A longitudinal study on engagement with dieting information as a predictor of dieting behavior among adults diagnosed with cancer

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Abstract

Objective—This study explores cancer survivors' engagement with information about dieting to control weight from doctors, interpersonal, and media sources and examines whether engagement from these sources impacts subsequent dieting behavior.

Methods—A total of 1,128 respondents diagnosed with colorectal, breast, or prostate cancers were surveyed over three years following their cancer diagnoses. Using weighted logistic regression analyses, the authors predicted the odds of dieting based on earlier information engagement with sources, controlling for dieting in the previous year and confounders.

Results—Participants reported talking with doctors more frequently (37%) than seeking or scanning from interpersonal and media sources about dieting (15–22%). Seeking from interpersonal and media sources, and discussion with physicians, significantly predicted dieting behavior. In addition, discussions with physicians increased the odds of subsequent dieting behavior by 2.32 times (95% CI: 1.50–3.61; p=.002), over and above the effects of other information engagement.

Conclusion—Cancer survivors reported engaging with a variety of information sources about dieting. Engagement with doctors and information-seeking from interpersonal or media sources predicted cancer survivors' dieting behavior a year later.

Practice Implications—The results may inform strategies to encourage and empower cancer survivors to engage with information about healthy lifestyle changes for promoting long-term health.

Keywords

dieting; information engagement; seeking and scanning; cancer survivorship; Pennsylvania

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1. Introduction

Cancer survivorship begins at diagnosis and lasts for the duration of an individual's life. Today, there are approximately 11.4 million cancer survivors and 1.5 million additional cases diagnosed each year in the United States.[1] As a result of early detection and advances in treatment, Americans with cancer now live many years beyond diagnosis. Promoting healthy lifestyle behaviors to reduce chronic disease risk is therefore a priority among public health professionals aiming to improve the long-term health of cancer survivors.[2, 3]

In addition to tobacco cessation, regular cancer surveillance, and follow-up care, healthy weight maintenance is an important determinant of health status among survivors with a variety of cancers.[4–9] Recent guidelines recommend that cancer survivors balance caloric intake with physical activity, avoid excessive weight gain, and achieve a healthy weight if currently overweight or obese.[10] Adherence to these guidelines reduces the likelihood of second cancers,[11, 12] recurrence of the primary cancer,[13] emergence of harmful co-morbidities, and deaths from cancer.[14]

This paper examined whether cancer survivors' dieting behavior may benefit from their engagement with information about weight management from a variety of sources including their healthcare provider, family and friends, and mass media. For instance, does searching for weight control recommendations from media sources lead to subsequent dieting behavior among cancer patients? And do conversations with doctors about dieting promote patients' dieting behavior? While targeted nutrition and exercise interventions by clinicians and other health care providers have been shown to successfully modify survivors' diet-related behaviors in select settings,[15–17] less is known about the impact of survivors' engagement with the wide availability of information on healthy weight management in their social environment. Since the cancer experience is often referred to as a —teachable moment during and after which positive health behavior changes are more likely to occur than increases in health risk behaviors,[18, 19] it seems plausible, then, that increased encounters with dieting information might also motivate weight management among survivors. In the following sections, we will outline prior literature that informed our study, describe the survey methods and findings, and discuss the research and practice implications of the results.

1.1. Prevalence and effects of health information engagement among cancer survivors

Research indicates that cancer survivors frequently acquire health information about their condition from a range of sources, including healthcare providers, interpersonal sources such as family and friends, and increasingly, mass media and the internet.[20, 21] Not only is the nature of information about dieting likely to differ across various sources, the manner that survivors come in contact with the sources (active seeking versus routine exposure) can vary as well. Prior studies have also shown that information sources can sometimes complement[22–24] or substitute for one another.[25] It is therefore important to understand the patterns of how survivors engage with various information sources and the impact of that information engagement, if any, on health behaviors.[26]

Information acquisition may be broadly categorized into two related but distinct types of interactions with sources: *information seeking* and *information scanning*. Information seeking is characterized by an active and motivated search for specific information.[27] A prime example would be an individual using a specific health website to find low-fat recipes or nutrition facts for maintaining a healthy weight. Information scanning, on the other hand, is a less purposive, more incidental behavior that occurs during an individual's routine encounters with various sources. Scanning would involve coming across and attending to information when a person is not intentionally looking for it, for instance, during a regular

visit with a primary care physician or while watching the nightly news.[28, 29] In short, the critical difference between these two types of information engagement is the individual's level of activeness in looking for information, and presumably his or her prior motivation to obtain specific information.

Recent studies report that health information seeking and scanning are both common behaviors in the general population.[28, 30] Among cancer survivors, information seeking has also been shown to be prevalent.[31] Seeking for cancer information can help cancer survivors to fulfill unmet informational needs,[32] prepare them for shared decision-making,[33] and relieve stress associated with survivorship.[34] Particularly during the rehabilitation phase, survivors report a specific need for nutrition and diet information.[20, 35] Similarly, some studies indicate that patients diagnosed with certain cancer types as well as older cancer patients tend to acquire information about their disease in more passive ways.[34–36] Furthermore, healthy lifestyle behaviors including diet and nutrition are the most frequently mentioned risk factors in cancer news stories which are likely sources of information scanning for cancer survivors.[37] Information seeking and scanning may therefore play important roles in influencing dieting behaviors among cancer survivors.

Studies among healthy individuals in the general population have shown that information seeking and scanning about various health topics are positively associated with corresponding cancer prevention and screening outcomes, including knowledge, fruit and vegetable consumption, exercise and certain screening behaviors.[30, 38–40] In comparison, studies describing seeking and scanning effects on health behaviors in cancer survivors are less common. Past research involving cancer patients has typically focused on how exposure to one or multiple sources of information impacts the doctor-patient relationship.[25, 41–43] While these studies are informative, little is known about whether information acquired from multiple sources through seeking or scanning affects healthy lifestyle behaviors such as weight control among cancer survivors. Although stronger effects of seeking on health behaviors are expected, we have seen that this type of motivated searching is not the only way patients come in contact with useful information. We submit that if information scanning is omitted from analytic models examining the consequences of information exposure, sizeable effects on dieting behavior may be overlooked.

To address the above research gaps, in this longitudinal survey of a population-based sample of breast, prostate and colorectal cancer patients, we described the prevalence of various forms of engagement with dieting information to control weight from different sources (i.e., healthcare professionals, interpersonal sources other than doctors, and media) and examined whether these exposures predicted survivors' subsequent dieting behavior. We also explored the interactive effects of physician sources with interpersonal and media sources on dieting behavior because prior studies indicate that information sources can sometimes complement[22–24] or substitute for one another.[25]

2. Methods

2.1. Sample and data collection

We conducted three rounds of annual surveys beginning in 2006 among a cohort of patients diagnosed with breast, prostate or colorectal cancers residing in Pennsylvania. Study participants were sampled from the Pennsylvania Cancer Registry (PCR) list of patients who were diagnosed with one of the above three cancers between January 2005 and December 2005. We developed the survey questionnaire following a literature review, expert consultation, and a pilot study with 29 cancer patients. Appropriate revisions to the survey were included following the pilot testing.

Details of the characteristics of the study population and the data collection procedure have been fully described elsewhere.[44] Essentially, 26,608 patients from the PCR formed the sampling frame. We mailed survey questionnaires to 3,994 randomly selected participants (15% of the sampling frame) using Dillman's tailored design method for mail surveys.[45] We first sent a notice letter to sampled participants informing them of the study objectives and instructions for opting out. The survey, a small monetary incentive, and a stamped return envelope were then sent to participants. Those who did not indicate their wish to opt out and did not return the survey within two weeks were sent an additional letter and survey. Instructions for completing the survey indicated that participation was voluntary and submitting a completed questionnaire implied informed consent. To facilitate subgroup analyses, we over-sampled cancer patients who were African American and those diagnosed with Stage IV disease. Probability sample weights based on demographic and clinical variables were then applied for the analyses to accurately represent the PCR population.

This analysis focused on the data obtained from rounds 2 and 3 of the survey which included items asking participants about their engagement with dieting information from various sources and their dieting behavior. These items were not asked in the first round of the surveys. We did not restrict the analysis based on overweight status because we found that dieting was commonly reported among participants who were below the WHO body mass index (BMI) cutoffs for overweight and obese, presumably for the purpose of maintaining a healthy weight. Furthermore, we postulated that it was possible for the engagement of information exposure to be affecting the dieting behavior for survivors across all levels of BMI and did not find prior literature to suggest contingent effects.

There were 2,013 participants who completed round 1 of the study in 2005 (American Association for Public Opinion Research response rate 4 was 64%).[i] Of participants who agreed to be re-contacted for further surveys, a total of 1,293 completed round 2 and 1,128 participants completed round 3 of the study. Analyses below only included those respondents with round 3 data. Non-response in the third round was due to refusal to be re-contacted after round 1 (n=255) or round 2 (n=85), participants who were known to have passed away during the study period (n=66), and no response after the repeated mailed survey. The University of Pennsylvania Institutional Review Board approved the study procedure and materials.

2.2. Survey measures

2.2.1. Dieting behavior—Participants were asked in rounds 2 and 3 of the study, —During the past 30 days, have you controlled your diet to lose weight? (binary responses – i.e., yes or no). We hypothesized that dieting behavior at round 2 was likely to predict subsequent dieting at round 3. Therefore, the present analysis included round 2 dieting as a covariate.

2.2.2. Engagement with information related to dieting—Five survey items assessed participants' level of engagement with dieting information in round 2 from three different types of information sources (interpersonal, media, and physicians). First, participants were asked, —What sorts of information did you <u>actively look</u> for concerning [breast/colon/ prostate] cancer from <u>other people</u> (friends, family, co-workers, other cancer patients) in the <u>past 12 months</u>? Do not include information that you received from your doctors and could check off the box that indicated —I did actively look for information from other people in the past 12 months about the following topics: Dieting to control weight and my cancer .[ii]

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[i]Briefly, the AAPOR response rate 4 (RR4) takes into account the proportion of cases of unknown eligibility that were actually eligible and also includes partial interviews as respondents.[46]

Second, a similar item asked participants if they actively looked for dieting information from media sources (defined as television, radio, newspapers, magazines, books, brochures, pamphlets, and the internet). Third, participants were asked, —What information have you come across about [breast/colon/prostate] cancer from other people (friends, family, co-workers, other cancer patients) when you were not actively looking for it in the past 12 months? and they could check off a box indicating —I have come across information from other people about the following topics in the past 12 months: Dieting to control weight and my cancer .[ii] The fourth item was worded similarly and asked participants to recall if they had come across dieting information from media sources. Finally, one item asked participants, —Since your cancer diagnosis, which of the following have your doctors talked to you about? whereby they could respond Yes', No', or I don't know' for the item dieting to control weight'. This item did not distinguish between the participant's actively seeking for the information about dieting from their physician initiating the discussion about dieting.

2.2.3. Control variables—We included as covariates demographic variables (age at cancer diagnosis in years, gender, education level, ethnicity, and marital status), psychological variables (Lerman cancer worry scale),[47] anthropometric measurements (BMI categories based on WHO cutoffs),[48] and cancer-related variables (cancer type[iii], stage of disease at diagnosis, type of treatment received, health status, and frequency of physician visits) that were described in the literature as predictive factors of dieting or nutrition behaviors among cancer survivors.[49]

2.3. Analytic procedure

Analyses were conducted using the M*plus* statistical package version 6.[50] We performed full information maximum likelihood (FIML) estimation to account for the presence of missing values in the independent variables. The FIML technique is preferable to ad hoc methods for dealing with missing data (e.g., listwise deletion, pairwise deletion, and mean imputation) because of reduced bias and sampling variability in multivariate regression models.[51, 52] To reflect the distribution of cases in the PCR by cancer type, date of diagnosis, cancer stage, and demographic variables, post-stratification weights were applied to the data for analyses. This permitted inferences about patients with colorectal, breast, or prostate cancer in the PCR population. The results of the regression analyses were substantively similar to parallel analyses without sampling weights. Therefore, only the weighted analyses will be reported here.

To assess the effects of type of engagement with dieting information from different sources on dieting behavior individually, we fit five weighted logistic regression models (Models 1 to 5), controlling for round 2 dieting and other potential confounders. For instance, Model 1 predicts dieting behavior in round 3 with active seeking about dieting information from interpersonal sources and dieting behavior in round 2. Next, we included all five types of engagement with information in Model 6 to adjust for the combined effects of the sources on dieting in round 3. This allows for the assessment of the effect of exposure to each information source above and beyond the other information sources' influence on dieting behavior.

We further tested for the presence of interactions between information seeking and scanning from interpersonal and media sources with talking to physicians about dieting by including

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[ii]The emphases in the phrasing of these items were present in the original survey questionnaire. The cancer type printed in the questionnaire was matched to the type of cancer with which the respondents were known to have been diagnosed.
[iii]Because of the presence of gender-specific cancer types, we combined gender and cancer type into a single covariate such that four categories were controlled for in the analysis (female colorectal, male colorectal, breast, and prostate cancers). This did not influence the substantive findings in the analysis.

the product terms of these measures. Non-significant interaction terms were omitted from the final models.

3. Results

Approximately 40% of participants reported having dieted in the preceding 30 days in both rounds 2 and 3. Over half of the sample was female (52%), mean age was 68 years, most of the sample was white (87%), and almost half (49%) completed some college or higher education. The majority of participants (69%) were overweight or obese based on BMI calculated from their self-reported height and weight. Other sample characteristics are detailed in Table 1.

Table 2 shows the weighted frequency of engaging in the various forms of active seeking and coming across information about dieting from interpersonal or media sources and discussion with physicians. Participants reported that the most common type of exposure to dieting information came from discussions with their physicians (37%), followed by coming across dieting information in media sources when they were not actively looking for it (22%). Specifically, the weighted percentages of talking to physicians about dieting among those who were considered to be overweight or obese were 37% and 59% respectively. The prevalence of seeking and scanning from interpersonal and media sources were significantly lower than physician discussions about dieting using McNemar's test of the unweighted paired proportions (all ps<.001). Additionally, seeking from family and friends was more common than scanning from family and friends (p=.002) but scanning from media sources was more common than seeking from media sources (p=.0004).

Table 3 shows the weighted multivariate logistic regressions predicting dieting behavior at round 3 with each source of dieting information, controlling for dieting behavior at round 2 and potential confounders. The analysis provided evidence that seeking from interpersonal sources, seeking from media sources, and discussion with physicians at round 2 predicted increased odds of participants reporting that they dieted to lose weight in round 3 (Models 1, 2, and 5). Furthermore, Table 4 shows that over and above the effects of other information sources, discussion with physicians about dieting predicted an increase in the odds of dieting at round 3 by 2.32 times (95% CI: 1.50–3.61; p=.002) (Model 6). Adjusted for all round 2 variables, including dieting behavior, round 3 dieting was reported by 49.5% of those who did and only 29.7% of those who did not discuss dieting with their physicians. There were no significant interactions between information seeking and scanning from interpersonal and media sources with talking to physicians about dieting.

We conducted further analyses to assess whether the effect of discussion with physicians on dieting behavior was contingent on participants' BMI category at round 2 and did not find any significant interactions between physician discussion and BMI categories.

There was no evidence of multi-collinearity among the independent variables. The collinearity statistics were within the recommended levels (tolerance measures were above 0.27 and variance inflation factors were below 3.70).

4. Discussion and Conclusion

4.1 Discussion

The results from this longitudinal study offer several novel insights on the patterns of cancer survivors' engagement with dieting information sources and the concurrent effects of seeking and scanning about dieting from multiple sources on subsequent dieting behavior. First, including all five types of source engagement as predictors, discussion with physicians about dieting predicted a doubling in the odds of subsequent dieting behavior in the study

population. We did not find any significant differences in the effect of discussions with physicians on dieting between participants who were in the overweight or obese BMI categories compared to those with BMIs below these cutoffs. This provided initial evidence suggesting the important role that physicians may play in encouraging healthy weight control through dieting among cancer survivors, over and above survivors' seeking and scanning about dieting from their family, friends and from media sources. In this study, the nature and content of discussions with physicians about dieting was not captured. Future studies would be necessary to assess the main components and the context of these physician discussions that seem to be influencing dieting behavior. Cancer survivors and their physicians may then be better equipped with effective communication tools during clinic encounters that would promote the adoption of healthy lifestyle behaviors and improve long-term health outcomes.

Second, although seeking and scanning about weight management did not predict dieting behavior in the overall model, this study found evidence that individually, seeking from the mass media, as well as family and friends, predicted increased odds of reporting recent dieting behaviors among cancer survivors. These results corroborated earlier research on the influence of active information seeking about cancer-related information from media and interpersonal sources on lifestyle behaviors[53] or treatment decision making among cancer survivors.[54] The mechanism for the effects of active information seeking from media and interpersonal sources on cancer survivors' dieting behavior is unclear in our study and deserves further attention in future research. In particular, what unique element of information seeking motivates cancer survivors to adopt dieting behavior for weight control? For instance, among the various media sources, are there specific media channels or outlets that cancer survivors tend to seek dieting information from and what type of dieting content is available from these media channels? By capturing and understanding more fully the features of information seeking from media and interpersonal sources that drive behavior change, it may be possible for physicians to better direct cancer survivors to effective resources for making healthy lifestyle modifications.

The analysis showed that while the associations between scanning from media or interpersonal sources and dieting tended to be positive, they were not statistically significant; indicating that information scanning may have minimal impact on weight management behaviors among this study population of cancer survivors. This finding differed from prior research which found positive effects of information scanning on healthy lifestyle and cancer screening behaviors, albeit among the general population.[30, 38–40] Despite this, scanning from media and interpersonal sources were not rare behaviors. Furthermore, scanning about dieting from media sources in this study was found to occur more frequently than seeking from media sources, suggesting that scanned information about dieting was not a trivial part of survivors' experience with dieting information. Further studies should consider including both information seeking and scanning measures in examining a different patient population or behavioral outcome to avoid omitting an important avenue of how cancer survivors encounter information about various health topics.

This study has several strengths that can be attributed to the design of the survey. Multiple rounds of data collection allowed for longitudinal analyses, and consequently temporal order of the observed associations could be established. In addition, the lagged regression models, which controlled for baseline dieting, made it less likely that the observed effects were due to an underlying personal motivation to be healthy. Finally, the population-based data increased the representativeness of our sample in contrast to convenience samples drawn in other studies.

The study was limited in a few ways. First, we relied on cancer survivors' self-reported dieting behavior and information engagement, which may be subject to recall and social desirability biases. Although prior studies validated scanning measures for cancer screening information with independent data on news media coverage of screening tests,[55] further research is necessary to develop additional objective measures of information seeking and scanning of health information. A particular concern is that patients' recall of scanning and seeking, and in particular conversations with their physicians about dieting, may reflect patients' interest in this issue rather than an objective assessment of whether such conversations occurred. However, we controlled for participants' prior dieting behavior in the analyses in order to account for their underlying interest in this topic. Second, survey participants were sampled from the PCR and may be dissimilar from cancer patients in other geographic locations. Research in other patient populations may be necessary to examine whether the predictive effect of information engagement on dieting behavior can be replicated. In addition, in separate analyses, we found statistically significant but minimal change in respondents' weight observed over time among those who reported that they dieted between the two rounds of surveys. The median difference in weight loss between dieters and non-dieters was one pound over the follow-up period (results not shown here). Whether there is any risk or mortality reduction as a consequence of information engagement remains unclear. Future studies may require a longer time frame to detect meaningful declines in weight.

4.2 Conclusion

In sum, this study explored the patterns of engagement about dieting information among cancer survivors across various information sources (i.e., doctors, interpersonal, and media sources). While survivors reported that discussion with doctors about dieting occurred most frequently, active seeking and scanning from interpersonal and media sources were also present. The analysis further found that cancer survivors who actively sought information about dieting from interpersonal sources, media, or discussed dieting with their physicians were more likely to report dieting a year later.

4.3 Practice Implications

In light of the study results, strategies to encourage and empower cancer survivors to engage with information about healthy lifestyle changes such as weight management for promoting long-term health may be considered. In particular, only 37% of overweight and 59% of obese patients reported having had a diet-related conversation with their physicians. Given the evidence here that patients' recall of such conversations predicts subsequent dieting, physicians may be well advised to increase memorable discussions with their patients about dieting.

Acknowledgments

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Table 1

Weighted characteristics of analyzed sample (N=1128)

Characteristics	Mean	SD	%
Dieting behavior at round 3			40.4
Dieting behavior at round 2			40.5
Age at cancer diagnosis (years)	67.5	11.6	
Gender – Female			51.8
Education – Some college and above			49.1
Race/ ethnicity			
White			86.7
Black			8.5
Hispanic or other			4.8
Marital status – Married			60.3
BMI category at round 2			
Below 25 kg/m^2			30.9
25 to 29.9 kg/m^2			39.8
30 kg/m^2 and above			29.3
Cancer type			
Colon cancer (female)			15.9
Colon cancer (male)			14.2
Breast cancer			36.0
Prostate cancer			33.9
Type of treatment received			
Surgery			72.2
Radiation therapy			49.4
Chemotherapy or hormonal therapy			52.3
Cancer stage			
Stage 0			12.4
Stage I			20.4
Stage II			48.3
Stage III			12.0
Stage IV			7.1
Health status at round 2	3.2	0.9	
Frequency of doctor visits scale	2.7	1.0	
Lerman worry scale	6.6	2.6	

Table 2

Weighted population prevalence of engagement with dieting information from various sources at round 2 in the analyzed sample (n=1,128)

Information source of dieting information	Proportion (%)	95% CI
Seeking from other people[a]	16.4	13.6 – 19.1
Seeking from media sources[a]	15.4	12.8 – 17.9
Scanning from other people[a]	15.1	11.8 – 18.3
Scanning from media sources[a]	22.0	18.6 – 25.3
Discussion with doctor [b]	37.1	33.1 – 41.0

Note.

[a] In the preceding 12 months.

[b] Since cancer diagnosis (on average 27 months).

Table 3

Weighted logistic regression analyses predicting round 3 dieting behavior with each information source of dieting information

Model	Predictors	OR	95% CI
1	Seeking from other people	2.03[b]	1.24 – 3.30
2	Seeking from media sources	1.85[a]	1.12 – 3.06
3	Scanning from other people	1.72	0.97 – 3.05
4	Scanning from media sources	1.42	0.95 – 2.29
5	Discussion with doctor	2.51[c]	1.63 – 3.86

[a]$p<.05$

[b]$p<.01$

[c]$p<.001$

Notes. OR: weighted odds ratio. 95% CI: 95% confidence interval. Models 1 to 5 examined the individual predictive effects of each source in round 2 on dieting behavior in round 3, controlling for dieting behavior in round 2, demographic characteristics (age, education level, ethnicity, marital status), anthropometric indices (WHO BMI categories), psychological variables (Lerman cancer worry scale), and cancer-related variables (cancer type by gender, stage of disease at diagnosis, type of treatment received, health status, and frequency of physician visits).

Table 4

Weighted logistic regression analyses predicting round 3 dieting behavior with information sources of dieting information

Model	Predictors	OR	95% CI
6	Seeking from other people	1.31	0.69 – 2.49
	Seeking from media sources	1.31	0.67 – 2.56
	Scanning from other people	1.18	0.61 – 2.26
	Scanning from media sources	0.94	0.53 – 1.68
	Discussion with doctor	2.32[c]	1.50 – 3.61

[a]
$p < .05$

[b]
$p < .01$

[c]
$p < .001$

Notes. OR: weighted odds ratio. 95% CI: 95% confidence interval. Model 6 examined the predictive effects of active seeking or coming across dieting information from various sources in round 2 on dieting behavior in round 3, controlling other information sources, dieting behavior in round 2, demographic characteristics (age, education level, ethnicity, marital status), anthropometric indices (WHO BMI categories), psychological variables (Lerman cancer worry scale), and cancer-related variables (cancer type by gender, stage of disease at diagnosis, type of treatment received, health status, and frequency of physician visits).