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Previous research suggests positive effects of health information seeking on prevention behaviors such as diet, exercise, and fruit and vegetable consumption among the general population. The current study builds upon this research by examining the effect of cancer patients' active information seeking from media and (nonmedical) interpersonal sources on fruit and vegetable consumption. The results of this longitudinal study are based on data collected from a

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randomly drawn sample from the Pennsylvania Cancer Registry, comprising breast, prostate, and colorectal cancer patients who completed mail surveys in the fall of 2006 and 2007. There was a 65% response rate for baseline subjects (resulting $n = 2013$); of those, 1,293 were interviewed one year later and 845 were available for final analyses. We used multiple imputation to replace missing data and propensity scoring to adjust for effects of possible confounders. There is a positive effect of information seeking at baseline on fruit and vegetable servings at follow-up; seekers consumed 0.43 (95% CI: 0.28 to 0.58) daily servings more than nonseekers adjusting for baseline consumption and other confounders. Active information seeking from media and interpersonal sources may lead to improved nutrition among the cancer patient population.

There is some evidence to suggest a probable association between increased fruit and vegetable consumption and reduced risk for several cancers (Vainio & Bianchini, 2003). It has been suggested that this decrease in cancer risk could be attributable to the molecular components contained within fruits and vegetables (Aggarwal & Shishodia, 2006). Some studies have demonstrated significant associations between fruit and vegetable intake and reductions in risk of breast (Gandini, Merzenich, Robertson, & Boyle, 2000), prostate (McCann et al., 2005), and colorectal (Michels et al., 2006; Wu et al., 2009) cancers. However, other studies have failed to provide definitive support for the link between fruit and vegetable intake and cancer risk. According to an expert report on the association between intake of fruits and vegetables and cancer (World Cancer Research Fund/American Institute for Cancer Research, 2007), studies conducted since the mid-1990s have "made the overall evidence, that vegetables or fruits protect against cancers, somewhat less impressive. In no case now is the evidence of protection judged to be convincing. However, in a substantial number of cases, a judgment of probable is justified . . . there is evidence that some types of vegetables, and fruits in general, probably protect against a number of cancers" (p. 75). Specifically, the report finds probable evidence that consumption of foods containing dietary fiber, found in plant foods (particularly when in whole or relatively unprocessed forms), probably protect against colorectal cancer. The report also found evidence suggesting that consuming food containing selenium (such as Brazil nuts, fish, whole grains, wheat germ, and sunflower seeds) and lycopene (most highly concentrated in tomatoes, but also found in watermelon, red [bell] peppers, pink or red grapefruit, pink-fleshed guava, and persimmons) reduces the risk of prostate cancer.

These findings, along with other evidence for the health value of fruit and vegetable consumption, have led to a general recommendation favoring increased fruit and vegetable consumption for everyone. Although research into this topic has yet to provide conclusive evidence to support a causal claim, the American Cancer Society (2009) has recommended that cancer patients increase their fruit and vegetable consumption. Efforts to promote fruit and vegetable consumption are still worthwhile even if data have not demonstrated that increased consumption of fruits and vegetables will have a major effect on cancer incidence. In recent studies among cancer patients, fruit and vegetable consumption has been shown to reduce risks of cardiovascular disease (Dauchet, Amouyel, Hercberg, & Dallongville, 2006; World Health Organization, 2003) and to reduce blood pressure (Appel et al., 1997). Thus, whether fruit and vegetable consumption improves health generally, or may specifically prevent recurrence of some types of preexisting cancer, advocacy of increased fruit and vegetable consumption among cancer patients is justified.

However, if increased consumption is justified, how is it to be produced? There are two likely complementary routes: (1) advocacy by health professionals or others engaging in explicit persuasive outreach, or (2) self-persuasion as people are exposed to information that is available to them through media or interpersonal sources (either because they are passively exposed to it through routine use of media and conversation with others, or because they actively seek such information). For cancer patients, diagnosis with cancer may motivate an active search for information about lifestyle behaviors that may serve to restore their health and reduce their risk of cancer recurrence. We have shown that cancer patients report substantial levels of information seeking (Nagler et al., 2010). In this article we turn to the effects question: Does such information seeking lead to changes in behavior?

RESEARCH ON INFORMATION SEEKING

In the current media environment, patients have access to a wide range of sources of health information. During the year 2005, a conservative search found more than 980 references[1] to health benefits of fruit and vegetable consumption in major U.S. broadcast, print, and web media and more than 3,000 references to fruits and vegetables and health (LexisNexis Academic, search terms: "*fruit* and *vegetables* and *health*" in major U.S. and world publications, and web publications,1/1/2005 to 12/31/2005, retrieved January 17, 2010). In addition, national sources of health information, which include the National Cancer Institute (NCI), the Food and Drug Administration (FDA), and the American Cancer Society (ACS), provided information

[1] Search term: "fruit or vegetable" and "health" and "benefit."

about the health benefits of fruit and vegetables on their websites as well as other print publications.

This study contributes to research on information seeking (Kelly et al., 2010; Rees & Bath, 2001; Zanchetta, Perreault, Kaszap, & Viens, 2007) about cancer-related topics and its impact on cancer decisions and outcomes (Czaja, Manfredi, & Price, 2003; Talosig-Garcia & Davis, 2005). Specifically, we examine whether cancer patients' seeking for cancer-related information leads to an increase in fruit and vegetable intake over time. This study adds to research showing cross-sectional positive and significant associations between information seeking and healthy lifestyle behaviors such as dieting to lose weight, exercise, and fruit and vegetable consumption in a general population sample (Kelly, Niederdeppe & Hornik, 2009). Lagged evidence for a causal relationship, which demonstrates that information seeking leads to engaging in health behaviors, has been seen in other research (Ramirez et al., 2009). However, much of this research has been limited to studying information seeking and its influence on health behaviors among the general public.

The present study is one of the first to examine this question using a cancer patient population consisting of patients with one of three commonly diagnosed cancers (breast—women only, prostate—men only, colorectal), using longitudinal data to test the causal relation between seeking for cancer-related information and fruit and vegetable consumption. The analyses reported here come from a broader study of cancer patients described later. Results of separate analyses examining the association between information seeking for other healthy lifestyle behaviors and cancer-related decisions are presented elsewhere (Gray et al., 2009; Lee, Gray, & Lewis, 2010). Past research shows an effect of seeking from nonclinical sources on fruit and vegetable consumption in the general population, adjusting for seeking from medical professional sources (Ramirez et al., 2009).

Why would seeking cancer-related information from nonclinical sources influence fruit and vegetable intake? This process may, in part, be grounded in the shift toward a patient-centered model of health care, which places a higher responsibility on patients to be actively involved in decisions made about their health (Johnson, 1997; Levine, 2000). Under this new model of care, it is recognized that patients will be active in making decisions about their own health, and not entirely reliant upon their physicians. Responsibility for decision making then likely leads to active engagement with available information sources. We then expect that many cancer patients will be actively looking for information to protect their health and, in that context, will locate information about fruit and vegetable intake. We further assume that available information is overwhelmingly positive about the protective benefits of such consumption, and also projects a sense of normative expectation for increasing such consumption. Following the logic of the Theory of Reasoned Action (Fishbein & Aizen, 1975, 2010), increased perception of valued benefits and increased perception of normative expectations will lead to more positive intentions and behavior. Thus, the causal chain will run from information seeking to increased behavior. We test the following hypothesis:

> H1: Seeking for cancer-related information from nonclinical sources at baseline increases the likelihood of consuming fruits and vegetables at follow-up, adjusting for baseline fruit and vegetable consumption, as well as the propensity to seek cancer-related information, and other potential confounders.

MATERIALS AND METHODS

Participants

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. Stage four cancer patients (those with metastatic disease) and African-American patients were oversampled to maximize statistical power for some analyses, although in the weighted analyses reported here they are represented in proportion to their presence in the population in the PCR. In the fall of 2007, a follow-up survey was administered to the sample drawn in 2006.

Procedure

Cancer patients residing in Pennsylvania received a 61-question paper survey in the mail. The survey asked questions regarding patient characteristics, lifestyle behaviors, and information seeking about cancer and treatments. The survey also included questions developed with the specific goals of the present study in mind. Results of interviews with cancer patients and a pilot test of the survey guided question wording and format. Procedures for data collection followed procedures outlined in Dillman (2000) and have been described elsewhere (Lewis et al., 2009; Martinez et al., 2009).

Measures

Measures included in this study were based on self-report, and measured at baseline and follow-up. Participants provided information about their level of fruit and vegetable intake by answering two questions: "In the past week, on average, how many servings of fruit did you eat or drink per day? Please include 100% fruit juice, and fresh, frozen or canned fruits." "In the past week, on average, how many servings of vegetables did you eat or drink per day, not counting potatoes? Please include green salad, 100% vegetable juice, and fresh, frozen or canned vegetables." Both questions included six response options, including "Less than one serving per day," "one serving per day," "two servings per day," up to "5 or more servings per day." As in Ramirez et al. (2009), we created a composite measure of fruit and vegetable intake, where we treated the response options for each question as interval, ranging from 0 to 5 levels, then generated a summed variable ranging from 0 to 10 levels. While the extreme categories (0 and 5) of each measure are ordinally related to the adjoining categories, the remaining categories retain meaning at the interval level. For the full 0–10 scale less than 5% of all respondents fall at those extremes. We felt confident then in treating this measure as interval. The 1-year test–retest correlation for the summed scale is high (.64.)

Using a conceptualization of information seeking from previous research (Shim, Kelly, & Hornik, 2006; Niederdeppe et al., 2007), respondents answered questions related to their levels of seeking in the past year. Respondents were given three distinct opportunities to report seeking from nonclinical sources in the form of three questions: (1) "Think back to the first few months after you were diagnosed with your cancer. In making decisions about what treatments to choose, did you actively look for information about treatments from any sources?" (2) "What sources did you use when you were actively looking for any information related to your cancer?" (3) "Where have you actively looked for information about quality of life issues (i.e. physical problems, how to reduce cancer recurrence)." Responses for each question included a list of nonclinical sources (friends or family members, other cancer patients, television or radio, books or brochures, newspapers or magazines, support groups [face-to-face and online], and telephone hotlines) in which respondents were asked to check all that applied. Additionally, each question offered an option for respondents to indicate that they had not actively looked for information. The number of sources for each respondent was tallied, and each respondent was assigned an information seeking score, which was mean-centered and summed to create an index of information seeking. The variable was then dichotomized at the median split, where 0 represented no or lower levels of information seeking and 1 represented higher levels of information seeking.[2] This was our primary independent variable for information seeking from nonclinical sources as it was entered into the propensity model.

A separate measure for assessing level of information seeking from medical professional sources (including seeking information from treating doctor and other doctors or health professionals) was included in analyses to establish that any effects were not an artifact of the association of nonclinical seeking and clinical information seeking. The variable was a summed six-level score for responses to the three seeking items (the same items that were used to create the dichotomous nonclinical information seeking variable). Patients who reported information seeking from their doctor only or from another medical professional only were assigned a score of 1 for each of these items. Patients who sought information from both medical sources were assigned a score of 2, and patients who did not seek from either source were assigned a score of 0 for that item. The ordinal level summed variable is the one used in the final model. As a note, because we examined a population already diagnosed with cancer, seeking from medical professional sources was an almost universal event. Since we were only interested in testing the effects of seeking from nonclinical sources over and above any seeking from medical professional sources, the very few patients who reported no seeking from medical professional sources across the three seeking items were excluded from the analyses.

In addition to these variables and ones mentioned earlier, the final propensity model included 34 demographics and patient characteristics that were incorporated as possible confounders for causal claims about the information seeking–fruit and vegetable consumption relationship.[3]

Data Analysis

As described earlier, our purpose in this study is to establish evidence that information seeking from nonclinical media and interpersonal sources influences fruit and vegetable consumption among a cancer patient population. Our purpose is twofold: to show through analysis of longitudinal data that the flow of causal order between information seeking and fruit and vegetable consumption is one that runs from seeking toward fruit and vegetable consumption,

[2]We recognize that the use of a dichotomized measure restricts sensitivity to detect effects. However, in this case, the dichotomized measure permitted us to make use of propensity scoring procedures to fully account for the effects of confounders, and we thought the trade-off worthwhile.

[3]These variables include participants' age, gender, race, education, employment, and marital status, insurance status, smoking status, height and weight, current exercise, and diet behaviors and future intention to exercise or diet to lose weight. Other confounders include responses to questions about cancer-related treatments heard about and received, as well as self-reported satisfaction with treatments received and with clinical information provided. The model also accounted for patients' responses concerning their experience of physical symptoms, preferences for medical decision-making and actual decision-making practices, concern about cancer recurrence, tendency to avoid health information, and to comply with lifestyle recommendations as well as self-reported feelings of confidence and optimism, and whether participants were assisted by others in their social network in seeking cancer-related information.

and to capture an estimated causal effect of seeking from nonclinical media and interpersonal sources and fruit and vegetable consumption among a cancer patient population. Evidence for a causal effect of cancer patients' seeking from nonclinical sources on fruit and vegetable consumption must satisfy two conditions. The first requires that a statistically significant association exists between seeking at baseline and fruit and vegetable consumption at follow-up, controlling for fruit and vegetable consumption at baseline. We tested this condition using a series of ordinary least-squares regression models. The second condition requires that the observed association seen under the first condition is not attributable to other variables. We adjusted for any effect of potential confounders by using an approach known as propensity scoring. Propensity scoring attempts to replicate the strength of random assignment in experimental designs by comparing subjects matched on their probability of seeking conditional on potential confounders (Rosenbaum & Rubin, 1983). In this way, propensity scoring allows us to compare levels of fruit and vegetable consumption across subjects who are equally likely to seek at baseline while adjusting for effects of confounders.

This procedure allows us to test the effects of seeking conditional on propensity score. The decision to use propensity scoring rests on the advantages conferred by this approach. Compared to conventional methods, through propensity scoring we are able to see whether measured covariates are out of balance between conditions prior to calculating a final treatment effect (Rosenbaum, 2002; Yanovitzky, Hornik & Zanutto, 2008). A significant final treatment effect of seeking that adjusts for potential confounders would support our contention that cancer patients' information seeking from nonclinical sources influences their fruit and vegetable consumption. Like regression, propensity scoring cannot account for possible effects of unmeasured variables.

To generate the propensity score, we entered 34 confounders into a logistic regression model predicting information seeking from nonclinical sources. Subjects with equal propensity for seeking at baseline were then compared for differences in fruit and vegetable consumption associated with baseline seeking. Using standard propensity modeling approaches, we excluded low and high information seeking cases that did not overlap, thus dropping high-seeking cases with propensity scores higher than the highest low-seeking cases, and low-seeking cases with propensity scores lower than the lowest high-seeking cases. This reduced our sample size for analyses involving propensity scoring from 852 (described later) to 845. The propensity scores were then divided into quintiles, with subjects in each quintile sharing equal probabilities of seeking. The final treatment effect was estimated using ordinary least-squares regression, with fruit and vegetable consumption at baseline, seeking, and propensity as independent variables. An additional test of the interaction of information seeking and propensity was not significant and thus excluded from the final treatment effect model.

STATA 10, the ICE program (Royston, 2005), and the MIM program (Galati, Royston, & Carlin, 2007) were used to employ the multiple imputation procedure, which is recommended by Allison (2001) and Little and Rubin (2002) to address problems of missing data. Poststratification weights based on age, sex, marital status, date of diagnosis, race/ethnicity, and stage of disease were also applied to reflect the distribution of cases in the PCR across cancers.

RESULTS

Descriptive Statistics

The response rate for baseline respondents ($n = 2{,}013$) was 65%. The response rates at baseline were 61% for colorectal cancer participants, 68% for breast cancer participants, and 64% for prostate cancer participants. The 1,701 patients who had agreed to participate in a follow-up round, and who were not known to have died in the interim period, were sent follow-up questionnaires. Of these, 1,293 returned follow-up questionnaires, resulting in a response rate of 76%. The follow-up response rates were 75% for colorectal cancer participants, 79% for breast cancer participants, and 77% for prostate cancer participants. Principal variables, demographics, and patient characteristics remained similarly distributed upon applying weights and imputing values. After running the multiple-imputation procedure, we restricted our sample to include only subjects who responded to the questions about fruit and vegetable consumption at baseline and follow-up, which comprised a total of 964 subjects. We further excluded people (12% of the restricted sample) who did not report seeking from either their own physician or another medical professional, producing a sample of 852, which was reduced finally to 845 under the propensity score procedures described previously.[4] As distributions of sample characteristics did not significantly change after applying weights, Table 1 displays only the weighted demographic characteristics of the sample following the imputation procedure. Table 2 shows how respondents varied from baseline to follow-up on primary variables. As seen in Table 2, fruit and vegetable consumption remained fairly constant from baseline to follow-up. At baseline, the mean number of fruit and vegetable servings consumed was 3.90 [95% CI: 3.75, 4.03], and 4.10 [95% CI: 3.95, 4.23] at follow-up. These are not significantly different.

As with other measured variables, information seeking from nonclinical sources remained constant across data points: 49% reported seeking from nonclinical sources at

[4]An analysis comparing the 845 respondents retained for the analysis with the remainder of the baseline sample showed no substantial differences.

TABLE 1
Sample Demographics ($n = 852$)

Demographics	%
Age	
24–50 years	13.3
51–60 years	25.4
61–70 years	29.1
71–80 years	23.0
81–105 years	9.2
Gender	
Male	48.4
Female	51.6
Race/ethnicity	
White	86.9
Nonwhite	13.1
Education	
Eighth grade or less	2.3
Some high school	9.8
High school diploma	37.9
Some college/2 year degree	23.2
College graduate	26.8
Marital status	
Married	72.6
Not married	27.4
Cancer	
Breast	35.3
Prostate	34.1
Colon	30.7
Stage of cancer	
In situ and local	63.1
Regional spread	22.9
Metastatic	14.1

TABLE 2
Baseline and Follow-Up Levels of Seeking and Fruit and Vegetable Consumption ($n = 852$)

Variables	*Baseline Scores*	*Follow-Up Scores*
Information seeking from nonclinical sources (% information seeking)	49.8%	46.8%
Fruit and vegetable consumption [mean (sd) daily number of servings, range = 0–10]	3.90 (2.08)	4.10 (2.14)

Note. None of the differences reported here across baseline and follow up scores were statistically significant.

baseline and 46% at follow up. Table 3 shows the correlations among the primary variables. All correlations among primary variables were statistically significant at the .01 level or less and were positive.

Estimation of Results

Information seeking from nonclinical sources was positively associated with eating fruits and vegetables cross-sectionally at baseline ($B = 0.66$, $p < .001$) in model 1 and at follow-up ($B = 0.37$, $p < .01$) in model 2 of Table 4. Model 2 also shows that the effect of information seeking at baseline on fruit and vegetable consumption at follow-up remains significant upon adjusting for the effect of fruit and vegetable consumption at baseline ($B = 0.65$, $p < .001$). The propensity score analysis adjusted for potential confounders (and excluded cases that had no overlap in propensity scores between seekers and nonseekers) appears in model 3 (see Table 4). This propensity-controlled model includes four dummy indicators for the information seeking propensity quintiles. Interactions between information seeking and propensity quintiles were tested using a likelihood ratio test. The test indicates these interactions did not make significant contributions ($F(4, 1000) = 2.08$, *n.s.*), and thus are excluded from the model. Two confounders (level of seeking from medical professional sources, and insurance) were found to be out of balance in the generation of the propensity scores and were included in model 3 as covariates. The propensity-controlled model (adjusting for effects of the confounders that were out of balance) shows that high information seekers at baseline reported eating on average nearly half a serving of fruit and vegetables more per day 1 year later ($B = 0.43$, $p < .01$) compared to low information seekers at baseline, adjusting for their baseline consumption (Table 4).

DISCUSSION

The central finding of this study, that cancer patients' seeking cancer-related information from nonclinical sources predicts fruit and vegetable consumption adjusting for baseline fruit and vegetable consumption and an array of

TABLE 3
Correlation Matrix of Primary Variables ($n = 852$)

	Information Seeking (Baseline)	*Information Seeking (Follow-Up)*	*Fruit and Vegetable Consumption (Baseline)*
Information seeking (Follow-Up)	0.422		
Fruit and vegetable consumption (baseline)	0.092	0.133	
Fruit and vegetable consumption (follow-up)	0.126	0.085	0.638

Note. All displayed variables are statistically significant at $p < .01$ or less.

TABLE 4
Cross-Sectional and Lagged Relationships of Seeking Cancer-Related Information From Nonclinical Sources With Fruit and Vegetable Consumption (Dependent Variable)

	Model 1 (n = 852), B (SE)	*Model 2 (n = 852), B (SE)*	*Model 3 (n = 845), B (SE)*
Information seeking from nonclinical sources (baseline)	0.66 (0.17)[c]	0.37 (0.13)[b]	0.43 (0.17)[b]
Fruit and vegetable consumption (baseline)		0.65 (0.03)[c]	0.65 (0.03)[c]
Level of information seeking from medical professional sources			0.01 (0.04)
Insurance			0.06 (0.29)
R-squared	0.415	0.423	0.425

Note. Model 1: Cross-sectional association between baseline seeking and outcome behavior. Model 2: Lagged association, adjusting for baseline behavior. Model 3: Lagged association, adjusting for baseline behavior, propensity quintiles, and unbalanced confounders.
[b]Significant at $p < .01$.
[c]Significant at $p < .001$.

confounders, supports our hypothesis and is consistent with previous research examining similar questions among the general population (Kelly, Niederdeppe & Hornik, 2009; Ramirez et al. 2009). Our study is the first to show a controlled lagged association between information seeking about cancer-related information from nonclinical sources and fruit and vegetable consumption among a cancer population. This finding indicates that active information seeking about cancer-related information from nonclinical sources may lead to improved nutrition among the cancer patient population.

This finding suggests that, among a population afflicted with cancer, information seeking from nonclinical sources matters with regard to engaging in healthy behaviors. Given the recent changes in the current model of health care and a continued focus on patients' responsibility for their health, this may be particularly true for cancer patients who desire more information about prevention over and above what they receive from their treating physicians. This desire to engage in healthy behaviors may be particularly salient if cancer patients believe they are at high risk of recurrence and that a diet rich in fruits and vegetables may confer protective benefits. Despite having what one could reasonably expect to be a comparatively greater motivation to live a healthier life, most cancer patients in our study consume slightly fewer servings below the daily recommended five servings of fruits and vegetables encouraged by the American Cancer Society (2009). We find some support for this result in existing research suggesting that cancer survivorship in itself does not prompt considerable changes in related healthy lifestyle habits such as weight control and physical activity (Courneya, Katzmarzyk, & Bacon, 2008).

Some may wonder whether our central finding is merely an artifact of engagement with medical professional sources. In the current analysis this was addressed by limiting the analysis to those who reported some information seeking from clinical sources. In model 3 in Table 4, we also show that the effects of information seeking from nonclinical sources remained even when level of information seeking from medical professional sources was controlled.

The longitudinal design and propensity analysis demonstrated here offers substantial and novel evidence for the positive influence of seeking for cancer-related information from nonclinical sources on fruit and vegetable consumption among cancer patients. Given the use of propensity scoring procedures, it also controls for effects of a wide range of potential confounding variables. The lagged design, with its control for baseline levels of fruit and vegetable consumption, accounts for unmeasured variables that affect both information seeking and fruit and vegetable consumption simultaneously. It also is not threatened by uncertainties about the causal order of the two variables, specifically the possible effects of fruit and vegetable consumption on information seeking. Still, the present study has a number of limitations. Perhaps the most substantial threat to influence of information seeking from nonclinical sources on fruit and vegetable consumption is the possibility of a nonmeasured third variable, which might drive both the likelihood of information seeking as well as the increase in fruit and vegetable consumption but at different times. For example, our analysis does not include a measure of participants' motivation to address their health issues; this is an example of a variable that might positively influence cancer patients' motivation to seek information earlier but only affect their fruit and vegetable consumption later.

An additional limitation of the study is that reported frequency of information seeking and of fruit and vegetable consumption are based upon patients' recall, and thus may potentially be an inaccurate reflection of the actual frequency of these events. A further limitation of the study is that the measures used have not been previously validated. However, a pretest of the measures was conducted with cancer patients, and existing literature was used to guide the development of these measures. Given the high response rates, the sample likely represents the 2005 population of diagnosed breast, prostate, and colorectal cancer patients in Pennsylvania, but it does not represent patients in other states or with other cancers or in other time periods.

Another limitation of our study relates to the limitations of the statistical analysis used to answer the central questions of this research, which have not permitted us to perform a dose-response analysis. Examination of a dose-response effect could be of interest as it might identify a threshold point at which one could expect the effect of information seeking to begin to influence fruit and vegetable consumption. Future research employing less confining statistical methods may explore this question.

Finally, this study uses a sample consisting of patients with only three cancer types. However, it should be noted that breast cancer, colorectal cancer, and prostate cancer are three of the most prevalent cancer types affecting the U.S. population today (American Cancer Society [ACS], 2008). Consequently, our sample represents a sizeable population of patients diagnosed with cancer in the United States. Breast cancer ranks second as a cause of cancer death in women (after lung cancer) (ACS, 2008, p. 9). Prostate cancer is the most frequently diagnosed cancer in men. Colorectal cancer is the third most common cancer in both men and women. Finally, our measure of information seeking only assesses breadth of seeking—whether information seeking occurred and from where—rather than depth—the frequency with which information seeking took place or sources were consulted. One potential avenue for future research may be to investigate reliance on specific nonclinical information sources and how it translates into engaging in healthy behavior such as fruit and vegetable consumption. Other further research may also examine the relation between information seeking from nonclinical sources among individuals in nonchronic or nonlife threatening situations. Finally, it is worth noting that the measure of information seeking focuses on seeking for cancer-related information generally, rather than seeking for nutritional information specifically. Future research should test whether a more specific measure of information seeking, for example, seeking information about diets or healthy lifestyle habits, might show an even stronger effect.

Summary Implications

The recent emphasis on empowering the patient in a clinical setting within the health care system has placed a greater responsibility on patients to be more aware of how their current health behaviors and choices translate into health outcomes. From the results of this study, it is clear that cancer patients look for cancer-related information above and beyond the information obtained through physicians, perhaps as a result of absorbing more responsibility for decisions related to their health behavior. This desire for supplemental information may become more acute over time as patients are expected to assume more active roles in their health care. The results presented here also show the influence that exposure to nonclinical information sources such as media and interpersonal sources can have on cancer patients' engagement in health behaviors such as fruit and vegetable consumption. Based on these findings, physicians and health professionals may consider a dual-pronged approach to maximize the potential health benefits resulting from information seeking behavior. This entails encouraging cancer patients to seek cancer-related information from nonclinical sources and promoting more media coverage of healthy behaviors, thus shaping available cancer-related information in the media environment.

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