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Publisher: Routledge

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Health Communication

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/hhth20>

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Version of record first published: 22 Feb 2012.

To cite this article: Chul-joo Lee, A. Susana Ramírez, Nehama Lewis, Stacy W. Gray & Robert C. Hornik (2012): Looking Beyond the Internet: Examining Socioeconomic Inequalities in Cancer Information Seeking Among Cancer Patients, *Health Communication*, 27:8, 806-817

To link to this article: <http://dx.doi.org/10.1080/10410236.2011.647621>

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Looking Beyond the Internet: Examining Socioeconomic Inequalities in Cancer Information Seeking Among Cancer Patients

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The gap in cancer information seeking between high-socioeconomic-status (high-SES) cancer patients and low-SES cancer patients deserves serious attention, considering the importance of information and knowledge in cancer control. We thus explored the association of SES, as measured by education, with cancer patients' overall cancer information seeking, and with seeking from each source (i.e., the Internet, mass media, medical sources, and nonmedical interpersonal sources) and across two topic categories (i.e., treatment, quality of life). We then asked whether the effect of education on treatment information seeking is reduced among those who are particularly motivated to control treatment choices. We conducted a survey with breast, prostate, and colon cancer patients diagnosed in 2005 ($n = 2,013$), who were randomly drawn from the Pennsylvania Cancer Registry in the fall of 2006. We found that education was more strongly associated with Internet use than with the use of other sources regardless of topics. Also, when information was sought from mass media, education had a greater association with treatment information seeking than with quality-of-life information seeking. Preference for active participation in treatment decision making, however, did not moderate the effect of education on treatment information seeking. The implications of these findings for public health research and cancer patient education were discussed.

The information revolution in the United States allowed for a rapid increase in the amount of cancer-related information that is available to cancer patients (Kreps & Neuhauser,

2010; Viswanath, 2005). Simultaneously, changes in the current U.S. health care system have led to a paradigm that emphasizes patients' active role in managing their disease and thus encourages patients to actively seek out cancer information outside their doctor's office (Kaplan & Frosch, 2005). Given these two trends, it is important to understand how cancer patients navigate today's complex information

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environment and how they acquire cancer-related information from a variety of medical and nonmedical sources (Arora et al., 2008; Finney-Rutten, Arora, Bakos, Aziz, & Rowland, 2005; Johnson, 1997). While a number of studies have addressed these issues, questions remain about (1) whether there are any systematic differences in cancer information seeking between high- and low-socioeconomic status (SES, hereafter) cancer patients, and (2) what factors moderate the effect of SES on cancer information seeking among cancer patients.

To directly address these issues, we first examine whether cancer patients with high SES (measured by education) are more likely to engage in cancer information seeking than cancer patients with low SES using statewide representative survey data with breast, prostate, and colon cancer patients in Pennsylvania. Many studies have shown that there is an association between education and information seeking; we explore that association in detail with a new high-quality sample of cancer patients. We ask how that association varies across sources and across two distinct topics, and then ask whether the effects of education are reduced among those who are particularly motivated to control treatment choices. In doing so, we aim to help public health practitioners develop a more efficient communication strategy aimed at reaching particular population subgroups with appropriate public-health-intervention messages over effective communication channels.

THE EFFECT OF EDUCATION ON CANCER INFORMATION SEEKING

Exploring the socioeconomic disparities in cancer information seeking is practically and theoretically important. Many studies have reported that cancer patients who seek out health information more frequently and thus possess higher levels of health knowledge are more likely than others to actively participate in medical decision making, to be satisfied with their medical services, to engage in healthy lifestyle behaviors, and to ultimately achieve better health outcomes (for an overview, see Huang & Penson, 2008). Therefore, there is a concern that differences in cancer information seeking among high- and low-SES cancer patients may lead to disparities in cancer treatment, quality of life, and death rates from cancer among different SES groups.

Theoretically, examining cancer patients' cancer information seeking may inform the long-standing scholarly debates on the interactive effects of SES and motivation on information seeking and subsequent knowledge gains. One group of scholars argues that more educated cancer patients will be more likely to seek cancer information from a wide range of information sources than their less educated

counterparts (as is seen with people in the general public; e.g., Johnson, 1997; Viswanath, 2005). In contrast, another group of scholars contends that situational factors, such as a cancer diagnosis, may mitigate the gaps in information seeking and knowledge between groups of different education levels (Ettema, Brown, & Luepker, 1983; Kwak, 1999). This is based on the *motivation-contingency model*, which posits that even low-SES individuals are likely to look actively for information (and can obtain high levels of knowledge) when they are highly motivated or interested in a specific issue (Bonfadelli, 2002; Kwak, 1999). According to this model, when faced with issues that are highly relevant and interesting, both high-SES and low-SES groups will be motivated to seek out information, and there will be small gaps in information seeking and knowledge. Being diagnosed with a serious and life-threatening disease, such as cancer, may motivate both more educated and less educated individuals to actively seek out cancer-relevant information (Finney-Rutten et al., 2005; Johnson, 1997). Given the multiple, complex decisions that a patient faces over the course of his or her cancer journey, cancer patients may have a strong need for information about multiple topics over time, including health care providers, hospitals, treatment options, side effects, and quality-of-life issues (Finney-Rutten et al., 2005; McInnes et al., 2008). If the *motivation-contingency model* is accurate, less educated cancer patients might engage in cancer information seeking as actively as their more educated counterparts.

Some empirical studies have examined the association between education and cancer patients' cancer information seeking and reported positive associations between education and cancer information seeking (e.g., Bylund, Gueguen, D'Agostino, Imes, & Sonet, 2009; Carlsson, 2000). However, most previous studies in this area have used convenience samples of patients from cancer clinics, hospitals, or online communities, rather than a population-based sample. In order to evaluate whether the findings from these smaller, less representative populations are more generalizable, it is necessary to examine the effect of education on cancer information seeking in a representative population of cancer patients. Thus, we start with the foundational hypothesis:

H1: Education will be related to overall information seeking across sources and across topics.

We then turn to elaboration of this basic expected finding and generate the following research question:

RQ1: Will education increase the odds of seeking cancer information from medical sources, the Internet, mass media, and nonmedical interpersonal sources?

SOCIOECONOMIC DISPARITIES IN CANCER INFORMATION SEEKING BY SOURCE, BY TOPIC, AND BY MOTIVATION

In addition to exploring the main effect of education on information seeking, we are also interested in how that association might vary by source, by topic category, and by individual differences in motivation. In the following sections, we provide an overview of the research on each of these factors, thereby clarifying the reasons why we expect that each variable may moderate the effect of education on information seeking.

Channels: The Internet Versus Traditional Information Sources

Given that information sources differ in terms of the literacy and communication skills that are required for their use (Bonfadelli, 2002; DiMaggio, Hargittai, Celeste, & Shafer, 2004), education may differentially affect the use of medical sources, nonmedical mediated and interpersonal channels, and the Internet for cancer information acquisition. However, little is known about whether particular information channels are more susceptible to socioeconomic disparities than others. Therefore, additional data about the usefulness of various information channels for patients of different education levels will be valuable—particularly if we find that information seeking is lower among patients with low education as compared to patients with high education.

In this study, we focus primarily on the differences between the Internet and other traditional health information sources. Recently, the Internet has received much attention as a potentially effective and efficient tool for cancer education because it provides a readily accessible, almost unlimited amount of cancer information to cancer patients (Gustafson, Brennan, & Hawkins, 2007; Kreps & Neuhauser, 2010). However, given that cancer patients still depend on health care professionals, mass media, family and friends, support groups, and other patients, in addition to the Internet, to acquire cancer-relevant information (Arora et al., 2008; Carlsson, 2000), comparative descriptive statistics about the use of each source are warranted. Thus, before comparing the Internet with other information sources in terms of the susceptibility to socioeconomic disparities, we propose the following research question:

RQ2: What proportion of cancer patients seek cancer information from the Internet vis-à-vis the proportion who report seeking it from other sources?

Then, which information channel shows more gaps in its use between high- and low-SES cancer patients?

The Internet versus mass media. We expect that cancer information seeking on the Internet is influenced by users' education more strongly than cancer information seeking via mass media. Some scholars have argued that knowledge gaps in mass media stem from differences in topic-related interest or involvement rather than from differences in cognitive abilities because "the sort of information disseminated by the mass media . . . is *not* so complicated that it requires highly sophisticated information processing skills" (Ettema et al., 1983, p. 517; see also Kwak, 1999). Thus, less educated cancer patients may seek health information from mass media as frequently as more educated cancer patients. Contrary to mass media, users' consumption of the Internet requires active engagement and search skills (Bonfadelli, 2002; DiMaggio et al., 2004). That is why the Internet may make it more difficult for less educated users to navigate, process, evaluate, and understand online information than for more educated users. Moreover, online health information was found not to be easy to comprehend for those with low levels of education because of their lack of health literacy and online search skills (Gustafson et al., 2007). In addition, because much online health information does not go through an editorial process, which is typical for mass-mediated information, users are required to have critical appraisal skills in judging the credibility of online health information (Kreps & Neuhauser, 2010). Because people with high levels of education have better communication skills and comprehension abilities in general and online literacy or Internet-related skills specifically (Schnittker, 2005; Tichenor, Donohue, & Olien, 1970), their relative advantage in terms of cancer information seeking may be more evident in the case of the Internet than in other information sources. These considerations lead us to propose the following hypothesis:

H2: Cancer information seeking on the Internet will be influenced by education more strongly than cancer information seeking from mass media.

The Internet versus interpersonal sources. Aside from mass media and the Internet, health professionals and lay people are also very important sources of health information (Brashers, Goldsmith, & Hsieh, 2002; Dutta-Bergman, 2004). However, unlike in the case of the Internet and mass media, there is insufficient research to allow us to propose a hypothesis comparing the size of the effect of education on patients' use of the Internet and medical/non-medical interpersonal sources. Thus, we posit the following research question:

RQ3: Is the effect of education on cancer information seeking stronger for the Internet than for medical and non-medical interpersonal sources?

Topics: Treatment Options Versus Quality-of-Life Issues

We next examine whether cancer patients with low levels of education have more problems understanding certain types of information than their more educated counterparts. Many surveys of health information seeking have measured this practice through only one or two broad questions, for example asking people how often they or their caregivers have sought health or cancer information. Even though these measures can show an overall association, general information-seeking behaviors do not explain how education is related to the types of information sought and found from a variety of sources. Because understanding what specific information low-SES cancer patients do not obtain is crucial for counseling and educating low-SES cancer patients, we investigate whether the effect of education on cancer information seeking varies across topics.

To be more specific, we divide cancer-relevant information into two categories: treatment options and quality-of-life issues. Many studies on the knowledge-gap phenomenon reported that knowledge gaps among SES groups occurred mostly in complex topics (Viswanath & Finnegan, 1996). Information about quality-of-life issues (e.g., specific symptoms, emotional support) tends to be written in plain, everyday language. In contrast, because information about treatment options is often written in technical language (e.g., probabilistic, relative risk estimates of each treatment option and medical jargon) and requires basic health literacy, cancer patients with low levels of education may feel less competent in seeking treatment information than their more educated counterparts. Therefore, we expect the following:

H3: The magnitude of the effect of education on cancer information seeking will be greater for treatment information than for quality-of-life information.

Motivation: Preference for Active Participation in Treatment Decision Making

As outlined earlier, examining the association between education and information seeking among cancer patients provides a unique opportunity to test the motivation-contingency model, which argues that motivation moderates the effect of education on health information seeking. However, a health condition itself may not necessarily predict health information seeking because there may be large individual differences in motivation to look for information about diagnosis, treatment, prognosis, and side effects of any disease among patients (Ayers & Kronenfeld, 2007; Finney-Rutten et al., 2005). Thus, we consider cancer patients' interest in taking an active role in treatment decisions as a potential moderator of the effect of education on treatment information seeking. This variable, however, taps issue involvement only in treatment options, not in motivation to seek information with regard to quality-of-life decisions. Because our survey does not include motivation measures related to quality-of-life issues, we cannot test the

moderating effect of motivation on the association between education and seeking information about quality-of-life issues.

It was found that cancer patients who want to play a leadership role in treatment decision making are more likely to seek treatment-related information than those who are passive in the decision making process (Kaplan & Frosch, 2005; Lee, Gray, & Lewis, 2010). This may, in part, overcome the influence of their educational background. This would lead to an expectation that education level exerts weaker effects on those who are highly motivated to be in control of treatment decision making than on those who are passive in the treatment decision-making process. Thus, it is proposed:

H4: The effect of education on treatment information seeking will be weaker among cancer patients with high (vs. low) levels of preference for active participation in treatment decision making.

METHODS

Data Source

A sample of 2,013 patients diagnosed in 2005 (all patients received a cancer diagnosis within a year prior to their participation in this study) with any of three commonly diagnosed cancers (breast—women only, prostate—men only, colorectal) was drawn in the fall of 2006. The sample, stratified by cancer, was randomly selected from the list of all diagnosed patients through the Pennsylvania Cancer Registry (PCR). By law, Pennsylvania requires that all cancer cases be reported within 6 months of diagnosis. The sampling frame for this study was comprised of the approximately 95% of all cancer cases expected to be included in the PCR.

The response rates for the primary sample were 68%, 64%, and 61% for the breast, prostate, and colorectal cancer patients, respectively (overall response rate = 64%; using American Association for Public Opinion Research, 2006, response rate #4).¹ Of 2,972 people originally sampled across the three types of cancer, 1,641 returned usable questionnaires, 64 responded but claimed to have no cancer, and 347 were estimated to have died. Mortality estimates were based on Surveillance Epidemiology and End Result (SEER) cancer mortality information and Centers

¹AAPOR response rate number 4 refers to the method by which the response rate was calculated for the survey. The American Association for Public Opinion Research has created standardized definitions of response rates, which distinguish between response rates and cooperation rates, cover household, telephone, mail, and Internet modes of administration, discuss the criteria for ineligibility, and specify methods for calculating refusal and noncontact rates. As a result, response and nonresponse rates can now be successfully compared across surveys of different topics and organizations. In addition, these definitions and their widespread acceptance have resulted in a greater willingness of researchers to report low response rates. AAPOR recommends that researchers include in their survey reports the response rate, computed according to the appropriate AAPOR formula—in this case the appropriate response rate number 4.

TABLE 1
Descriptive Statistics of the Weighted Sample

	<i>n</i>	<i>M</i>	<i>SD</i>
Age	2,012	66.16	12.38
Gender	2,010	Female 50.9%	
Education in years	1,979	13.14	2.57
Race/ethnicity	2,013		
Non-Hispanic White		85.6%	
Non-Hispanic Black		10.5%	
Latino		3.3%	
Other		0.6%	
Marital status	1,979	67.1% currently married	
Employment status	1,487	32.5% currently employed	
Cancer stage	1,967		
In situ or local		60.8%	
Regional spread		21.4%	
Metastasis		15.5%	
Self-rated health (1–5)	2,013	2.14	.87
Preference for active participation in treatment decision making (1–5)	1,917	3.21	.84
Type of cancer	2,013		
Breast cancer		33.7%	
Prostate cancer		32.3%	
Colon cancer		34.0%	

Note. This table provides the descriptive statistics of the unimputed, weighted sample.

for Disease Control (CDC) Pennsylvania overall mortality information, taking into account age and time since diagnosis at the date questionnaires were distributed. There was subsequent oversampling for colorectal cancer, stage 4, and African American respondents to increase sample sizes for analyses of those subgroups (adding 372 cases to the sample). For the sample characteristics, see Table 1.

Measures

Cancer information seeking. Respondents were asked about the sources from which they sought cancer information for two specific topic areas: treatment options and quality-of-life issues. Information sought about treatment options was measured by asking respondents:

Think back to the first few months after you were diagnosed with [colon, breast, prostate] cancer. In making decisions about what treatments to choose, did you (including your friends and family) actively look for information about treatments from each of the following sources²: (1) my treating

doctors, (2) other doctors or health professionals, (3) family members, friends, or coworkers, (4) other cancer patients, (5) face-to-face support groups, (6) online support groups, (7) telephone hotlines, (8) television or radio, (9) books, brochures or pamphlets, (10) newspapers or magazines, and (11) Internet (other than personal email and online support groups).

From responses to these questions, 11 dichotomous items were created. Finally, by combining some detailed information categories, we constructed four measures of how patients seek information about treatment options: (1) from medical sources, created by combining respondents who reported seeking information from treating doctors and other doctors or health professionals; (2) from mass media, created by collapsing respondents who had sought information from at least one of the following sources: television, radio, books, brochures, pamphlets, newspapers, and magazines; (3) from nonmedical interpersonal sources, created by collapsing respondents who had sought information from at least one of the following sources: family members, friends, coworkers, other cancer patients, support groups, and telephone hotlines; and (4) from the Internet.

Measures tapping cancer patients' seeking of information about quality-of-life issues were created in a similar manner. Quality-of-life issues include the following topics: reducing the chance of cancer recurrence, reducing the chance of getting a different cancer, reducing the risk of children or family members getting the cancer, whether other members of the family are at risk for developing a different type of cancer, where to obtain emotional support, and whether the

²We used only one's own education levels in testing the association of education with information seeking done by friends and family as well as by oneself, assuming that our respondents' family and friends have similar levels of education. This assumption is based on the "homophily," which refers to "the principle that a contact between similar people occurs at a higher rate than among dissimilar people" (McPherson, Smith-Lovin, & Cook, 2001, p. 416). Since social scientists started systematically observing people's social networks and group formations in the 1920s and 1930s, scholars have remarkably consistently detected substantial homophily by sociodemographic, behavioral, and psychological characteristics (McPherson et al., 2001).

respondent is at increased risk of having other health problems as a result of the cancer or treatment. Respondents were asked where they had actively looked for information about these issues. Using the same response options as described above, the composite measures were constructed for seeking information about quality-of-life issues in the same way as seeking information about treatment options.

Next, in order to construct an overall information seeking measure (for H1), we counted the number of the four categories of sources from which respondents claimed to have sought information about two topics. The resulting scale could then vary from 0 to 8, with a score of 8 earned when an individual reported seeking information from all four source categories for both topics ($KR-20 = .76$, $M = 3.39$, $SD = 2.25$).

It should be noted that these measures are original with this research, based on extensive qualitative interviews and pretesting with cancer patients (see Nagler et al., 2010). They were developed based on similar information-seeking measures previously validated with a noncancer patient sample (Kelly, Niederdeppe, & Hornik, 2009; Niederdeppe et al., 2007).

Education. We used education as an indicator of SES for the three reasons. First, education was most frequently relied upon as a measure of SES in previous studies on health information seeking and knowledge gaps (Viswanath & Finnegan, 1996). Second, although much of the literature in this area focuses on income disparities, Marmot (2002) demonstrated that education is an even better indicator of social position than income as it relates to health-related behaviors, such as health information seeking. Third, as a practical matter, income was not measured due to concerns that a substantial proportion of patients would not be willing to provide this information and might refuse to participate in a mail survey if this were asked (Dillman, Smyth, & Christian, 2008).

Education was measured by asking respondents their highest grade or level of school completed using a 6-point scale (1 = "8th grade or less," 2 = "some high school, but did not graduate," 3 = "high school graduate or GED," 4 = "some college or 2-year degree," 5 = "4-year college graduate," 6 = "more than 4-year college degree"). Education was then recoded as a ratio variable, which represents the number of years typically required to obtain a degree (i.e., 1 to 8, 2 to 10, 3 to 12, 4 to 14, 5 to 16, and 6 to 18). Although it is quite common to treat ordinal variables as interval variables in regression analyses, we tried to meet the assumptions of regression analyses by making this analytical decision (Asher, 1983).

Preference for active participation in treatment decision making. Treatment decision-making preference was adapted from Llewellyn-Thomas, McGreal, Thiel, Fine, and Erlichman (1991). We asked our respondents the following question: "After patients have all of the information

they need about their illness and possible treatment, some prefer to leave decisions about their treatment up to their doctor, while others prefer to participate in these decisions. Of the following statements, please choose the one that best describes what you prefer to happen." Then the respondents were asked to choose only one among the following statements: "The doctor should make the final decision without considering my opinion" (1); "The doctor should make the final decision after seriously considering my opinion" (2); "The doctor and I should share responsibility for the final decision" (3); "I should make the final decision after seriously considering my doctor's opinion" (4); or "I should make the final decision on the basis of the facts that I learn from my doctor and elsewhere, without considering my doctor's opinion" (5). Because many respondents chose more than one category, we recorded these respondents' scores as the middle point among the options they chose. For example, if a respondent marked 1 and 2, we recorded their response as 1.5. In this way, we recoded this variable as a 9-category ordinal measure (i.e., 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, and 5).

We recoded this variable in this way to avoid dropping respondents who we interpreted as providing legitimate answers, but who were between two response categories. This approach allowed us both to keep respondents who would have been missing if adjacent category respondents were eliminated, and still to take full advantage of the spread of responses. While the responses were only ordered, and could not be turned into meaningful interval scores, we believe that this variable, including the average scores, can be used in regression and treated as interval-level predictors. This is consistent with typical practice for variables with five or more categories (Asher, 1983). Furthermore, we note that the results were virtually the same when we dropped respondents who chose more than one option and ran our analysis using the original 5-point measure.

Control variables. We controlled for self-reported sociodemographic variables, such as age, gender, race/ethnicity, marital status, and employment status, that have been found to predict health information seeking in previous studies (Cotten & Gupta, 2004; Johnson, 1997). We also controlled for cancer type and cancer stage. In addition, we adjusted for self-rated health, which was measured by asking respondents how they would describe their health, with the following five response choices: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

Analysis Procedures

All analyses reported in this article were conducted with a weighted sample using the STATA 11 survey modules. We handled missing cases using multiple imputation because more than 15% of cases were missing across analyses (Little & Rubin, 2002). Using the ICE program in STATA 11, we created five data sets with imputed values for each

analysis. Then, using the MIM command, we calculated parameter estimates by averaging across five data sets.

H1 was tested by calculating the bivariate correlation of education and overall information seeking. In order to rule out any alternative explanations, we also conducted partial correlation analysis after adjusting for the following variables: age, gender, race/ethnicity, marital status, employment status, cancer type, cancer stage, and self-rated health.

To answer RQ2, the amount of information seeking from each source for each topic was determined by calculating the percentage of respondents who reported seeking information about that topic from that source. Ninety-five-percent confidence intervals were calculated to assess differences among topics and sources.

H2 and H3 were tested and RQ3 was answered in the following manner. We first performed a series of bivariate logistic regression analyses to examine the effect of education on information seeking across different sources and topic areas. To test whether the results were robust to potential confounders, we also ran multivariable logistic regression analyses with the control variables outlined earlier. Then, we performed a series of *t*-tests using the log-odds from the multivariable logistic regression models.

To test whether the effect of education on treatment information seeking is moderated by preference for active participation in treatment decision making (H4), we created a multiplicative term between *education* and *preference for active participation in treatment decision making* after *z*-standardizing the main effect variables. This procedure was undertaken to avoid a multicollinearity problem between the product term and its components (Cohen, Cohen, West, & Aiken, 2003).

For the logistic regression analyses, we report odds ratios (ORs) rather than customary regression coefficients because the ORs are easier to interpret in the case of a binary-dependent variable than are regression coefficients (Allison, 1999). An OR (significantly) greater than 1 indicates a positive relationship between the independent variable and the dependent variable, whereas an OR (significantly) less than 1 indicates a negative relationship.

RESULTS

Descriptive Statistics

Table 2 shows the weighted percentages of cancer patients who reported seeking cancer-related information from each source. Overall, more cancer patients reported seeking information about treatment options than quality-of-life issues for every type of source. For both topics, cancer patients relied upon medical sources most, followed by mass media and nonmedical interpersonal sources. Interestingly, the Internet turned out to be the least frequently utilized source among

cancer patients. For every comparison in Table 2, the confidence intervals for the Internet did not overlap with the use of the other sources for either information about treatment options or quality-of-life issues.

Overall Association of Education and Information Seeking

In this study, as in most others, there is a clear overall association of education and information seeking, supporting H1. The bivariate correlation was 0.26 ($p < .001$). Even after controlling for the aforementioned confounding factors, the partial correlation was 0.19 ($p < .001$). While these observed associations are consistent with the findings of many other studies, the goal of this study was to push beyond the overall association and examine whether the relationship of education and information seeking varied by channel, by topic, and by individual differences in preference for control over treatment decisions.

Channels

H2 and RQ3 concern how disparities in terms of cancer information seeking compare across information sources. We found that education exerted stronger influence on patients' cancer information seeking via the Internet than it did on seeking via other channels in both treatment options and quality-of-life issues, which supports H2 (see Table 3). When it comes to treatment information, there were significant differences in the odds ratios for the Internet (OR = 1.39, $p < .001$), mass media (OR = 1.14, $p < .001$), and medical sources (OR = 1.09, $p < .01$; Internet vs. mass media: $t = 4.05$, $p < .001$; Internet vs. medical sources: $t = 4.86$, $p < .001$). Because the effect of education on treatment information seeking from nonmedical interpersonal sources was not statistically significant (OR = 1.02, $p = .37$), and its confidence interval does not overlap with that for the Internet, one can conclude that Internet use is more heavily influenced by education than any other treatment information sources. Second, a 1-year increase in education increased the odds of seeking quality-of-life information from the Internet by 29% (OR = 1.29, $p < .001$). In contrast, education was not statistically significantly related to seeking information about quality-of-life issues from medical sources, nonmedical interpersonal sources, and mass media, and none of their confidence intervals overlapped with that for Internet use. That is, online information about quality-of-life issues is more related to socioeconomic disparities compared with the same type of information in other information sources.

Topics

H3 was partially supported. Table 3 shows that education seems to be more strongly related to seeking information

TABLE 2
Weighted Percentage of Cancer Patients Who Seek Cancer-Related Information From Each Source

	Medical ^a	Mass Media ^b	Nonmedical Interpersonal ^c	Internet
Treatment, <i>n</i> = 1,878	77.3 (77.28–77.32)	52.5 (52.48–52.52)	58.2 (58.18–58.22)	26.5 (26.48–26.52)
Quality of life, <i>n</i> = 1,914	50.8 (50.78–50.82)	31.6 (31.58–31.62)	36.9 (36.88–36.92)	11.7 (11.69–11.71)

Note. The results are based on the unimputed, weighted sample. The numbers in parentheses represent 95% confidence intervals for percentages.

^aMedical sources include my treating doctors, other doctors, and health professionals.

^bMass media include television, radio, books, brochures, pamphlets, newspapers, and magazines.

^cNonmedical interpersonal sources include family members, friends, coworkers, other cancer patients, support groups, and telephone hotlines.

TABLE 3
Associations of Education With Cancer Information Seeking by Source and by Topic

	Medical ^a		Mass Media ^b		Nonmedical Interpersonal ^c		Internet	
	Unadjusted Odds Ratio	Adjusted Odds Ratio	Unadjusted Odds Ratio	Adjusted Odds Ratio	Unadjusted Odds Ratio	Adjusted Odds Ratio	Unadjusted Odds Ratio	Adjusted Odds Ratio
Treatment options	1.17*** (1.11–1.23) <i>n</i> = 1,848	1.09** (1.03–1.15) <i>n</i> = 1,878	1.20*** (1.15–1.25) <i>n</i> = 1,848	1.14*** (1.09–1.19) <i>n</i> = 1,878	1.11*** (1.07–1.16) <i>n</i> = 1,848	1.02 (0.98–1.07) <i>n</i> = 1,878	1.43*** (1.37–1.50) <i>n</i> = 1,848	1.39*** (1.31–1.46) <i>n</i> = 1,878
Quality of life	1.06** (1.01–1.10) <i>n</i> = 1,889	1.03 (0.98–1.07) <i>n</i> = 1,914	1.07** (1.02–1.11) <i>n</i> = 1,889	1.04 (0.99–1.09) <i>n</i> = 1,914	1.06** (1.02–1.11) <i>n</i> = 1,889	1.04 (.99–1.09) <i>n</i> = 1,914	1.35*** (1.28–1.43) <i>n</i> = 1,889	1.29*** (1.21–1.38) <i>n</i> = 1,914

Note. The results are based on the imputed, weighted sample. The numbers in parentheses represent 95% confidence intervals for odds ratios. Significance is indicated by ** $p < .01$; *** $p < .001$. Adjusted odds ratios for *education* in *treatment* controlled for age, gender, race/ethnicity, marital status, employment status, cancer type, cancer stage, self-rated health, and preference for active participation. Adjusted odds ratios for *education* in *quality of life* controlled for age, gender, race/ethnicity, marital status, employment status, cancer type, cancer stage, and self-rated health.

^aMedical sources include my treating doctors, other doctors, and health professionals.

^bMass media include television, radio, books, brochures, pamphlets, newspapers, and magazines.

^cNonmedical interpersonal sources include family members, friends, coworkers, other cancer patients, support groups, and telephone hotlines.

about treatment options from medical sources, mass media, and the Internet than it is to seeking information about quality-of-life issues from the same sources. However, our *t*-tests showed that there were no statistically significant differences between treatment options and quality-of-life issues in terms of the associations of education with seeking information from the Internet ($t = 1.26$, $p = .21$), seeking it from medical sources ($t = 1.51$, $p = .13$), and seeking it from nonmedical interpersonal sources ($t = 0.57$, $p = .57$). Only in the case of mass media did education have stronger associations with seeking information on treatments than it did with seeking information on quality-of-life issues ($t = 2.47$, $p < .05$).

Motivation

Consistent with previous studies reporting the role of motivation and issue interest in health information seeking, we found that preference for active participation in treatment decision making was positively associated with treatment information seeking from any sources (see the “preference for active participation” row in Table 4). Preference

for active participation, however, did not moderate the effect of education on treatment information seeking (see the “education \times preference for active participation” row in Table 4), which does not support H4.

DISCUSSION

This study shows that education is positively related to cancer patients’ cancer information seeking overall and specifically from medical sources and nonmedical mediated sources (but not for nonmedical interpersonal sources). The effect is particularly strong for seeking information from the Internet and for seeking mass media treatment information. The overall association is consistent with many studies surveying the general public (e.g., Ayers & Kronenfeld, 2007; Cotten & Gupta, 2004). However, our results are particularly worrisome because, as compared to cancer-free adults, cancer patients are in arguably greater need of information (Finney-Rutten et al., 2005; Kaplan & Frosch, 2005). Cancer patients with high levels of education search for cancer information more frequently than cancer patients with low levels

TABLE 4
Moderating Role of Motivation in the Associations Between Education and Treatment Information Seeking

	<i>Medical^a</i>		<i>Mass Media^b</i>		<i>Nonmedical Interpersonal^c</i>		<i>the Internet</i>	
	<i>Unadjusted Odds Ratio</i>	<i>Adjusted Odds Ratio</i>	<i>Unadjusted Odds Ratio</i>	<i>Adjusted Odds Ratio</i>	<i>Unadjusted Odds Ratio</i>	<i>Adjusted Odds Ratio</i>	<i>Unadjusted Odds Ratio</i>	<i>Adjusted Odds Ratio</i>
Preference for active participation	1.43*** (1.21–1.68) <i>n</i> = 1,797	1.25* (1.04–1.49) <i>n</i> = 1,878	1.30*** (1.14–1.47) <i>n</i> = 1,797	1.09 (0.94–1.25) <i>n</i> = 1,878	1.42*** (1.25–1.62) <i>n</i> = 1,797	1.23** (1.07–1.41) <i>n</i> = 1,878	1.63*** (1.43–1.86) <i>n</i> = 1,797	1.28** (1.09–1.51) <i>n</i> = 1,878
Education × preference for active participation	–	1.08 (.93–1.26) <i>n</i> = 1,878	–	1.10 (.98–1.23) <i>n</i> = 1,878	–	1.09 (.97–1.22) <i>n</i> = 1,878	–	.96 (.83–1.10) <i>n</i> = 1,878

Note. The results are based on the imputed, weighted sample. The numbers in parentheses represent 95% confidence intervals for odds ratios. Significance indicated by * $p < .05$; ** $p < .01$; *** $p < .001$. Adjusted odds ratios for *preference for active participation* controlled for age, gender, race/ethnicity, marital status, employment status, cancer type, cancer stage, self-rated health, and education. Adjusted odds ratios for the interaction between *education and preference for active participation* controlled for age, gender, race/ethnicity, marital status, employment status, cancer type, cancer stage, self-rated health, education, and preference for active participation.

^aMedical sources include my treating doctors, other doctors, and health professionals.

^bMass media include television, radio, books, brochures, pamphlets, newspapers, and magazines.

^cNonmedical interpersonal sources include family members, friends, coworkers, other cancer patients, support groups, and telephone hotlines.

of education maybe because the former are more capable of seeking out and making sense of cancer information than the latter. Consequently, it stands to reason that more educated cancer patients may also enjoy the benefits of this information, such as confidence in medical decision making and better health outcomes (Huang & Penson, 2008; Lee et al., 2010). In contrast, less educated patients may make their decisions concerning their health based upon limited knowledge as a result of their less frequent use of important cancer information sources. This represents a serious public health concern because an inverse information law may operate with regard to cancer patients' health information seeking, such that cancer patients who need cancer-related information most, that is, low-SES cancer patients, are less likely to gain the benefits of that information (Bonfadelli, 2002; DiMaggio et al., 2004; Kreps & Neuhauser, 2010).

Limitations

Before discussing implications of these findings, a few limitations of this study should be mentioned. First, cancer information seeking variables reported here are dichotomous; therefore, we were not able to compare respondents on the basis of their frequency of seeking from each source. However, we decided to use simple "yes/no" items to capture information seeking from each source because of the following considerations. During the pretests of our survey measures, we found that asking the respondents their frequency of use of each source for each topic gave them too much cognitive burden, that it took too much time for them to answer those questions, and that it resulted in many missing cases. Also, a measure of frequency may be an error-prone gauge of time spent with the source. For example, a respondent who reported seeking information five times

per week over the past 12 months may have spent several hours or only a few moments during each incident of information seeking. That is, it would be very difficult to compare respondents on the basis of the number of times that information seeking occurred without asking for additional details relating to actual time spent with each source. In contrast, our dichotomous measures were less likely to be affected by inaccurate recall. In addition, these dichotomous measures have been used in previous research (e.g., Kelly et al., 2010). For our overall analysis of the association of education and information seeking, however, we did sum the dichotomous measures across sources and across topics to make use of a more differentiated measure.

Second, we focused only on one's own education in predicting information seeking done by oneself and his or her family and friends. Ideally, we would have measured and tested whether one's friends and family's education influenced his or her health information seeking as well. However, we found that in most cases a spouse or children sought cancer information for the respondents. Only 320 out of 2,013 said that friends sought information for them. Because people are more likely to share the same or similar SES with their family members than with their friends, this limitation is not critically problematic.

Third, preference for active participation in treatment decision making is only one aspect of motivation to seek treatment-related information. Even though previous studies have reported that there are high levels of positive correlation between health information-related motivation and preference for active participation in medical decision making (e.g., Lee et al., 2010), these are conceptually separate constructs. Patients may look for treatment-related information to inform themselves even if they do not want to actively participate in the medical decision making process

(Kaplan & Frosch, 2005). That is, preference for active participation in treatment decision making is only one determinant that may motivate cancer patients to seek out information about treatment options. Thus, our measure is a proxy for cancer patients' motivation to seek treatment information.

Fourth, one might argue that Internet use in general or computer access, which was not included as a control variable in our analyses, explains the association between education and cancer information seeking. However, we contend that Internet use in general, or computer access, may serve as an important mediator between education and online health information seeking. This is consistent with previous literature reporting that individuals who use the Internet (in general) and for whom the Internet has become an integral part of their daily lives are more likely to use the Internet for more diverse purposes, such as health or science information acquisition (e.g., Jung, Qiu, & Kim, 2001; Lee, 2009). Therefore, we would expect education to be positively associated with Internet use/computer access, which would, in turn, predict online health seeking. The association of education and Internet health information seeking is likely to reflect both this general influence on Internet use, as well as any additional education influences specific to health-related uses of the Internet. We are unable to distinguish the general and specific influences of education because we do not have measures of general Internet access. Thus, future studies in this area would benefit from examining the relationships among SES, Internet use, computer access, and online health information seeking.

Finally, related to the fourth limitation, we did not control for income in examining the association between education and online health information seeking because we did not ask the respondents about their income. Therefore, we cannot completely rule out the possibility that income might explain some portion of the observed associations between education and online health information seeking. However, we do not think controlling for income will make the statistically significant association between education and online health information seeking disappear for the following reasons. Although education is positively associated with income, the empirical findings regarding the association between income and cancer information seeking are mixed at best. Niederdeppe (2008), for example, did not detect a statistically significant association between income and cancer information seeking (measured by the following question: "Have you ever looked for information about cancer from any source?") using data from the 2005 Health Information National Trends Survey. Similarly, Viswanath et al. (2006) analyzed data from the 2003 Health Information National Trends Survey, and found that cancer knowledge—an outcome of cancer information seeking—was primarily associated with education, not income. Moreover, as outlined earlier, although a few studies reported a positive association between income and cancer information seeking

among cancer patients, most of these studies did not rely on a population-based sample.

Socioeconomic Disparities in Cancer Information Seeking

Despite these limitations, this study moves the literature substantially forward in its use of a statewide representative sample of cancer patients in Pennsylvania, in its documentation of the effect of education on cancer patients' use of a variety of sources across different topic areas, and in its comparison between the Internet and other information sources.

In this context, a few findings should be highlighted. First, one might have expected that education would not matter in cancer patients' cancer information seeking because of cancer patients' high level of information need. Our study, however, showed that education is a significant factor even in cancer patients' treatment information seeking and that even those with more motivation to seek out treatment information (i.e., cancer patients who prefer an active role in treatment decision making) do not overcome education-based deficiencies in treatment information seeking. Also, we detected a positive association between education and treatment information seeking from mass media, as well as from medical sources. Based on our findings, we argue that the gap in cancer information seeking among SES groups is based on deep-rooted social structural inequalities, rather than just an individual issue that can be addressed by boosting health-related motivation.

As we expected, education also exerts a stronger influence on cancer information seeking on the Internet than it does on other sources. Many scholars have argued that health education through the Internet has greater potential for people in low-SES groups than mass-mediated public health programs (Gustafson et al., 2007; Kreps & Neuhauser, 2010). To maximally realize the potential benefits of online health education programs, however, public health practitioners and policymakers should address socioeconomic disparities in online cancer information seeking. Although, in recent years, major health organizations have been designing and refining their websites to develop more useful Internet-based cancer education programs that appeal to all audiences (Gustafson et al., 2007), inequalities in access to the Internet persist and thus should be treated as an urgent public health agenda. If gaps in online cancer information seeking among SES groups are not addressed in a timely manner, the current shift in public cancer education from mass media to the Internet may exacerbate the preexisting cancer disparities, because socioeconomic disparities in cancer information seeking seem to be more serious on the Internet than in mass media.

Moreover, there was no difference between high- and low-education cancer patients in the extent to which they obtained cancer information from nonmedical interpersonal

sources. There have been two contradictory expectations regarding the effect of education on cancer information seeking from lay people. One group of scholars (e.g., Dutta-Bergman, 2004) contends that education is positively associated with cancer information seeking from nonmedical interpersonal sources. This is based on the possibility that people with high levels of education tend to have a more diverse social network, have skills and sufficient resources to go beyond their primary social network, and get valuable support from a wide range of people (Putnam, 2000). In contrast, other scholars argue that less educated cancer patients can obtain important health information from their primary social network members, even if they do not have easy access to medical care and medical information sources (Carlsson, 2000). Our results did support the latter.

In addition, education was more strongly associated with seeking treatment information from mass media than with seeking quality-of-life information from mass media. These findings might be accounted for by the possibility that quality-of-life information is less complex than treatment information and thus cancer patients with low levels of education have fewer problems in searching for quality-of-life information than treatment information, as we hypothesized. However, this alone does not appear to provide a full explanation, considering that education was positively associated with seeking quality-of-life information as well as treatment information from the Internet and that those associations were not statistically significantly different from each other. Another possible explanation is that cancer patients could find little quality-of-life information in mass media regardless of their education levels. A few recent content-analytic studies on mass media's cancer coverage reveal that mass media tend to heavily focus on treatment-related issues while relatively ignoring other cancer-relevant topic areas, which can be regarded as belonging to a broad category of quality-of-life issues, such as healthy behaviors, screening tests, survivorship, and end-of-life care (e.g., Gantz & Wang, 2009; Jensen, Moriarty, Hurley, & Stryker, 2010). That may be why there were no significant differences in terms of the effect of education on quality-of-life information seeking from mass media, even though there were education effects in the case of treatment information seeking from mass media.

Implications

To effectively relay cancer information to less educated cancer patients who may have limited access to medical care, the gaps in cancer information seeking detected in the current research should be redressed. Not all communication channels are equally effective for cancer education. One of the most basic rules in choosing the optimal communication tools for disseminating cancer information is the reach of a specific medium among target audience (Hutchinson & Wheeler, 2006). We showed that traditional

health information channels still play a major role in health-information diffusion and that the Internet is just one of many health information vehicles available to cancer patients. We also demonstrated that the association of education and cancer information seeking was larger for the Internet compared with other information sources. These findings suggest that the Internet may not be an optimal health communication channel for cancer patients as of yet, contrary to the recent attention to Internet-based health programs. Therefore, health communication practitioners and health professionals should pay attention to other information sources above and beyond the Internet in order to reduce the gaps in cancer information seeking among SES groups.

ACKNOWLEDGMENTS

This article was supported by grant 5P50CA095856-05 from the National Cancer Institute (NCI). We acknowledge that the NCI does not bear any responsibility for the content reported in this article. We are grateful to Katrina Armstrong, Angel Bourgoin, Xiaoxia Cao, Taressa Frazee, Derek Freres, Bridget Kelly, Lourdes Martinez, Rebekah Nagler, J. Sanford Schwartz, Aaron Smith-McLallen, and Norman Wong for their insightful comments on earlier drafts of the article and/or contributions to instrument development and data collection, and to Robin Otto, Craig Edelman, and personnel at the Pennsylvania Cancer Registry for collaboration on sample development. We also thank Brian Southwell and two anonymous reviewers for their invaluable comments on earlier versions of this article.

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