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To cite this article: Carissa A. Low, Ellen Beckjord, Dana H. Bovbjerg, Mary Amanda Dew, Donna M. Posluszny, John E. Schmidt, Amy E. Lowery, Stephanie A. Nutt, Sarah R. Arvey & Ruth Rechis (2014) Correlates of Positive Health Behaviors in Cancer Survivors: Results from the 2010 LIVESTRONG Survey, *Journal of Psychosocial Oncology*, 32:6, 678-695, DOI: [10.1080/07347332.2014.955243](https://doi.org/10.1080/07347332.2014.955243)

To link to this article: <http://dx.doi.org/10.1080/07347332.2014.955243>



Accepted author version posted online: 30 Aug 2014.
Published online: 30 Aug 2014.



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Correlates of Positive Health Behaviors in Cancer Survivors: Results from the 2010 LIVESTRONG Survey

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Positive health-promoting behaviors, including lifestyle factors (e.g., physical activity) and appropriate health service utilization (e.g., screening for secondary cancers), can minimize the health risks and challenges facing cancer survivors. The goal of this article is to examine factors associated with positive health behaviors in 2,615 posttreatment cancer survivors who completed the 2010 LIVESTRONG survey. Multivariate logistic regression was used to model odds of reporting each of six positive health behaviors “as a result of your experience with cancer”: three “healthy lifestyle” behaviors and three “health care utilization” behaviors. In fully adjusted models, factors associated with greater likelihood of engaging in positive lifestyle behaviors (e.g., physical activity, changing diet) included sociodemographic factors, greater knowledge about how to reduce cancer risk; and reporting more psychological benefits due to cancer ($ps < .01$). Factors associated with greater likelihood of attending medical appointments and obtaining recommended cancer screenings included older age, better patient–provider communication, greater knowledge about how to reduce cancer risk, and more psychological benefits of cancer ($ps < .01$). Results suggest that

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knowledge about how to prevent cancer and benefit finding after cancer are related to positive health behaviors broadly, whereas better patient–provider communication is associated with positive cancer screening and health care utilization but not healthy lifestyle behaviors. Clinical interventions targeting these modifiable factors could maximize positive health behavior changes among cancer survivors, affecting risk for cancer recurrence as well as overall health and well-being.

KEYWORDS *survivorship, health behavior, cancer, posttreatment, psycho-oncology*

The number of cancer survivors in the United States is steadily growing and will continue to expand with the aging of the population and advances in cancer treatment (Buchanan et al., 2013). Survivors are at significantly elevated risk for recurrence as well as secondary cancers, comorbid chronic conditions and lingering physical symptoms, and premature mortality related to the cancer and/or the consequences of treatment (Beckjord et al., 2013; Demark-Wahnefried, Aziz, Rowland, & Pinto, 2005; Hewitt, Rowland, & Yancik, 2003; McCabe, Partridge, Grunfeld, & Hudson, 2013). Thus, identifying strategies to promote optimal health after cancer is a public health priority and an evolving challenge for clinical practice.

Accumulating evidence suggests that healthy behaviors such as physical activity can help protect cancer survivors from recurrence and other health problems (Carmack, Basen-Enquist, & Gritz, 2011; Demark-Wahnefried, Pinto, & Gritz, 2006). Adherence to recommended cancer screenings is also important to promote long-term survivor health (Hewitt, Greenfield, & Stovall, 2005). The transition to cancer survivorship represents a “teachable moment” during which survivors may be more motivated to take better care of their health and to adopt a healthier lifestyle (Demark-Wahnefried et al., 2005).

Despite increased health risks, most cancer survivors do not increase positive, health protective behaviors in the years following a cancer diagnosis. Studies comparing cancer survivors to participants who have not had cancer suggest that survivors are not more likely to engage in healthy lifestyle behaviors (Mayer et al., 2007; Williams, Steptoe, & Wardle, 2013) or to obtain screenings for secondary cancers (Schumacher et al., 2012; cf., Bellizzi et al., 2005). A national survey of cancer survivors indicated that only a minority of cancer survivors met healthy lifestyle recommendations for diet and exercise (Blanchard, Courneya, & Stein, 2008), highlighting the importance of a better understanding of the factors associated with survivors’ engagement in positive health behaviors after cancer.

Identifying differences between those who engage in positive health behaviors after cancer and those who do not may guide clinical practice and

interventions to encourage sustained positive health behavior changes following cancer treatment. Several studies have examined sociodemographic and cancer-related factors as correlates or predictors of health behaviors. Younger survivors, females, those with more education, and survivors farther from diagnosis have been demonstrated to be more likely to adopt positive health behaviors following cancer (Demark-Wahnefried et al., 2005; Hawkins et al., 2010). A range of potentially modifiable psychosocial correlates have also been examined, with evidence suggesting that greater fear of recurrence, greater sense of control over illness, greater social support and optimism, and greater perception of cancer-related psychosocial benefits (e.g., strengthened spirituality or increased appreciation for life) are related to positive health behavior change (Harper et al., 2007; Hawkins et al., 2010; Park, Edmonson, Fenster, & Blank, 2008; Park & Gaffey, 2007).

The health belief model and social cognitive theory (Rosenstock, Strecher, & Becker, 1998) suggest that health-promoting behaviors after cancer diagnosis will be positively correlated with factors associated with (1) greater perceived health threat (e.g., younger age, fear of recurrence) and (2) greater self-efficacy (e.g., knowledge about how to minimize risk). This conceptual framework raises several additional factors as yet unexamined in relation to health behavior engagement after cancer. First, variability in physical symptoms experienced after cancer (e.g., fatigue, pain) may be related to individual differences in perceived health threat and may serve as cues to action to engage in healthy behaviors. Second, patient-provider communication factors likely affect survivor self-efficacy and knowledge about how to reduce recurrence (Epstein & Street, 2007). It is important to determine the extent to which these factors relate to positive lifestyle (e.g., diet and exercise) and health care utilization (e.g., surveillance) behavior in cancer survivors, as late physical symptoms and patient-provider communication are potentially addressable in clinical practice.

The goal of this article is to examine factors associated with positive health behaviors in cancer survivors who completed the 2010 **LIVESTRONG** survey. The 2010 **LIVESTRONG** survey provides a valuable opportunity to examine a range of potential correlates of self-reported positive health behaviors in a large sample of cancer survivors, including correlates examined in previous studies (e.g., sociodemographic and cancer-related factors, positive emotional sequelae of cancer), as well as previously unexplored factors (e.g., patient-provider communication, posttreatment physical symptoms).

METHOD

Procedure

From June 2010 through March 2011, **LIVESTRONG** fielded the online **LIVESTRONG** Survey for Post-Treatment Cancer Survivors (see Rechis et al., 2011 for details on administration and a copy of the survey instrument). The

survey was available on LIVESTRONG.org, and LIVESTRONG constituents were notified about the survey through e-mails, Twitter, and Facebook posts. Additionally, LIVESTRONG reached out to partner organizations (e.g., the American Cancer Society) and state cancer coalitions who shared information about the survey with their constituents. Finally, LIVESTRONG worked with several Comprehensive Cancer Centers to share the survey with patients.

Participants

A total of 4,286 posttreatment cancer survivors responded to the 2010 LIVESTRONG survey. Posttreatment cancer survivors were defined as respondents who reported being finished with their cancer treatment, or who reported managing cancer as a chronic condition or taking medication (e.g., tamoxifen) to prevent a recurrence.

Respondents were excluded from the current analyses if they were missing any data on any of the six questions concerning positive health behaviors, the primary study outcomes ($n = 1,091$); relative to respondents with health behavior data, participants missing these data tended to be older, more recently diagnosed, female, and to have not undergone chemotherapy ($ps < .05$). Additional participants were excluded from analyses who were missing sociodemographic data (age, gender, race/ethnicity, education, marital status; $n = 337$) and/or cancer-related data (type of cancer; time since diagnosis; treatment received; $n = 210$) and/or other survey data used in analyses ($n = 158$). The final sample for analyses included 2,615 posttreatment cancer survivors.

Demographic characteristics of the sample are displayed in Table 1. As can be seen, the survey was completed by cancer survivors representing a wide range of demographic and medical history characteristics, including age, education level, primary cancer diagnosis, time since last treatment, and physical and emotional sequelae of cancer. There were more females in the sample than males, and the sample was predominantly White and married. Because the data on time since diagnosis was significantly skewed, this variable was log-transformed to normalize prior to regression analyses.

Measures

Positive health behaviors. Questions about positive health behaviors were presented as a series of items starting with the following statement: "Since completing treatment, have any of the following statements been true for you as a result of your experience with cancer?" Statements included three items assessing positive lifestyle changes (i.e., "I have led a more healthy lifestyle," "I have participated in regular physical activity (for example, you

TABLE 1 Descriptive Statistics ($N = 2615$)

Age	$M = 48.47$, $SD = 12.37$, range = 18–85 years
Gender	62% female ($n = 1,614$)
Race	93% White ($n = 2,439$)
Education	21% less than college ($n = 552$) 25% some college ($n = 645$) 32% college graduate ($n = 827$) 23% postcollege ($n = 591$)
Marital status	70% married ($n = 1,825$) 18% single ($n = 480$) 12% divorced/widowed ($n = 310$)
Diagnosis	23% breast ($n = 607$) 13% hematological ($n = 329$) 9% testicular ($n = 236$) 7% colorectal ($n = 178$) 6% prostate ($n = 164$) 42% other (<5% for any specific type) ($n = 1101$)
Years since last treatment	$M = 5.00$, $SD = 6.16$, range = 0–54 years
Cancer treatment	54% chemo plus surgery/radiation ($n = 1,398$) 37% no chemo ($n = 965$) 10% only chemo ($n = 252$)
Patient-provider communication	$M = 2.18$, $SD = .76$, range 0–3
Needs met by team during treatment	$M = 4.13$, $SD = .83$, range 1–5
Needs met by team after treatment	$M = 3.81$, $SD = 1.01$, range 1–5
Know how to reduce cancer risk	$M = 1.99$, $SD = .70$, range 0–3
Number of benefits reported	$M = 4.59$, $SD = 1.62$, range 0–6
Number of physical concerns reported	$M = 3.49$, $SD = 2.57$, range 0–13
Number of emotional concerns reported	$M = 3.70$, $SD = 1.89$, range 0–7

participate in some type of physical activity at least 2 to 3 times a week),” and “I have changed my diet to eat more healthy foods”) and three items assessing positive health service utilization (i.e., “I have attended all regular medical appointments,” “I have received screenings for secondary cancers,” and “I am up to date on all recommended cancer screenings”). Endorsement of any of the items (yes vs. no) was counted as a positive health behavior change. “Don’t know” responses were infrequent and were coded as *no*. The list also included an item on smoking (“I have quit smoking”), but because smoking history and status were not assessed, negative responses to this question did not discriminate between respondents who had never smoked and those who continued to smoke, and this item was omitted.

Sociodemographic and cancer-related variables. Sociodemographic variables included age, gender, race/ethnicity, education, and marital status. Cancer-related medical variables included type of cancer, treatment received (i.e., chemotherapy plus radiation and/or surgery, chemotherapy only, and no chemotherapy), and years since completing treatment.

Communication with health care providers. Participants also answered questions about provider–patient communication, derived from the Health

Information National Trends Survey (see Cantor et al., 2009 for methodology). These items were modified versions of items developed for the Consumer Assessment of Health Providers and Systems (CAHPS) (Darby, Crofton, & Clancy, 2006), which have been shown to index a single underlying communication quality construct (Hays, Chong, Brown, Spritzer, & Horne, 2003). The question asked, "During the past 12 months, how often did doctors, nurses, or other health professionals: give you the chance to ask all the health-related questions you had? Give the attention you needed to your feelings and emotions? Make sure you understood the things you needed to do to take care of your health? Help you deal with feelings of uncertainty about your health or health care? Involve you in decisions about your health care as much as you wanted?"

Respondents rated each of the five items on a 4-point response scale, with choices ranging from *always* to *never*. For analysis, responses were reverse scored so that higher numbers indicated more positive perceptions of communication. The mean of the five items served as the measure of patient-provider communication quality, consistent with previous research using the CAHPS measures (Rutten, Auguston, & Wanke, 2006). Reliability analyses in the **LIVESTRONG** sample showed high internal consistency (Cronbach's $\alpha = .91$).

In addition, participants responded to two single items assessing whether their health care team met all, many, some, very few, or none of their needs "while on treatment for cancer" and "after I finished treatment for cancer." Finally, participants rated (on a 4-point scale from *strongly disagree* to *strongly agree*) how much they agreed with the statement "I know what to do to reduce my risk for cancer."

Emotional and physical sequelae of cancer. Positive emotional sequelae of cancer (i.e., benefit-finding as a result of cancer) was assessed by asking whether the following statements have been true "as a result of your experience with cancer": "I have appreciated life more because of having cancer," "I have felt that cancer helped me to recognize what is important in life," "I have had a renewed sense of spirituality because of having cancer," "I have felt better able to deal with stress because of having cancer," "I have realized that having had cancer helps me to cope better with problems now," and "I feel that my experience with cancer has made me a better person." Agreement with any item (yes vs. no) was counted as a perceived benefit, and a summed index of all six items was created for analyses.

Respondents also reported whether they had experienced any common physical and emotional symptoms since completing treatment "as a result of your experience with cancer." The total number of 13 potential physical concerns endorsed (problems with heart, lungs, vision, hearing, oral health, lymphedema, neuropathy, thyroid problems, incontinence, sexual dysfunction, pain, cognitive problems, and fatigue) and seven potential emotional concerns (emotional distress, grief and identity issues, spiritual concerns, fear

TABLE 2 Frequencies of Self-Reported Positive Health Behaviors as a Result of Cancer

Type of Health Behavior Engagement	Yes % (<i>n</i>)	No % (<i>n</i>)
Positive lifestyle behaviors		
I have led a more healthy lifestyle.	81 (2,122)	19 (493)
I have participated in regular physical activity.	76 (1,979)	24 (636)
I have changed my diet to eat more healthy foods.	74 (1,942)	26 (673)
Positive healthcare utilization behaviors		
I have attended all regular medical appointments.	92 (2,416)	8 (199)
I have received screening for secondary cancers.	68 (1,779)	32 (836)
I am up-to-date on all recommended cancer screenings.	81 (2,122)	19 (493)

of recurrence, social anxiety, concerns about family risk, and concerns about body image) was computed for each respondent.

Analytic Approach

Descriptive statistics were used to characterize the sample and patterns of positive health behaviors. Logistic regression was used to model odds of reporting each positive health behavior. Multivariate models included sociodemographic (Step 1) and cancer-related (Step 2) covariates as well as potentially modifiable variables regarding communication with health care team (Step 3) and physical and emotional sequelae of cancer (Step 4). To reduce risk of Type I error, significance was set at $p < .01$.

RESULTS

As displayed in Table 2, a majority of respondents endorsed engaging in some positive health behaviors “as a result of (your) experience with cancer.” A significant minority of respondents did not endorse positive health behaviors; for example, one fourth of respondents reported that they had not participated in regular physical activity or changed their diet to eat more healthy foods since completing treatment for cancer, and 19% indicated that they were not up-to-date on all recommended cancer screenings.

Correlates of Positive Lifestyle Behaviors

Associations with the three positive lifestyle behaviors assessed by **LIVESTRONG** are displayed in Table 3. The only significant ($p < .01$) factors associated with a greater likelihood of “leading a more healthy lifestyle” were better knowledge about how to reduce cancer risk and more positive emotional sequelae of cancer, both of which were also related to greater

TABLE 3 Multivariate Logistic Regression Models of Associations with Positive Healthy Lifestyle Behaviors

	Odds of Leading a More Healthy Lifestyle		Odds of Participating in Regular Physical Activity		Odds of Changing Diet to Eat More Healthy Foods	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Sociodemographic						
Age (years)	1.01 [1.00 – 1.02]	.13	1.00 [.99, 1.00]	.30	1.02 [1.01, 1.03]	<.01
Gender						
Male	0.88 [0.67, 1.16]	.36	1.57 [1.21, 2.02]	<.01	0.87 [0.68, 1.11]	.26
Female (referent)	1.00		1.00		1.00	
Race						
White	0.89 [0.57, 1.37]	.89	1.02 [0.70, 1.47]	.94	0.53 [0.35, 0.82]	<.01
Other (referent)	1.00		1.00		1.00	
Education						
< College	0.82 [0.60, 1.11]	.20	0.65 [0.49, 0.86]	<.01	0.92 [0.69, 1.22]	.55
Some college	1.05 [0.78, 1.43]	.74	0.81 [0.62, 1.07]	.14	0.74 [0.57, 0.96]	.03
College graduate	0.94 [0.71, 1.25]	.66	0.77 [0.60, 1.00]	.06	0.96 [0.72, 1.24]	.74
Graduate school (referent)	1.00		1.00		1.00	
Marital status						
Single	1.07 [0.81, 1.42]	.64	1.06 [0.82, 1.37]	.66	1.05 [0.82, 1.35]	.71
Divorced/widowed	1.00 [0.72, 1.39]	.98	0.89 [0.67, 1.18]	.43	0.99 [0.73, 1.33]	.92
Married (referent)	1.00		1.00		1.00	
Cancer-related						
Cancer diagnosis						
Breast cancer	0.99 [0.74, 1.33]	.96	1.30 [1.00, 1.68]	.05	1.18 [0.90, 1.55]	.22
Testicular cancer	0.98 [0.65, 1.47]	.91	0.72 [0.48, 1.06]	.09	1.00 [0.70, 1.42]	.99
Colorectal cancer	1.41 [0.88, 2.26]	.16	0.98 [0.67, 1.44]	.92	1.52 [0.99, 2.32]	.06
Hematological cancer	1.25 [0.87, 1.80]	.23	0.93 [0.68, 1.27]	.64	1.08 [0.79, 1.48]	.62
Prostate cancer	0.96 [0.60, 1.55]	.88	1.25 [0.77, 2.03]	.38	0.86 [0.56, 1.31]	.48
Other (referent)	1.00		1.00		1.00	
Time since last treatment (years; log transformed)	1.17 [0.98, 1.40]	.09	1.13 [0.96, 1.34]	.13	1.08 [0.92, 1.28]	.33

(Continued on next page)

TABLE 3 Multivariate Logistic Regression Models of Associations with Positive Healthy Lifestyle Behaviors (*Continued*)

Sociodemographic	Odds of Leading a More Healthy Lifestyle		Odds of Participating in Regular Physical Activity		Odds of Changing Diet to Eat More Healthy Foods	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Cancer treatment						
No chemotherapy	1.01 [0.78, 1.32]	.92	0.92 [0.73, 1.16]	.46	1.07 [0.84, 1.34]	.60
Chemotherapy only	0.82 [0.57, 1.19]	.30	1.10 [0.78, 1.55]	.60	1.04 [0.74, 1.45]	.83
Chemotherapy plus surgery/ radiation (referent)	1.00		1.00		1.00	
Patient-provider factors						
Patient-provider communication (Score, 0-3)	1.08 [0.91, 1.28]	.40	0.95 [0.81, 1.11]	.48	1.00 [0.86, 1.17]	.99
Know how to reduce cancer risk (Score, 0-3)	1.37 [1.18, 1.58]	<.01	1.22 [1.06, 1.39]	<.01	1.36 [1.19, 1.55]	<.01
Needs met during treatment (Score, 1-5)	1.02 [0.85, 1.22]	.86	0.97 [0.83, 1.15]	.75	0.98 [0.83, 1.16]	.80
Needs met after treatment (Score, 1-5)	0.95 [0.81, 1.12]	.53	1.11 [0.96, 1.28]	.15	1.02 [0.89, 1.18]	.77
Cancer sequelae						
Emotional benefits (Count, 0-6)	1.37 [1.29, 1.45]	<.01	1.16 [1.10, 1.23]	<.01	1.27 [1.20, 1.34]	<.01
Physical concerns (Count, 0-13)	0.96 [0.91, 1.01]	.11	0.89 [0.85, 0.93]	<.01	1.02 [0.98, 1.07]	.39
Emotional concerns (Count, 0-7)	1.06 [0.99, 1.13]	.10	1.05 [0.99, 1.11]	.10	1.11 [1.05, 1.18]	<.01

OR = odds ratio; CI = confidence interval.

odds of regular physical activity and changing diet. Other factors associated with a greater likelihood of regular physical activity included male gender, greater education, and fewer physical concerns as a result of cancer. Additional factors associated with greater likelihood of changing diet were older age, minority race, and more negative emotional sequelae of cancer (e.g., anxiety about recurrence).

Correlates of Positive Health Care Utilization

Associations with the three positive health care utilization behaviors assessed are displayed in Table 4. Factors associated with greater likelihood of attending all medical appointments, receiving screenings for secondary cancers, and being up-to-date on cancer screenings ($p < .01$) included older age, better patient-provider communication, and reporting more positive emotional sequelae of cancer. Survivors who had more recently completed treatment had a greater likelihood of attending all medical appointments and being up-to-date on all cancer screenings but lower likelihood of receiving screenings for secondary cancers. Better knowledge about how to reduce cancer risk was associated with increased likelihood of receiving secondary screenings and being up-to-date on cancer screenings. Reporting more physical and emotional concerns due to cancer was associated with greater likelihood of receiving screenings for secondary cancers. Prostate cancer patients were less likely to receive screenings for secondary cancers. Divorced/widowed respondents were less likely to be up-to-date on all cancer screenings.

DISCUSSION

Positive health-promoting behaviors, including lifestyle factors (e.g., physical activity) and appropriate health service utilization (e.g., screening for secondary cancers), can minimize the health risks and challenges facing cancer survivors (Carmack et al., 2011; Demark-Wahnefried et al., 2006). In the data from this large online survey of posttreatment cancer survivors, we found somewhat different correlates for each of the six different positive health behaviors. Sociodemographic factors were associated with some positive lifestyle and health care utilization behaviors (e.g., male gender and more education linked to regular physical activity, older age and minority race linked to healthier diet, older age linked to all three health care utilization behaviors). Cancer-related factors (including diagnosis, treatment, and time since diagnosis) were not reliably related to healthy lifestyle behaviors but were significantly associated with positive health care utilization; specifically, less time since completing cancer treatment was associated with a greater likelihood of attending all medical appointments and being up-to-date on

TABLE 4 Multivariate Logistic Regression Models of Positive Health Service Utilization Changes

Sociodemographic	Odds of Attending All Medical Appointments		Odds of Receiving Screenings for Secondary Cancers		Odds of Being Up-to-Date on Cancer Screenings	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Age (years)	1.04 [1.02, 1.05]	<.01	1.01 [1.01, 1.02]	<.01	1.02 [1.01, 1.03]	<.01
Gender						
Male	0.67 [0.45, 1.02]	.06	1.19 [0.94, 1.51]	.15	.99 [0.75, 1.31]	.94
Female (referent)	1.00		1.00		1.00	
Race						
White	1.18 [0.67, 2.06]	.57	1.44 [1.03, 2.01]	.03	1.44 [0.99, 2.11]	.06
Other (referent)	1.00		1.00		1.00	
Education						
<College	0.75 [0.48, 1.19]	.22	0.82 [0.63, 1.06]	0.12	0.74 [0.54, 1.01]	.06
Some college	0.77 [0.49, 1.19]	.23	0.68 [0.53, 0.88]	<.01	0.68 [0.51, 0.92]	.01
College graduate	1.13 [0.73, 1.70]	.59	.96 [0.75, 1.21]	.71	1.07 [0.79, 1.44]	.66
Graduate school (referent)	1.00		1.00		1.00	
Marital status						
Single	1.11 [0.73, 1.70]	.62	0.81 [0.64, 1.02]	.08	0.71 [0.54, 0.93]	.01
Divorced/widowed	0.95 [0.59, 1.52]	.83	0.97 [0.74, 1.28]	.83	0.66 [0.48, 0.89]	<.01
Married (referent)	1.00		1.00		1.00	
Cancer related						
Cancer diagnosis						
Breast cancer	0.74 [0.46, 1.18]	.21	0.77 [0.60, 0.98]	.03	1.18 [0.87, 1.61]	.28
Testicular cancer	1.04 [0.60, 1.82]	.89	1.04 [0.73, 1.48]	.83	0.91 [0.61, 1.37]	.66
Colorectal cancer	1.25 [0.55, 2.86]	.59	1.53 [1.02, 2.29]	.04	1.02 [0.65, 1.60]	.94
Hematological cancer	1.18 [0.71, 1.95]	.52	1.00 [0.74, 1.34]	.99	.94 [0.67, 1.31]	.71
Prostate cancer	0.58 [0.28, 1.17]	.12	0.39 [0.26, 0.58]	<.01	0.60 [0.37, 0.99]	.05
Other (referent)	1.00		1.00		1.00	
Time since last treatment (years; log transformed)	0.39 [0.29, 0.54]	<.01	1.41 [1.22, 1.64]	<.01	0.79 [0.65, 0.95]	.01

Cancer treatment								
No chemotherapy	0.72 [0.49, 1.06]	.10	1.17 [0.94, 1.45]	.17	1.07 [0.82, 1.40]	.61		
Chemotherapy only	0.60 [0.35, 1.10]	.05	0.77 [0.57, 1.05]	.10	0.95 [0.66, 1.37]	.78		
Chemotherapy plus surgery/ radiation (referent)	1.00		1.00		1.00			
Patient-provider factors								
Patient-provider communication	1.53 [1.22, 1.91]	<.01	1.25 [1.08, 1.44]	<.01	1.41 [1.20, 1.66]	<.01		
Know how to reduce cancer risk								
(Score, 0-3)	.96 [0.77, 1.20]	.74	1.18 [1.04, 1.34]	<.01	1.35 [1.16, 1.56]	<.01		
Needs met during treatment	1.04 [0.82, 1.31]	.77	1.09 [0.93, 1.27]	.30	.96 [0.81, 1.14]	.66		
Needs met after treatment	1.36 [1.10, 1.68]	<.01	1.11 [0.97, 1.28]	.11	1.37 [1.18, 1.59]	<.01		
(Score, 1-5)								
Cancer sequelae								
Emotional benefits	1.15 [1.05, 1.26]	<.01	1.10 [1.04, 1.16]	<.01	1.10 [1.03, 1.17]	<.01		
(Count, 0-6)								
Physical concerns	0.97 [0.91, 1.04]	.41	1.09 [1.05, 1.14]	<.01	0.97 [0.92, 1.02]	.19		
(Count, 0-13)								
Emotional concerns	1.03 [0.94, 1.13]	.52	1.09 [1.03, 1.15]	<.01	1.07 [1.00, 1.14]	.05		
(Count, 0-7)								

all cancer screenings, but a lower likelihood of obtaining screening for secondary cancer. Consistent with the importance of survivor self-efficacy, we found that better knowledge about how to prevent cancer was associated with higher positive health behaviors broadly. Perceived patient–provider communication quality was related to all three positive health care utilization behaviors but not lifestyle behaviors, suggesting that optimal communication with physicians may keep survivors appropriately engaged with the health care system after treatment but may matter less for diet and exercise engagement.

With regard to emotional and physical effects of cancer, emotional benefit finding related to cancer was positively associated with all six health behaviors. Late physical symptoms related to cancer or its treatment were only associated with participation in screening and physical activity, but in different ways: survivors reporting more physical concerns were more likely to have obtained screenings for secondary cancers but less likely to engage in regular physical activity. It may be that physical concerns promote more proactive engagement in screening for new physical problems, while lessening ability to engage in physical activity. Emotional symptoms related to cancer were also associated with increased likelihood of screening for secondary screening as well as changing diet.

Overall, results suggest that knowledge about how to prevent cancer and benefit finding after cancer are related to protective health behaviors broadly, whereas better patient–provider communication is associated with positive health care utilization but not healthy lifestyle choices. Clinical interventions targeting these modifiable factors could maximize positive health behavior changes among cancer survivors, potentially affecting risk for cancer recurrence as well as overall health and well-being.

Our results are in line with previous studies on health behavior change following cancer, although there are some noteworthy differences. Emotional sequelae of cancer (i.e., benefit finding and cancer-related distress) have been repeatedly found to be related to health behavior changes in previous studies of cancer survivors (Harper et al., 2007; Hawkins et al., 2010). Consistent with those studies, we found that benefit finding was related to all six positive health behaviors and that negative emotional sequelae of cancer were related to increased likelihood of dietary changes and obtaining secondary screenings. Like Hawkins et al. (2010), we also found that more educated respondents were more likely to report regular physical activity, but we did not find that a longer time since diagnosis and younger age were associated with positive health behavior change, as they did. 2010 **LIVESTRONG** respondents (who were younger on average than the Hawkins et al., 2010, sample) were more likely to change diet and engage in recommended health service utilization if they were older and had more recently completed treatment.

In this study, knowledge about how to reduce cancer risk was significantly associated with five out of six positive health behaviors. Recent surveys have found that 65% of survivors endorse unmet information needs related to health promotion (Kent et al., 2012) and rarely report receiving recommendations about health behaviors from their clinical providers (Sabatino et al., 2007), suggesting room for improvement in survivor education about how to reduce cancer risk. Increased delivery of comprehensive survivorship care plans, which are recommended to include guidelines for healthy lifestyle and for cancer screenings (Hewitt et al., 2005; Rechis, Beckjord, Arvey, Reynolds, & Goldrick, 2012), are intended to address some of these gaps in survivor knowledge and increase patient self-efficacy to make the positive health changes most essential to their long term well-being.

The interpretation of results from this study must be tempered by a recognition that the anonymous surveys were completed at a single time point (cross-sectional study design), which leaves determination of the causal directionality underlying the statistically significant relationships for some variables as an important issue for future research. The need for additional research to follow-up on the results presented here is especially noteworthy with regard to physical sequelae of cancer treatment, as greater symptom burden may affect health behaviors (e.g., fatigue or pain may make survivors less likely to engage in regular physical activity) and may be affected by behaviors (e.g., physical inactivity may worsen fatigue or pain). Future research should employ prospective longitudinal designs as feasible to capture changes in health behaviors following a cancer diagnosis (e.g., Satia et al., 2004; Williams et al., 2013) and to disentangle these bidirectional relationships. Future research should also expand upon the single retrospective items used here to assess health behaviors and address measurement issues potentially introduced by recall bias, social desirability, or by motivations to find positive meaning in one's cancer experience. In addition, it would be of interest in future research to include questions to explore the extent of health behavior engagement (e.g., whether respondents met recommendations of at least 150 minutes of moderate-to-strenuous physical activity per week or consumed at least five servings of fruits and vegetables each day; Blanchard et al., 2008), the duration/maintenance of behavior change, as well as pre-diagnosis health behaviors and the extent to which the endorsed behavior represents a change from prediagnosis behavior. Given the voluntary, on-line nature of the 2010 **LIVESTRONG** survey, results may not represent the experiences of all posttreatment cancer survivors. Another key limitation of this study is that responses to health behavior questions (which came at the end of the lengthy online survey) were not provided by one fourth of the respondents to the survey, with additional data missing for 16% of the sample. Nevertheless, these findings contribute to growing scientific understanding of

the predictors of cancer survivor health and well-being. Significant strengths of the study include the large and varied sample, consideration of healthy lifestyle behaviors and appropriate health service utilization among cancer survivors, as well as the investigation of novel and potentially modifiable factors such as patient–provider communication quality.

In summary, most posttreatment cancer survivors completing the 2010 **LIVESTRONG** survey reported that they had made healthy lifestyle changes and that they were adherent to health service utilization recommendations. Factors associated with positive health behaviors in both categories included feeling more knowledgeable about how to reduce cancer risk and finding more positive emotional benefits in the cancer experience. Results from this study also highlight demographic subgroups that may be less likely to adopt positive health behaviors after cancer, suggesting the need for targeted lifestyle intervention. Finally, results suggest that improving the quality of patient–provider communication may lead survivors to be more adherent to recommended screenings and scheduled medical appointments. As the health care burden due to the expanding population of long-term cancer survivors continues to grow, maximizing and sustaining engagement in positive health behaviors after cancer treatment should be a priority for oncologists and other providers.

Clinical Implications

These findings suggest that, though many posttreatment cancer survivors endorse positive health behaviors, room for improvement remains. Providing patients with coordinated cancer survivorship care plans could increase survivor knowledge about the steps necessary to reduce risk of recurrence and have positive effects on health behaviors. Coordinated cancer survivorship care plans could also improve patient perceptions of the quality of their communication with providers, improving future cancer screening behavior. In addition, results suggest that cognitive-behavioral interventions that encourage cognitive reappraisal of cancer-related changes could facilitate benefit finding and health behavior change (Antoni et al., 2001).

FUNDING

This research was supported by funding from the **LIVESTRONG** Foundation.

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