Health Behaviors in Cancer Survivors

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Purpose/Objectives: To describe health behaviors of cancer survivors by cancer diagnosis and to compare them to people without a personal or family cancer history.

Design: Cross-sectional secondary data analysis.

Setting: A national, list-assisted telephone survey using random-digit dialing of U.S. adults about use of cancer-related information and cancer beliefs.

Sample: 619 cancer survivors and 2,141 participants without a history of cancer from the original 6,369 Health Information National Trends Survey (HINTS) respondents.

Methods: Using the National Cancer Institute's 2003 HINTS, further analyses were conducted.

Main Research Variables: Cancer history, current smoking, fruit and vegetable consumption, physical activity, and body mass index (BMI).

Findings: When controlling for demographic variables, no differences were found in self-reported health behaviors between survivors and those without cancer: 22.5% of survivors and 18.4% of those without cancer were current smokers, 18% of survivors and 14.9% of those without cancer consumed at least five fruits or vegetables per day, 45.3% of survivors and 53% of those without cancer were physically active at least weekly, and 58% of survivors and 54.9% of those without cancer were overweight or obese (i.e., BMI > 25). Only 7.4% of survivors and 6.4% of participants without cancer reported positively on all three health behaviors and had a healthy or normal weight.

Conclusions: Survivors did not have different health behaviors when compared to participants without a history of cancer. Neither group met the American Cancer Society or Healthy People 2010 objectives for these behaviors. Adoption of healthy lifestyle behaviors should be addressed in cancer survivors.

Implications for Nursing: Cancer survivors need to be assessed for current smoking, dietary habits, physical activity, and weight. Information and resources should be made available, if needed, to promote the adoption of healthy lifestyle behaviors.

Key Points . . .

- More than 10 million cancer survivors are living in the United States, representing 3.5% of the U.S. population. This group is expected to grow dramatically as baby boomers age.
- Cancer survivors have poorer health than the general population and are at higher risk for developing second cancers.
- Cancer survivors do not differ from the general population in their rates of smoking, eating fruits and vegetables, engaging in regular physical activity, or maintaining a healthy or normal weight. Only 7.4% of the cancer survivors and 6.4% of participants in the control group without cancer reported positively on all three health behaviors and had a healthy or normal weight.
- Neither group met the American Cancer Society or Healthy People 2010 objectives for smoking, eating fruits and vegetables, engaging in regular physical activity, or maintaining a healthy or normal weight. Adoption of healthy lifestyle behaviors should be addressed by nurses when caring for cancer survivors.

Tremendous progress has been made in the diagnosis and treatment of cancer since the 1950s, leading to a growing population of cancer survivors (American Cancer Society, 2007; Edwards et al., 2005). The United States has more than 10 million cancer survivors, representing 3.5% of the population; this number is expected to grow dramatically as the U.S. population ages (Institute of Medicine, 2006; National Cancer Institute, 2005). Although they are living longer, cancer survivors are not as healthy as the general population (Gotay & Muraoka, 1998; Hewitt, Breen, & Devesa, 1999; Yabroff, Lawrence, Clauser, Davis, & Brown, 2004). In addition to long-term and late effects of cancer and its treatment, more than 10% of new cancers are diagnosed in survivors, and they face increased risk for weight gain, cardiovascular disease, diabetes, and osteoporosis (Demark-Wahnefried, Aziz, Rowland, & Pinto, 2005;

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Institute of Medicine; National Cancer Institute, 2005). Cancer survivors also are more likely than the general population to report poorer health and experience a greater burden, including limitations in activities of daily living, psychologic functioning, and ability to work (Baker, Denniston, Smith, & West, 2005; Hewitt, Rowland, & Yancik, 2003; Nord, Mykletun, Thorsen, Bjoro, & Fossa, 2005; Yabroff et al.).

Tobacco use, poor diet, physical inactivity, and obesity have been linked to the incidence and mortality of a number of cancers. Estimates suggest that more than half of U.S. cancer deaths are caused by behaviors such as smoking (30%), poor dietary choices and obesity (25%–30%), and physical inactivity (varies by cancer type) (National Cancer Institute, 2006). Those health behaviors also contribute to the development of cardiovascular disease and diabetes, which, along with cancer, are the leading causes of death in the United States (Eyre et al., 2004; Mokdad, Marks, Stroup, & Gerberding, 2004; Olshansky et al., 2005).

Healthcare professionals and survivors alike have suggested that the cancer experience provides a "teachable moment" where a cancer survivor may be motivated to assess and change behaviors to promote a healthy lifestyle (Brown et al., 2003; Demark-Wahnefried, Aziz, et al., 2005; Demark-Wahnefried, Peterson, McBride, Lipkus, & Clipp, 2000; Demark-Wahnefried, Werner, et al., 2005). The health behaviors of cancer survivors have been evaluated in a number of studies, many of which show that health behaviors improved after a diagnosis of cancer. Reductions in tobacco use and better diet have been documented, although in many instances physical activity declined (Blanchard et al., 2003, 2004; Coups & Ostroff, 2005; Lindsey, Waltman, Gross, Ott, & Twiss, 2004; Mullens, McCaul, Erickson, & Sandgren, 2004; Patterson et al., 2003; Satia et al., 2004). None of the cited studies documented attainment of all of the American Cancer Society guidelines (2006) regarding smoking, fruit and vegetable intake, level of physical activity, or weight (see Table 1).

Theoretical Framework

The Health Belief Model (HBM) framework was the best fit to guide the selection of variables to be explored in this study (Janz, Champion, & Strecher, 2002). The HBM posits that people will take action to prevent, screen for, or control their health conditions if they believe that (a) they are susceptible to the condition (susceptibility), (b) the condition would have serious consequences (seriousness), (c) taking a course of action has benefit (benefits), (d) the benefits are greater than the barriers for taking action (barriers), and (e) they are able to perform the action to control the illness (self-efficacy) (Janz et al.; Strecher, DeVellis, Becker, & Rosenstock, 1986). According to the HBM, cancer survivors would be expected to take actions to promote their health based on their cancer experience that may influence perceived seriousness, susceptibility, benefits, barriers, and self-efficacy.

Purpose

The purpose of the present study is to describe and compare knowledge, beliefs, and health behaviors of cancer survivors and those without a cancer history and to explore differences among groups of survivors by cancer type. Specific research questions are

- What are the knowledge, beliefs, and health behaviors regarding smoking, fruit and vegetable consumption, physical activity, and body mass index (BMI) of cancer survivors when compared to a group without a personal or family history of cancer?
- What are the health behaviors and BMI of survivors by cancer diagnosis?

Methods

This was a cross-sectional study using a national list-assisted random-digit–dial telephone survey about the public's use of cancer-related information and other cancer-related beliefs and behaviors (National Cancer Institute, 2003; Nelson et al., 2004). Findings related to cancer screening and information-seeking behaviors are reported elsewhere (Mayer, Terrin, Kreps, et al., 2007; Mayer, Terrin, Menon, et al., 2007).

Measures and Procedures

The National Cancer Institute's **Health Information National Trends Survey (HINTS)** consists of 148 questions on cancer communication (35 items), cancer history and general cancer knowledge (16 items), cancer-specific personal risk and screening (54 items), risk behaviors (29 items), and health status and demographics (14 items) (National Cancer Institute, 2003; Nelson et al., 2004). The survey is available in English and Spanish on the HINTS Web site (National Cancer Institute, n.d.). Only questions relevant to the research questions were used in the analysis.

After obtaining an exemption from the Tufts-New England Medical Center and University of Utah institutional review boards, the researchers collected HINTS data from October 2002–May 2003 following best practices identified by the American Association for Public Opinion Research (2006) and obtained a final sample of 6,369 (Nelson et al., 2004). Special efforts were made to oversample African Americans and Hispanics or Latinos, groups traditionally underrepresented in national surveys. Telephone interviews lasted an average of 30 minutes. After obtaining institutional review board exemption and registering for access at the National Cancer Institute, researchers obtained the HINTS I SAS files and codebooks from the HINTS Web site (National Cancer Institute, n.d.) for the secondary data analysis.

Sample

Of the 6,369 evaluable survey participants, 619 (9.7%) identified themselves as having had cancer, although the stage of cancer and type of treatment were not ascertained. An additional 143 participants identified themselves as having nonmelanoma skin cancer, and they were not included in the analysis. Of the 619 survivors, 68% reported having one of seven types of cancer: breast cancer (n = 119), cervical cancer (n = 94), prostate cancer (n = 62), melanoma (n = 61), colorectal cancer (n = 49), and endometrial cancer (n = 39). The other 32% reported ovarian cancer (n = 23), lymphoma (n = 21), head and neck cancer (n = 19), thyroid cancer (n = 16), lung cancer (n = 16), bladder cancer (n = 14), kidney cancer (n = 9), stomach cancer (n = 6), leukemias (n = 5), pancreatic cancer (n = 2), bone cancer (n = 10), and other (n = 48) types of cancer. In addition, 59 (9.5%) of the survivors

Table 1. American Cancer Society (ACS) and Healthy People 2010 Goals and 2003 U.S. Population Prevalence Rates

Health Behavior	U.S. Prevalence Rates	ACS (n.d.) 2015 Objectives	Healthy People 2010 (n.d.) Goals
Smoking or tobacco use	21.7% currently smoke. 25.2% are former smokers. 52.1% never smoked.	12% of adults use tobacco products.	12% of adults smoke cigarettes.
Fruit and vegetable consumption	22.6% of adults consume at least five fruits or vegetables per day.	75% of adults follow ACS guidelines for fruit and vegetable consumption (eat at least five servings per day).	No goal has been established by Healthy People 2010. ACS has a current goal of at least five per day.
Physical activity	76.9% have been physically active in the past month. 47.2% meet guidelines for moderate physical activity. 23% of adults engage in vigorous physical activity three or more days per week for 20 or more minutes per occasion (ACS, n.d.). 40% of adults engage in no leisure-time physical activity (ACS, n.d.).	60% of adults follow ACS guidelines for physical activity to engage in moderate activity (at least 30 minutes of moderate activity at least five days per week).	Increase the proportion of adults who engage in vigorous physical activity three or more days per week for 20 or more minutes per occasion to 30%. Reduce the proportion of adults who engage in no leisure-time physical activity to 20%.
Weight (body mass index [BMI])	39.2% are healthy or normal weight (BMI = 18.5–25). 35.7% are overweight (BMI > 25). 23% are obese (BMI > 30).	Maintain a healthy or normal weight. Lose weight if overweight or obese.	60% of adults are at a healthy or normal weight. 15% of adults are obese.

Note. Based on information from Centers for Disease Control and Prevention, 2007a, 2007b.

reported having more than one type of cancer. Other survey participants who did not report a personal or family history of cancer (33.6%, n = 2,141) served as the control group.

Statistical Analysis

Replicate weights, provided by the National Cancer Institute, were used to compute jackknife variance estimations, to adjust for nonresponse, and to calibrate or weight for gender, age, race or ethnicity, and education to allow for mean population estimates (Rizzo, 2003). All sample sizes are reported as unweighted and all percentages are reported as weighted, which allow for the sample data to be adjusted for and be representative of U.S. population estimates. Descriptive statistics were calculated for responses related to health knowledge, beliefs, behaviors, and demographic variables for the survivor and no history of cancer groups as well as for any type of cancer that had at least 30 respondents. Categorical data were analyzed using cross-tabulations, and chi-square and continuous data were analyzed using means and t tests in the univariate analyses.

The health behaviors evaluated in the present study were defined as currently smoking (yes or no), daily intake of at least five fruits or vegetables (yes or no), at least weekly physical activity working out long enough to work up a sweat (yes or no), and BMI (weight [lb]/[height (in)]^2 x 703). Patients were classified according to BMI as underweight (BMI < 18), healthy or normal weight (BMI 18 to < 25), overweight (BMI 25 to < 30), or obese (BMI ≥ 30) (Centers for Disease Control and Prevention, 2006; Keys, Fidanza, Karvonen, Kimura, & Taylor, 1972). To evaluate whether having had cancer was a predictor of current smoking, eating fruits or vegetables, or physical activity, separate logistic regression analyses were performed for each behavior. Each health behavior (yes or no) was the dependent variable, and cancer status (yes or no) was the independent variable. Other covariates associated with having had cancer in the univariate analyses (i.e., covariates with $p < 0.10$) were controlled for and included age (younger than 65 or 65 or older), gender, race or ethnicity (Caucasian, African American, other), marital status (married or not married), education (less than high school, completed high school, or more than high school), employment status (employed or unemployed), regular healthcare provider (yes or no), and health insurance (yes or no). Variables that were not significant were then dropped from the model in stages until all the variables were significant in the final model. SAS® version 9.0 (SAS Institute) and SUDAAN SAS Callable version 9.1 (RTI International) were used for all analyses. Significant p values ($p \leq 0.05$) are reported.

Results

Study Sample

When demographic variables were compared between the group without a history of cancer and survivors, a number of significant differences were found, including age, gender, employment, marital status, race or ethnicity, healthcare access, and general health status (see Table 2). The demographics by cancer diagnosis (breast, cervical, prostate, melanoma, colorectal, endometrial, and more than one cancer) also are reported.

No significant differences were found between the group without cancer and survivors when the three health behaviors (not smoking, eating at least five fruits or vegetables per day, and physical activity) were summed. The majority practiced one or two of the three behaviors (82% for those without cancer and 79% for survivors), but few practiced all three health behaviors (6.5% for those without cancer and 7.4% for survivors).

Smoking

No significant differences were found in the proportion of current smokers between the groups—18.4% of those without

Table 2. Demographics of Participants Without Cancer and Survivors by Cancer Diagnosis[a]

	No Cancer (N = 2,141)		Survivors (all) (N = 619)		Breast (N = 119)		Cervical (N = 94)		Prostate (N = 62)		Melanoma (N = 61)		Colorectal (N = 49)		Endometrial (N = 39)		> One Cancer (N = 59)	
Characteristic	$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$	
Age (years)	42.0		58.0		64.0		44.0		71.0		61.0		63.0		54.0		62.0	
Years since diagnosis	–		11.0		11.6		15.3		6.3		11.3		8.4		15.0		17.0	
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Male gender	981	55.1	179	34.5	–	–	–	–	62	100.0	32	56.9	14	42.7	–	–	17	32.4
Employment																		
Employed	1,285	62.2	228	39.4	42	37.2	52	57.5	14	29.8	25	50.0	13	41.5	11	20.9	14	26.3
Retired	295	11.8	237	35.3	53	49.6	11	9.7	40	61.8	31	41.7	23	42.7	13	28.0	28	44.3
Married	1,148	61.4	309	65.7	49	56.4	47	65.6	38	81.8	38	74.4	19	64.1	11	33.7	27	64.1
Race or ethnicity																		
White	1,236	61.9	486	81.1	93	75.6	67	79.4	46	82.7	58	95.8	40	91.6	31	74.2	47	84.9
Black	273	11.3	48	8.5	13	11.4	10	8.0	4	5.1	–	–	1	0.8	6	23.1	5	6.6
Hispanic	395	19.0	32	4.7	5	6.1	10	7.9	1	3.1	1	0.8	3	7.6	–	–	2	1.9
All others	128	7.8	30	5.7	7	6.8	6	4.7	4	9.1	1	3.5	–	–	1	2.8	3	6.6
Education																		
Less than high school	331	20.7	74	18.2	13	18.7	11	13.0	10	25.0	8	17.1	4	12.0	5	13.4	8	21.6
High school	619	32.1	207	38.2	40	37.6	38	50.6	16	28.6	11	18.7	15	38.9	16	56.6	18	34.4
More than high school	1,100	47.2	321	43.7	65	43.7	44	36.4	31	46.3	42	64.3	26	49.1	17	30.0	30	43.9
Income ($)																		
< 25,000	604	26.5	215	32.4	45	38.6	39	40.1	16	22.6	12	19.7	17	22.3	12	30.8	24	44.4
25,000 to < 35,000	275	12.3	81	12.5	14	10.4	15	17.9	11	22.1	5	5.3	4	7.5	7	12.2	8	11.0
35,000 to < 50,000	307	13.7	83	15.6	13	14.2	16	18.6	12	20.8	14	24.3	6	29.1	5	12.4	4	6.0
50,000–75,000	291	14.4	74	11.5	19	14.3	9	9.9	7	10.2	9	14.3	8	17.2	4	5.2	4	6.5
> 75,000	373	18.2	90	15.6	15	11.3	9	8.7	8	12.8	13	26.0	6	15.4	2	5.8	10	18.8
Missing	291	14.9	76	12.5	13	11.3	6	4.7	8	11.5	4	10.4	8	8.6	8	33.6	9	13.3
Had a regular healthcare provider	1,264	54.9	519	81.6	15	86.9	75	78.3	53	80.5	52	83.2	38	87.5	33	71.1	54	94.3
Had insurance	1,696	80.9	558	92.5	114	97.4	72	72.0	56	98.9	61	100.0	44	99.1	37	99.3	53	91.3
Health status (fair or poor)	441	21.4	200	36.1	39	41.6	33	37.9	19	28.4	16	29.7	13	25.1	16	53.9	17	32.5

[a] Represents 68% of Health Information National Trends Survey cancer survivors (more than 30 subjects with any one cancer type)

Note. All sample sizes are reported as unweighted and all percentages are reported as weighted, which allow for the sample data to be adjusted for and representative of U.S. population estimates.

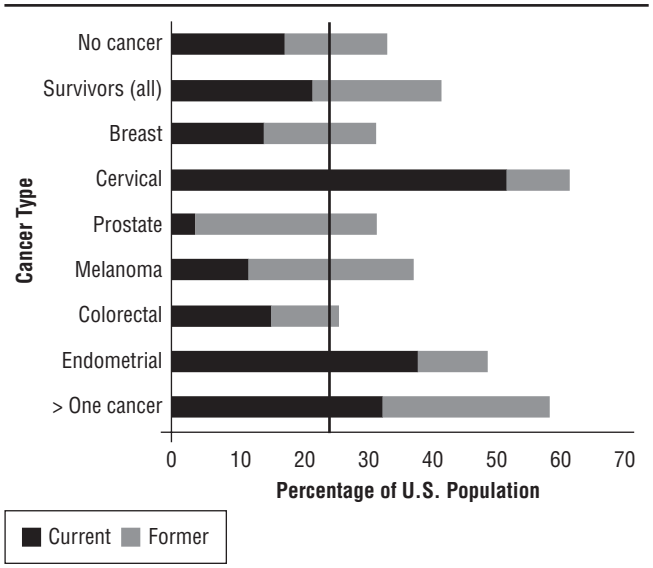
cancer and 22.5% of survivors reported being current smokers. Smoking prevalence rates are reported in Figure 1. Among cancer survivors, the lowest smoking rates were in men with prostate cancer (4%) and the highest rates were in women with cervical cancer (51.5%). Four of the seven cancer diagnoses had lower than national averages for current smoking (breast, prostate, melanoma, and colorectal), whereas three had higher than national averages (cervical, endometrial, and more than one cancer). When asked about what people could do to reduce their chances of getting cancer, 41.4% of subjects without cancer and 31.7% of survivors identified quitting or not smoking as a way to prevent cancer (see Table 3). Of current smokers, 64.7% of subjects without cancer and 48.9% of survivors expressed a desire to quit smoking.

In the final predictive model for smoking, cancer status was not associated with this behavior (survivor odds ratio [OR] = 1.3, 95% lower and upper confidence intervals [CI] = 0.9–1.8, p = 0.13). The odds of being a smoker were significantly associated with other covariates: Men were more likely than women to smoke (OR = 1.6, CI = 1.2–2.1, p < 0.01), those younger than 65 years were more likely to smoke (OR = 2.2, CI = 1.2–4, p < 0.01), divorced subjects were more likely to smoke than those who were married (OR = 2.1, CI = 1.1–3.9, p < 0.001), Caucasians were more likely to smoke than non-Caucasians (OR = 1.9, CI = 1.3–2.7, p < 0.01), and those who had health insurance were less likely to smoke (OR = 0.5, CI = 0.3–0.6, p < 0.001).

Fruit and Vegetable Consumption

The proportion of respondents eating at least five fruits or vegetables per day was not significantly different between participants without cancer (14.9%) and survivors (18%) (see Figure 2). When asked what people could do to reduce their chances of getting cancer, 21.6% of subjects without cancer and 29% of survivors identified eating better. For those who responded eating better, eating more fruits (13.6% of those without cancer and 12.1% of survivors) and more vegetables (20.7% and 20.1%, respectively) were identified as specific changes to reduce cancer risk. For respondents not eating at least five fruits or vegetables a day, 17% of those without cancer and 20% of survivors identified eating better as a desired personal change.

In the final predictive model, eating at least five fruits or vegetables per day was not associated with cancer status (survivor OR = 1.1, CI = 0.8–1.5, p = 0.5). Men (OR = 0.5, CI = 0.4–0.7, p < 0.001) and people with less than a high school education (OR = 0.6, CI = 0.4–0.8, p < 0.001) were less likely to eat at least five fruits or vegetables a day than women or people with at least a high school education.



Note. The vertical line represents the 2003 Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2007a) national average for adult current smokers (22%). No significant differences (p = 0.3) existed in smoking prevalence between those with and without cancer.

Figure 1. Smoking Prevalence

Physical Activity

Almost 53% of the group without cancer and 45.3% of the survivors participated in regular physical activity (p = 0.001) (see Figure 2). Rates of regular physical activity varied by cancer diagnosis and ranged from 32.7% for women with endometrial cancer to 53% for men with prostate cancer. When participants were asked if they had anything about their own behavior or lifestyle that they would like to change, 20.5% of those without cancer and 36.6% of overweight or obese survivors identified exercising more, yet only 4% of those without cancer and 3% of survivors identified regular physical activity as a way to prevent cancer.

In the final predictive model, cancer status was not associated with regular physical activity (survivor OR = 0.3, CI = 0.7–1.1, p = 0.29). The odds of engaging in regular physical activity were associated with other covariates and included never being married (OR = 2, CI = 1.2–3.5, p < 0.01), being younger than 65 years of age (OR = 1.7, CI = 1.3–2.3, p < 0.001), being male (OR = 1.4, CI = 1.2–1.7, p < 0.001), and having health insurance (OR = 1.5, CI = 1.1–1.9, p < 0.01). Having less than a high school education was not associated with regular physical activity (OR = 0.5, CI = 0.3–0.6, p < 0.001).

Weight

Mean BMI was not significantly different between the subjects without cancer (mean BMI = 26.5) and survivors (mean BMI = 27). More than half of both groups were overweight or obese (54.9% of those without cancer and 58% of survivors) (see Figure 3). The percentage of overweight or obese participants ranged from 54%–69.6% by cancer diagnosis (see Table 3). When asked whether they would like to change anything about their own behavior or lifestyle to reduce their chances of getting cancer, 16.1% of survivors and 6.6% of those without cancer who were either overweight or obese identified losing weight. Yet only 0.2% (n = 3) respondents without cancer and none of the survivors identified maintaining a healthy or normal weight as a way to prevent cancer.

Discussion

Using the HBM framework, the authors expected that cancer survivors would be more likely to take actions to promote their health based on their cancer experience than people without cancer. The behaviors included not smoking, eating at least five fruits or vegetables per day, engaging in regular physical activity, and maintaining a healthy or normal weight. This study evaluated the health behaviors in 619 cancer survivors an average of 11 years postdiagnosis and compared them to the behaviors of 2,141 adults without a history of cancer. Significant differences were found between the group without cancer and survivors in a number of demographic variables: Cancer survivors were older, and more were female and Caucasian. More survivors were retired or unable to work and not married. More survivors also reported having regular healthcare providers, health insurance, and fair or poor health. When controlling for the covariates, however, no significant differences were found in the three health behaviors or in weight between survivors and the group without cancer. Although all components of the HBM (susceptibility, seriousness, benefits, barriers, and self-efficacy) were not evaluated in the present study, gaps in knowledge about healthy behaviors and gaps between knowledge and expressed desire to change to healthier lifestyle behaviors were found.

Smoking

Abstinence from smoking is the most important health behavior that can be adopted to reduce the burden of cancer. Continued tobacco use in cancer survivors has been associated with the development of new primary cancers, poorer quality of life, and reduced survival (Garces et al., 2004; Gritz et al., 2006). In the present study, the prevalence of smoking in cancer survivors was similar to the national average (22%) and slightly lower for the group without cancer at the time of data collection in 2003 (Centers for Disease Control and Prevention, 2007a); variations were found by cancer diagnosis. Smoking was associated with being male, Caucasian, younger than 65, and divorced; having a high school education or less; and being less likely to have health insurance. The findings were similar to those reported by Bellizzi, Rowland, Jeffery, and McNeel (2005) in 7,384 cancer survivors from the National Health Interview Survey data. They found a 20.2% rate of current smokers and variation in smoking rates by cancer type. Similar to the present study's results, they also found a lower smoking rate among men with prostate cancer (11.1%) and a higher rate in women with gynecologic cancers (37.3%). Because smoking increases the risk for cervical and other cancers, the higher prevalence rate among women with a history of cervical cancer is of particular concern. Given the public's awareness of smoking issues, the finding that less than half of either group identified quitting or not smoking as a way to prevent cancer was surprising. Fortunately, many smokers in both groups expressed a desire to quit smoking.

Fruit and Vegetable Consumption

In 1991, the National Cancer Institute, in partnership with the Produce for Better Health Foundation, initiated the "5 a Day for Better Health" program to increase consumption of

Table 3. Percentage of Participants Who Agree That Health Behaviors Reduce Cancer Risk[a]

Health Behavior	No Cancer (N = 2,114)	Survivors (N = 619)	Breast (N = 119)	Cervical (N = 94)	Prostate (N = 62)	Melanoma (N = 61)	Colorectal (N = 49)	Endometrial (N = 39)	> One Cancer (N = 59)
Exercise knowledge									
Regular physical activity or exercise	77.9	73.0*	24.0	17.8	20.1	12.4	10.6	14.0	10.4
Fruit and vegetable knowledge									
Eat at least five servings per day.	23.1	27.5	42.7	24.8	19.0	33.5	33.3	24.8	27.2
Knowledge about what can help reduce cancer risk									
Eat better.	21.6	29.0**	15.2	8.6	12.6	11.2	15.3	7.1	6.9
Quit or do not smoke.	41.4	31.7	8.9	20.7	6.3	8.5	1.2	23.0	12.1
Exercise more.	4.0	3.0	7.3	8.3	4.6	14.5	9.8	7.2	7.5
Maintain healthy weight.	0.2	–	–	–	–	–	–	–	–
Desire to change own behavior									
Eat better.	11.7	12.6**	15.2	8.6	12.6	11.2	15.3	7.1	6.9
Quit or do not smoke.	13.4	10.6	8.9	20.7	6.3	8.5	1.2	23.0	12.1
Exercise more.	5.7	7.5	7.3	8.3	4.6	14.5	9.8	7.2	7.5
Obtain or maintain healthy weight.	1.2	3.3	7.9	3.2	1.3	2.9	–	8.3	–

[a] Represents 68% of cancer survivors (more than 30 subjects with any one cancer type)

* $p \leq 0.05$, ** $p \leq 0.001$

fruits and vegetables (National Cancer Institute, 2001). The program was based on accumulating evidence about the impact of diet on cancer. Since then, the program has changed to "Fruits and Veggies—More Matters." A World Cancer Research Fund (1997) report also made recommendations about diet and cancer prevention that included increasing consumption of fruits and vegetables. A number of studies showed consistent benefits of fruit and vegetable consumption on several cancers (Steinmetz & Potter, 1996). In the present study, consuming at least five fruits or vegetables per day was low (less than 20%) in both groups. Although healthy eating was identified as a way to prevent cancer and as a desired behavior change, the endorsement was low in both groups.

Physical Activity

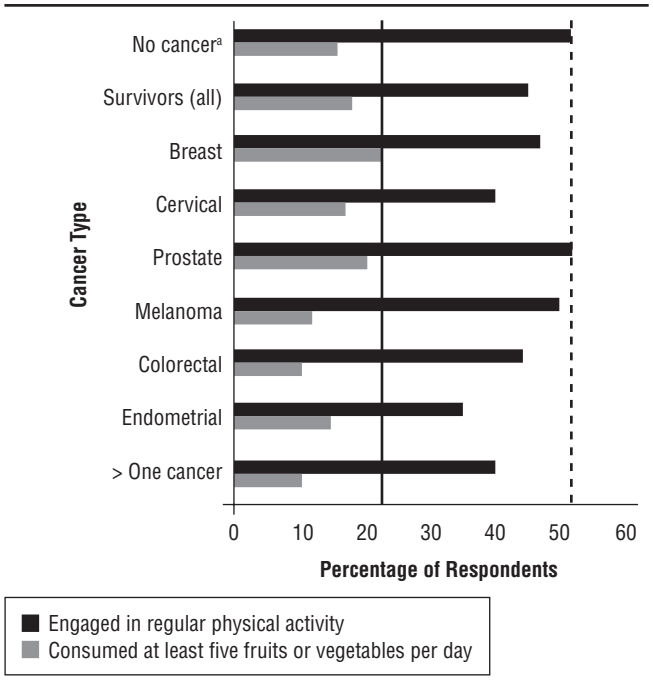
The American Cancer Society and Healthy People 2010 recommended that regular physical activity be practiced at least three to five times a week ("American Cancer Society Guidelines," 2006). The HINTS I question asked participants if they engaged in moderate physical activity at least once a week, making it impossible to know how many participants actually met the recommended guidelines. Researchers can assume that fewer participants met the recommended guidelines of exercising at least three times a week because the study asked about weekly exercise. Bellizzi et al. (2005) found that only 29.6% of cancer survivors met recommended physical activity guidelines. The public may be unaware that physical activity can help prevent some cancers. In addition, only a small number in both groups (less than 10%) identified exercising as a desired behavior change. Clearly, this area is in need of further exploration and intervention because physical activity consistently has been shown to improve the quality of life and physical functioning of cancer survivors (Courneya, 2003; Courneya et al., 2003; Courneya & Friedenreich, 1999). Additional studies also have evaluated the beneficial effects of physical activity on cancer risk (Friedenreich, 2001; Lee, 2003; McTiernan, 2005) and prognosis (McTiernan, 2004).

Weight (Body Mass Index)

Being overweight is associated with a number of cancers and other chronic illnesses (Eyre et al., 2004; Key et al., 2004; McTiernan, 2005). Obesity also may contribute to recurrence rates and poorer prognosis in breast, prostate, and colon cancer survivors (Irwin et al., 2005; McTiernan, 2005; Rock & Demark-Wahnefried, 2002; Strom et al., 2005). More than half of the respondents in both groups were overweight or obese. Very few respondents identified losing weight as a desired behavior change. Even fewer identified the importance of maintaining a healthy or normal weight as a way to prevent cancer. This finding may change as the public becomes more aware of the health issues that obesity can cause.

Summary

Survivors were not different from the group without a history of cancer when controlling for other demographic variables in the specific health behaviors explored. Overall, the smoking rates of cancer survivors were similar to the national average. Women with cervical and endometrial cancers, however, reported much higher rates of current smoking than those with any other cancer diagnosis. Many in both groups consumed fewer than five fruits or vegetables daily, were not physically active on a regular basis, and were overweight. The public has a lack of awareness about the role of these health behaviors in preventing cancer. Although information regarding the impact of diet, physical activity, and weight is more recent, the role of smoking in the development of cancer has been known publicly for decades. Therefore, that less than half of either group identified not smoking (or quitting) as a way to prevent cancer is disconcerting.



[a] Comparisons between no cancer and survivors: $p < 0.001$ for physical activity and 0.1 for fruit or vegetable consumption

Note. The dotted and solid vertical lines represent the 2003 Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2007a) national averages for moderate or vigorous physical activity at least three days per week (52.8%) and fruit and vegetable consumption (22.6%), respectively.

Figure 2. Prevalence of Regular Physical Activity and Fruit and Vegetable Consumption

The U.S. population in general, and cancer survivors in particular, clearly could benefit from targeted health education and promotion interventions. The promotion of smoking prevention and cessation should be a priority for cancer survivors and the healthcare providers caring for them (Agency for Healthcare Research and Quality, 2005; Sarna et al., 2000). Smoking cessation interventions tailored to cancer survivors currently are being tested (Emmons et al., 2005; Pinto & Trunzo, 2005).

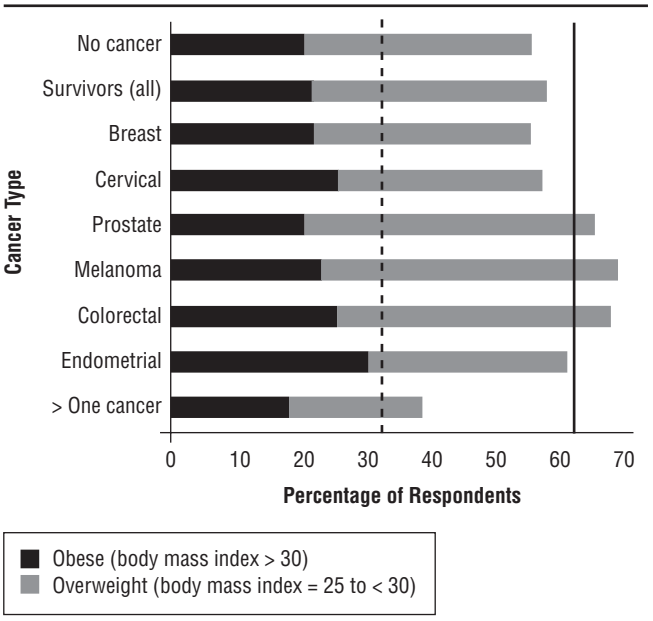
Survivors have expressed interest in receiving information about eating a healthy diet and exercise (Demark-Wahnefried et al., 2000; Demark-Wahnefried, Werner, et al., 2005; Jones & Courneya, 2002; Patterson et al., 2003; Pinto et al., 2002; Reedy, Haines, & Campbell, 2005; Satia et al., 2004). Recognizing that many survivors are interested in taking control of their own health, the American Cancer Society recently developed a guide regarding nutrition and physical activity during and after treatment (Brown et al., 2003; Kushi et al., 2006). A growing number of randomized, controlled trials are being conducted to explore the benefits of regular physical activity and healthy eating habits in cancer survivors (Cox, McLaughlin, Rai, Steen, & Hudson, 2005; Demark-Wahnefried et al., 2003; Irwin et al., 2004; Knols, Aaronson, Uebelhart, Fransen, & Aufdemkampe, 2005; Perry & Bauer, 2001; Pinto & Trunzo, 2005). In a historic joint venture, the American Cancer Society, American Diabetes Association, and the American Heart Association collaborated to create a common agenda for the U.S. population (Eyre et al., 2004). The agenda will promote healthy lifestyles and screening for the prevention and early detection of diseases such as cancer, diabetes, and heart disease. All of the interventions may help survivors remain on a path to achieving and maintaining a healthy or normal weight and lifestyle.

Limitations

The limitations of this study are mainly related to conducting a secondary data analysis, including working with the existing questions and data. As such, HINTS was not designed to test the HBM or its components (susceptibility, seriousness, benefits, barriers, and self-efficacy) or cancer survivorship issues. The HBM was not evaluated for its predictive ability but instead was used to guide the identification and inclusion of relevant variables in understanding self-reported health behaviors. Although the HINTS participants were a random sample of the U.S. population, the cancer survivors in the study may not have been representative of all U.S. cancer survivors. Information about cancer treatment and staging was not collected. Self-report of cancer history and health behaviors is subject to recall bias, and the self-report was not verified. Nevertheless, the robust sample of survivors and controls, as well as rich item content, provided a unique opportunity to explore these issues within the theoretical framework of the HBM.

Conclusion

Contrary to what the authors expected to find, cancer survivors did not differ from the group without a history of cancer when controlling for other demographic variables in the specific health behaviors explored in this study. Further exploration of the findings (e.g., impact of time since



Note. The solid and dotted vertical lines represent the 2003 Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2007a) national average for overweight (65.2%) and obese (31.1%) adults, respectively.

Figure 3. Prevalence of Participants Who Were Overweight or Obese by Body Mass Index

diagnosis) are warranted, including exploring the concept of the "teachable moment" for survivors. Abstaining from smoking, eating fruits and vegetables, being physically active, and maintaining a healthy or normal weight can enhance health-related quality of life and improve survival of cancer survivors (Demark-Wahnefried, Aziz, et al., 2005; Institute of Medicine, 2006). Adoption of healthy lifestyle behaviors should be addressed by nurses when caring for cancer survivors. The authors encourage development of health education programs to promote healthy behaviors and, more specifically, to develop and evaluate targeted programs for cancer survivors.

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References

Agency for Healthcare Research and Quality. (2005). *Helping smokers quit: A guide for nurses.* Rockville, MD: Author. Retrieved March 29, 2007, from http://www.ahrq.gov/about/nursing/hlpsmksqt.htm

American Association for Public Opinion Research. (2006). *Standard definitions: Final dispositions of case codes and outcome rates for surveys*. Retrieved April 9, 2007, from http://www.aapor.org/pdfs/standarddefs_4.pdf

American Cancer Society. (n.d.). Challenge goals, principles and nationwide objectives. Retrieved April 10, 2007, from http://www.facs.org/cancer/coc/acschallengegoals.pdf

American Cancer Society. (2007). *Cancer facts and figures, 2007*. Atlanta, GA: Author.

American Cancer Society guidelines on nutrition and physical activity for cancer prevention: Reducing the risk of cancer with healthy food choices and physical activity. (2006). *CA: A Cancer Journal for Clinicians, 56,* 254–281.

Baker, F., Denniston, M., Smith, T., & West, M.M. (2005). Adult cancer survivors: How are they faring? *Cancer, 104,* 2565–2576.

Bellizzi, K.M., Rowland, J.H., Jeffery, D.D., & McNeel, T. (2005). Health behaviors of cancer survivors: Examining opportunities for cancer control intervention. *Journal of Clinical Oncology, 23,* 8884–8893.

Blanchard, C.M., Denniston, M.M., Baker, F., Ainsworth, S.R., Courneya, K.S., Hann, D.M., et al. (2003). Do adults change their lifestyle behaviors after a cancer diagnosis? *American Journal of Health Behaviors, 27,* 246–256.

Blanchard, C.M., Stein, K.D., Baker, F., Dent, M.F., Denniston, M.M., Courneya, K.S., et al. (2004). Association between current lifestyle behaviors and health-related quality of life in breast, colorectal, and prostate cancer survivors. *Psychology and Health, 19,* 1–14.

Brown, J.K., Byers, T., Doyle, C., Coumeya, K.S., Demark-Wahnefried, W., Kushi, L.H., et al. (2003). Nutrition and physical activity during and after cancer treatment: An American Cancer Society guide for informed choices. *CA: A Cancer Journal for Clinicians, 53,* 268–291.

Centers for Disease Control and Prevention. (2006). BMI: About body mass index. Retrieved March 29, 2007, from http://www.cdc.gov/nccdphp/dnpa/bmi/adult_BMI/about_adult_BMI.htm

Centers for Disease Control and Prevention. (2007a). Behavioral Risk Factor Surveillance System. Retrieved March 29, 2007, from http://www.cdc.gov/brfss

Centers for Disease Control and Prevention. (2007b). National Health Interview Survey. Retrieved April 10, 2007, from http://www.cdc.gov/nchs/nhis.htm

Coups, E.J., & Ostroff, J.S. (2005). A population-based estimate of the prevalence of behavioral risk factors among adult cancer survivors and noncancer controls. *Preventive Medicine, 40,* 702–711.

Courneya, K.S. (2003). Exercise in cancer survivors: An overview of research. *Medicine and Science in Sports and Exercise, 35,* 1846–1852.

Courneya, K.S., & Friedenreich, C.M. (1999). Physical exercise and quality of life following cancer diagnosis: A literature review. *Annals of Behavioral Medicine, 21,* 171–179.

Courneya, K.S., Mackey, J.R., Bell, G.J., Jones, L.W., Field, C.J., & Fairey, A.S. (2003). Randomized controlled trial of exercise training in postmenopausal breast cancer survivors: Cardiopulmonary and quality of life outcomes. *Journal of Clinical Oncology, 21,* 1660–1668.

Cox, C.L., McLaughlin, R.A., Rai, S.N., Steen, B.D., & Hudson, M.M. (2005). Adolescent survivors: A secondary analysis of a clinical trial targeting behavior change. *Pediatric Blood and Cancer, 45,* 144–154.

Demark-Wahnefried, W., Aziz, N.M., Rowland, J.H., & Pinto, B.M. (2005). Riding the crest of the teachable moment: Promoting long-term health after the diagnosis of cancer. *Journal of Clinical Oncology, 23,* 5814–5830.

Demark-Wahnefried, W., Morey, M.C., Clipp, E.C., Pieper, C.F., Snyder, D.C., Sloane, R., et al. (2003). Leading the way in exercise and diet (Project LEAD): Intervening to improve function among older breast and prostate cancer survivors. *Controlled Clinical Trials, 24,* 206–223.

Demark-Wahnefried, W., Peterson, B., McBride, C., Lipkus, I., & Clipp, E. (2000). Current health behaviors and readiness to pursue life-style changes among men and women diagnosed with early stage prostate and breast carcinomas. *Cancer, 88,* 674–684.

Demark-Wahnefried, W., Werner, C., Clipp, E.C., Guill, A.B., Bonner, M., Jones, L.W., et al. (2005). Survivors of childhood cancer and their guardians. *Cancer, 103,* 2171–2180.

Edwards, B.K., Brown, M.L., Wingo, P.A., Howe, H.L., Ward, E., Ries, L.A., et al. (2005). Annual report to the nation on the status of cancer, 1975–2002, featuring population-based trends in cancer treatment. *Journal of the National Cancer Institute, 97,* 1407–1427.

Emmons, K.M., Puleo, E., Park, E., Gritz, E.R., Butterfield, R.M., Weeks, J.C., et al. (2005). Peer-delivered smoking counseling for childhood cancer survivors increases rate of cessation: The partnership for health study. *Journal of Clinical Oncology, 23,* 6516–6523.

Eyre, H., Kahn, R., Robertson, R.M., Clark, N.G., Doyle, C., Hong, Y., et al. (2004). Preventing cancer, cardiovascular disease, and diabetes: A common agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Stroke, 35,* 1999–2010.

Friedenreich, C.M. (2001). Physical activity and cancer prevention: From observational to intervention research. *Cancer Epidemiology, Biomarkers and Prevention, 10,* 287–301.

Garces, Y.I., Yang, P., Parkinson, J., Zhao, X., Wampfler, J.A., Ebbert, J.O., et al. (2004). The relationship between cigarette smoking and quality of life after lung cancer diagnosis. *Chest, 126,* 1733–1741.

Gotay, C.C., & Muraoka, M.Y. (1998). Quality of life in long-term survivors of adult-onset cancers. *Journal of the National Cancer Institute, 90,* 656–667.

Gritz, E.R., Fingeret, M.C., Vidrine, D.J., Lazev, A.B., Mehta, N.V., & Reece, G.P. (2006). Successes and failures of the teachable moment. *Cancer, 106,* 17–27.

Healthy People 2010. (n.d.). Search objectives. Retrieved April 10, 2007, from http://www.healthypeople.gov/search/objectives.htm

Hewitt, M., Breen, N., & Devesa, S. (1999). Cancer prevalence and survivorship issues: Analyses of the 1992 National Health Interview Survey. *Journal of the National Cancer Institute, 91,* 1480–1486.

Hewitt, M., Rowland, J.H., & Yancik, R. (2003). Cancer survivors in the United States: Age, health, and disability. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 58,* 82–91.

Institute of Medicine. (2006). *From cancer patient to cancer survivor: Lost in transition.* Washington, DC: National Academies Press.

Irwin, M.L., McTiernan, A., Baumgartner, R.N., Baumgartner, K.B., Bernstein, L., Gilliland, F.D., et al. (2005). Changes in body fat and weight

after a breast cancer diagnosis: Influence of demographic, prognostic, and lifestyle factors. *Journal of Clinical Oncology, 23,* 774–782.

Irwin, M.L., McTiernan, A., Bernstein, L., Gilliland, F.D., Baumgartner, R., Baumgartner, K., et al. (2004). Physical activity levels among breast cancer survivors. *Medicine and Science in Sports and Exercise, 36,* 1484–1491.

Janz, N., Champion, V., & Strecher, V. (2002). The Health Belief Model. In K. Glanz, B. Rimer, & F. Lewis (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 45–66). San Francisco: Jossey-Bass.

Jones, L.W., & Courneya, K.S. (2002). Exercise counseling and programming preferences of cancer survivors. *Cancer Practice, 10,* 208–215.

Key, T.J., Schatzkin, A., Willett, W.C., Allen, N.E., Spencer, E.A., & Travis, R.C. (2004). Diet, nutrition and the prevention of cancer. *Public Health Nutrition, 7,* 187–200.

Keys, A., Fidanza, F., Karvonen, M.J., Kimura, N., & Taylor, H.L. (1972). Indices of relative weight and obesity. *Journal of Chronic Disease, 25,* 329–343.

Kushi, L.H., Byers, T., Doyle, C., Bandera, E.V., McCullough, M., Gansler, T., et al. (2006). American Cancer Society guidelines on nutrition and physical activity for cancer prevention: Reducing the risk of cancer with healthy food choices and physical activity. *CA: A Cancer Journal for Clinicians, 56,* 254–281.

Knols, R., Aaronson, N.K., Uebelhart, D., Fransen, J., & Aufdemkampe, G. (2005). Physical exercise in cancer patients during and after medical treatment: A systematic review of randomized and controlled clinical trials. *Journal of Clinical Oncology, 23,* 3830–3842.

Lee, I.M. (2003). Physical activity and cancer prevention—data from epidemiologic studies. *Medicine and Science in Sports and Exercise, 35,* 1823–1827.

Lindsey, A.M., Waltman, N., Gross, G., Ott, C.D., & Twiss, J. (2004). Cancer risk-reduction behaviors of breast cancer survivors. *Western Journal of Nursing Research, 26,* 872–890.

Mayer, D.K., Terrin, N.C., Kreps, G.L., Menon, U., McCance, K., Parsons, S.K., et al. (2007). Cancer survivors' information seeking behaviors: A comparison of survivors who do and do not seek information about cancer. *Patient Education and Counseling, 65,* 342–350.

Mayer, D.K., Terrin, N.C., Menon, U., Kreps, G.L., McCance, K., Parsons, S.K., et al. (2007). Screening practices in cancer survivors. *Journal of Cancer Survivorship, 1,* 17–26.

McTiernan, A. (2004). Physical activity after cancer: Physiologic outcomes. *Cancer Investigation, 22,* 68–81.

McTiernan, A. (2005). Obesity and cancer: The risks, science, and potential management strategies. *Oncology, 19,* 871–881.

Mokdad, A.H., Marks, J.S., Stroup, D.F., & Gerberding, J.L. (2004). Actual causes of death in the United States, 2000. *JAMA, 291,* 1238–1245.

Mullens, A.B., McCaul, K.D., Erickson, S.C., & Sandgren, A.K. (2004). Coping after cancer: Risk perceptions, worry, and health behaviors among colorectal cancer survivors. *Psycho-Oncology, 13,* 367–376.

National Cancer Institute. (n.d.). Health Information National Trends Survey: How Americans find and use cancer information. Retrieved March 29, 2007, from http://hints.cancer.gov/hints

National Cancer Institute. (2001). *5 a day for better health program* [NIH Publication # 01–5019]. Washington, DC: U.S. Government Printing Office.

National Cancer Institute. (2003). *HINTS 1 final report.* Retrieved March 29, 2007, from http://hints.cancer.gov/hints/docs/final_report.pdf

National Cancer Institute. (2005). *SEER cancer statistics review, 1975–2002.* Bethesda, MD: Author.

National Cancer Institute. (2006). Cancer trends progress report—2005 update. Retrieved March 29, 2007, from http://progressreport.cancer.gov

Nelson, D., Rimer, B., Kreps, G., Hesse, B., Viswanath, K., Croyle, R., et al. (2004). The Health Information National Trends Survey (HINTS): Development, design, and dissemination. *Journal of Health Communication, 9,* 443–460.

Nord, C., Mykletun, A., Thorsen, L., Bjoro, T., & Fossa, S.D. (2005). Self-reported health and use of health care services in long-term cancer survivors. *International Journal of Cancer, 114,* 307–316.

Olshansky, S.J., Passaro, D.J., Hershow, R.C., Layden, J., Carnew, B.A., Brody, J., et al. (2005). A potential decline in life expectancy in the United States in the 21st century (Special report). *New England Journal of Medicine, 352,* 1138–1145.

Patterson, R.E., Neuhouser, M.L., Hedderson, M.M., Schwartz, S.M., Standish, L.J., & Bowen, D.J. (2003). Changes in diet, physical activity, and supplement use among adults diagnosed with cancer. *Journal of the American Dietetic Association, 103,* 323–328.

Perry, C., & Bauer, K. (2001). Effect of printed tailored messaging on cancer risk behavior. *Topics in Clinical Nutrition, 16,* 42–52.

Pinto, B.M., Maruyama, N.C., Clark, M.M., Cruess, D.G., Park, E., & Roberts, M. (2002). Motivation to modify lifestyle risk behaviors in women treated for breast cancer. *Mayo Clinic Proceedings, 77,* 122–129.

Pinto, B.M., & Trunzo, J.J. (2005). Health behaviors during and after a cancer diagnosis. *Cancer, 104,* 2614–2623.

Reedy, J., Haines, P.S., & Campbell, M.K. (2005). The influence of health behavior clusters on dietary change. *Preventive Medicine, 41,* 268–275.

Rizzo, L. (2003). *NCI HINTS sample design and weighting plan*. Bethesda, MD: National Cancer Institute.

Rock, C.L., & Demark-Wahnefried, W. (2002). Nutrition and survival after the diagnosis of breast cancer: A review of the evidence. *Journal of Clinical Oncology, 20,* 3302–3316.

Sarna, L.P., Brown, J.K., Lillington, L., Rose, M., Wewers, M.E., & Brecht, M.L. (2000). Tobacco interventions by oncology nurses in clinical practice: Report from a national survey. *Cancer, 89,* 881–889.

Satia, J.A., Campbell, M.K., Galanko, J.A., James, A., Carr, C., & Sandler, R.S. (2004). Longitudinal changes in lifestyle behaviors and health status in colon cancer survivors. *Cancer Epidemiology, Biomarkers and Prevention, 13,* 1022–1031.

Steinmetz, K.A., & Potter, J.D. (1996). Vegetables, fruit, and cancer prevention: A review. *Journal of the American Dietetic Association, 96,* 1027–1039.

Strecher, V.J., DeVellis, B.M., Becker, M.H., & Rosenstock, I.M. (1986). The role of self-efficacy in achieving health behavior change. *Health Education Quarterly, 13,* 73–92.

Strom, S.S., Wang, X., Pettaway, C.A., Logothetis, C.J., Yamamura, Y., Do, K.A., et al. (2005). Obesity, weight gain, and risk of biochemical failure among prostate cancer patients following prostatectomy. *Clinical Cancer Research, 11,* 6889–6894.

World Cancer Research Fund. (1997). *Food, nutrition and the prevention of cancer: A global perspective*. London: Author.

Yabroff, K., Lawrence, W., Clauser, S., Davis, W., & Brown, M. (2004). Burden of illness in cancer survivors: Findings from a population-based national sample. *Journal of the National Cancer Institute, 96,* 1322–1330.