	4584	70.4	(68.8–71.9)
Newspaper	3612	54.7	(53.3–56.1)
Internet	1848	27.9	(26.6–29.3)
Household income			
<\$50,000	3454	59.8	(58.2–61.5)
≥\$50,000	2169	40.2	(38.5–41.8)
Educational attainment			
≤HS grad	2575	48.9	(48.6–49.1)
>HS grad	3564	51.1	(50.9–51.4)

Source: 2003 Health Information National Trends Survey.

having a household income of at least \$50,000 predicted correct responses to the question about smoking greatly increasing a person's chances of getting cancer. Other characteristics of respondents who believed smoking greatly increases a person's chances of getting cancer included being younger, paying some or lot of attention to information about health or medical topics in newspapers (but not television or the Internet), having confidence they would be able to find cancer information, and having health care coverage.

Table 2. Percentage of respondents who say exposure to risk factor "increases a person's chances of getting cancer a lot" by income, educational attainment, race/ethnicity and other factors

	Smoking			Sun exposure		
	Unweighted <i>N</i>	Predicted marginal (95% CI)	<i>P</i> value (Wald contrast)	Unweighted <i>N</i>	Predicted marginal (95% CI)	<i>P</i> value (Wald contrast)
Age						
18-44	1323	86.8 (83.9-89.8)	0.0380	1315	64.3 (61.0-67.6)	0.9214
45-64	946	83.8 (80.7-86.8)		896	65.4 (60.7-70.1)	
65+	468	80.9 (76.2-85.5)		504	64.8 (59.6-70.1)	
Race/ethnicity						
Hispanic	344	88.3 (84.9-91.7)	0.1919	339	67.5 (62.5-72.5)	0.0000
Non-Hispanic White	1950	84.8 (82.2-87.4)		1898	68.8 (65.7-71.9)	
Non-Hispanic Black or African American	317	82.2 (78.0-86.5)		330	44.2 (37.5-50.9)	
Non-Hispanic (other or multiple)	126	82.8 (73.0-92.5)		148	47.8 (36.7-58.8)	
Do you have any kind of health coverage?						
Yes	2374	86.1 (83.9-88.3)	0.0225	2397	65.1 (62.8-67.5)	0.4148
No	363	79.5 (73.4-85.6)		318	62.0 (54.9-69.2)	
How confident are you that you would find cancer information?						
Very confident	1750	86.3 (83.7-88.8)	0.0368	1685	66.6 (63.7-69.5)	0.0437
Somewhat confident or less	987	82.9 (79.9-85.8)		1030	61.8 (58.1-65.4)	
Saw a doctor or other health care professional in the past 12 months						
Yes	2260	85.2 (82.8-87.7)	0.6040	2326	66.0 (63.5-68.6)	0.0179
No	477	84.0 (79.8-88.3)		389	58.2 (52.3-64.2)	

(Continued)

Table 2. Continued

	Smoking			Sun exposure		
	Unweighted <i>N</i>	Predicted marginal (95% CI)	<i>P</i> value (Wald contrast)	Unweighted <i>N</i>	Predicted marginal (95% CI)	<i>P</i> value (Wald contrast)
Attention to information about health or medical topics on TV						
Some or a lot	1945	85.7 (82.8–88.5)	0.3370	2019	66.6 (63.8–69.3)	0.0330
A little or not at all	792	83.5 (80.2–86.9)		696	60.0 (55.0–65.1)	
Attention to information about health or medical topics in newspapers						
Some or a lot	1569	86.8 (84.2–89.4)	0.0465	1550	68.5 (65.5–71.5)	0.0007
A little or not at all	1168	83.0 (79.9–86.2)		1165	60.4 (56.9–63.8)	
Attention to information about health or medical topics on the Internet						
Some or a lot	822	87.6 (84.7–90.5)	0.0697	821	70.2 (65.8–74.6)	0.0059
A little or not at all	1915	84.2 (81.5–86.8)		1894	62.7 (60.1–65.3)	
Household income						
<\$50,000	1669	83.7 (81.1–86.2)	0.0185	1662	63.6 (60.1–67.0)	0.2750
≥\$50,000	1068	87.5 (84.6–90.3)		1053	66.6 (63.0–70.2)	
Educational attainment						
≤HS grad	1127	82.7 (79.5–85.8)	0.0046	1094	60.7 (56.8–64.6)	0.0022
>HS grad	1610	87.7 (85.3–90.0)		1621	68.5 (65.8–71.2)	

Source: 2003 Health Information National Trends Survey.

Program: /prj/brp/hints/breen/knowledge_gap_income/tables2-3.04-26-2005.sas.

Of the two SES indicators, only having more than a high school education predicted the correct answer that sun exposure greatly increases a person's chances of getting skin cancer. Household income was not associated with knowledge about sun exposure causing cancer.

Other characteristics of respondents who believed sun exposure greatly increases a person's chances of getting cancer include reporting White or Hispanic race/ethnicity, having confidence they would be able to find cancer information, having seen a health care professional in the past 12 months, and paying attention to health or medical topics regardless of whether the source was television, newspapers, or the Internet.

Table 3 shows results of models similar to those presented in Table 2, except these models also included two interaction terms. The interactions we tested were (1) race/ethnicity with educational attainment and (2) household income with educational attainment. Significantly associated with knowledge that smoking causes cancer were age, health insurance coverage, confidence in ability to find cancer information, and attention to information in the newspapers and on the Internet. Neither interaction was significant, and confidence intervals for the different values overlapped. There was, nevertheless, a large difference in the percentages that answered correctly at the two ends of the SES spectrum (high education and high income and low education and low income). Otherwise, the patterns were consistent with those seen in Table 2 for smoking.

Significantly associated with knowledge that sun exposure causes cancer were confidence in ability to find cancer information, having seen a health care professional in the past year, and paying attention to health or medical topics regardless of the communication channel. Similar to findings for smoking, patterns were consistent with those seen in Table 2 for this outcome. The differences between lowest and highest education/income groups were large, though not significant. Interestingly enough, while there are no differences among more or less educated Hispanics or Blacks, Whites with high school or less education were less knowledgeable about the relationship between sun exposure and skin cancer compared with more educated Whites.

Discussion and Implications

We tested the premise that one contributor to the reported health disparities in cancer is differential knowledge about potential causes of cancer between socioeconomic status groups. Drawing from the knowledge gap hypothesis we expected to find that socioeconomic status is related to knowing about the link among smoking, sun exposure, and cancer. We also expected that the heavy attention to smoking and cancer in the news media may attenuate the relationship between SES and cancer knowledge, while the relatively modest media attention to the link between sun exposure and cancer may be associated with knowledge gaps.

In contrast to our expectations, the two indicators of SES, education and income, were significantly associated with awareness of the link between smoking and cancer despite the heavy attention this topic received in the news media when the survey was conducted. This knowledge, however, is distributed uniformly across racial and ethnic groups. In contrast, having at least a high school education is the only significant SES predictor of awareness of the link between sun exposure and skin cancer. We also found that among Whites, the most susceptible group to skin

Table 3. Interaction models showing the percentage of respondents who say exposure to risk factor “increases a person’s chances of getting cancer a lot” by income, educational attainment, race/ethnicity and other factors

	Smoking			Sun exposure		
	Unweighted N	Predicted marginal (95% CI)	P value (Wald contrast)	Unweighted N	Predicted marginal (95% CI)	P value (Wald contrast)
Age						
18-44	1323	86.8 (83.7-89.8)	0.0703	1315	64.4 (61.1-67.6)	0.9358
45-64	946	83.7 (80.6-86.8)		896	65.4 (60.6-70.2)	
65+	468	81.3 (76.8-85.9)		504	64.6 (59.3-69.9)	
Race/ethnicity Education Interaction						
Hispanic <=HS grad	227	86.8 (82.5-91.1)	0.1723	224	66.5 (60.6-72.5)	0.1394
Hispanic > HS grad	117	91.4 (84.6-98.2)		115	63.6 (53.0-74.2)	
Non-Hispanic White <=HS grad	718	83.3 (79.7-86.8)		683	63.3 (58.5-68.1)	
Non-Hispanic white > HS grad	1232	87.4 (84.9-90.0)		1215	73.5 (70.3-76.6)	
Non-Hispanic Black or African American <= HS grad	140	81.6 (75.4-87.7)		139	38.0 (27.0-49.1)	
Non-Hispanic Black or African American > HS grad	177	83.4 (76.2-90.6)		191	49.4 (41.4-57.4)	
Non-Hispanic (other or multiple) <= HS grad	42	72.1 (54.4-89.8)		48	52.8 (32.5-73.2)	
Non-Hispanic (other or multiple) >HS grad	84	93.6 (87.6-99.6)		100	44.4 (31.2-57.5)	
Do you have any kind of health coverage?						
Yes	2374	86.1 (83.8-88.3)	0.0277	2397	65.3 (62.9-67.7)	0.2926
No	363	79.7 (73.7-85.7)		318	61.2 (53.9-68.5)	

How confident are you that you would find cancer information?						
Very confident	1750	86.3 (83.8–88.9)	0.0269	1685	66.5 (63.7–69.4)	0.0528
Somewhat confident or less	987	82.7 (79.7–85.6)		1030	61.9 (58.2–65.6)	
Saw a doctor or other health care professional in the past 12 months						
Yes	2260	85.2 (82.8–87.6)	0.6324	2326	66.1 (63.5–68.6)	0.0145
No	477	84.1 (79.8–88.4)		389	58.0 (52.1–64.0)	
Attention to information about health or medical topics on TV						
Some or a lot	1945	85.6 (82.8–88.5)	0.3763	2019	66.5 (63.8–69.3)	0.0428
A little or not at all	792	83.7 (80.3–87.0)		696	60.2 (55.0–65.3)	
Attention to information about health or medical topics in newspapers						
Some or a lot	1569	86.8 (84.2–89.3)	0.0449	1550	68.5 (65.6–71.5)	0.0006
A little or not at all	1168	83.0 (79.9–86.2)		1165	60.3 (56.9–63.7)	
Attention to information about health or medical topics on the Internet						
Some or a lot	822	87.7 (84.8–90.6)	0.0538	821	70.3 (65.9–74.7)	0.0047
A little or not at all	1915	84.1 (81.5–86.7)		1894	62.6 (60.1–65.2)	
Household income and educational attainment						
>=\$50,000 and >HS grad	857	89.0 (85.9–92.1)	0.3453	845	70.3 (66.7–73.9)	0.6507
<\$50,000 and >HS grad	753	87.3 (84.5–90.0)		776	66.4 (62.3–70.5)	
>=\$50,000 and <=HS grad	211	87.2 (82.5–91.9)		208	61.5 (53.8–69.1)	
<\$50,000 and <=HS grad	916	80.5 (76.6–84.5)		886	59.7 (54.4–65.0)	

Source: 2003 Health Information National Trends Survey.
Program: /prj/brp/hints/breen/knowledge_gap_income/tables2-3.04-26-2005.sas.

cancer, the more educated Whites knew more about the link between sun protection and skin cancer compared with less educated Whites.

Our findings suggest some important clues about how differential media coverage leads to differential awareness about two causal links, one between smoking and cancer and the other between sun exposure and cancer. Although education was a significant predictor of knowledge of the links between smoking and cancer and between sun exposure and cancer, the percentage of respondents who are aware of the link between smoking and cancer is higher compared with those who were aware of the link between sun exposure and cancer. This suggests that heavy media attention did contribute to the higher knowledge levels on smoking though there are still differences between SES groups.

Second, in addition to education, other covariates that emerged as significant predictors of awareness of the sun exposure and cancer link include confidence in finding cancer information, seeing a doctor or other professional in the past 12 months, and attention to health information on television, in newspapers, and on the Internet. This suggests that in the absence of extensive coverage in the media, people may become aware of knowledge about an issue only when they either actively seek information or obtain it from other sources such as a physician, both of which are related to socioeconomic advantage. Whether media publicity could potentially obviate the need for active seeking, a characteristic of those with more education, is a proposition worthy of future research.

There are sharp disparities in knowledge between the "information rich" and the "information poor," particularly between groups at both ends of the spectrum: those with more than a high school education and an annual household income greater than \$50,000 versus those with less than a high school education and an annual household income of less than \$50,000. Our most important finding confirms the hypothesis that those poor in material and educational resources are also "information poor." We found this was true regardless of the level of media saturation or percent awareness about the risk factor.

Race and ethnicity are routinely treated as homogeneous groups, but our study indicates that future analyses should be sensitive to SES differences even within racial/ethnic subgroups. For example, even though there are no major differences between more and less educated respondents among different racial/ethnic groups on smoking, such gaps were more evident on sun exposure and cancer. That is, when there is no heavy news coverage, the more educated are more likely to know more than less educated even within different racial and ethnic groups.

Another interesting result for knowledge about sun exposure and skin cancer is worth noting. We found that African Americans know the least about skin cancer and sun exposure regardless of their educational status (Table 3). Given that African Americans as a group are less vulnerable to skin cancer than other groups, this knowledge is less salient to them and therefore there is less of a need to know about the link. Knowledge gaps between SES groups are likely to emerge when information is less salient (Ettema & Kline, 1977). At the same time, the fact that more educated Whites were more aware compared with less educated Whites should give us pause and could be important in understanding disparities. This suggests that it is necessary to take into account the SES variation within different racial and ethnic groups rather than to mask them by treating the group as one.

Attention to media plays a significant role in becoming aware of cancer and its causes. Specifically, attention to newspapers is positively related with knowledge on

both topics, while television is not positively related for smoking; over 80% of respondents know about this link whether or not they pay attention to health or medical topics on television. Newspapers have the space to provide more detailed information on health and with special health sections are able to cover issues more often and more prominently. It is easy to seek health information in newspapers should one be interested. Television news, on the other hand, despite some attention to health, is unlikely to produce detailed information given the short time spent on each story. Often, the stories are short announcements about different developments in health with little or no details. While television has the potential to narrow knowledge gaps, whether the current structure of the news will allow for detailed dissemination on cancer is an empirical question.

In summary, our analyses of data from a major national survey suggest that differential knowledge levels of causes of cancer between SES groups are one potential explanation of cancer disparities that have been extensively reported in the literature. It is evident that high income and high education are associated with awareness about causes of major cancers such as of lung and skin, and may allow people to protect themselves and minimize their risks. Our data also show that heavier media attention could attenuate the knowledge gaps, though moderate publicity or lack of news coverage may actually widen them. Given the limited resources of public health, it is worth thinking about how best to attract news media attention, which can provide "free" publicity in contrast to paid campaigns that could be expensive whether done at local or national levels.

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