Childhood Cancer Survivors' Perceived Barriers to Improving Exercise and Dietary Behaviors

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Purpose/Objectives: To determine childhood cancer survivors' barriers to increasing exercise and consuming less fat and more fruits and vegetables, whole grains, and calcium-rich foods.

Design: Mailed survey.

Setting: Cases from a comprehensive cancer center.

Sample: Convenience sample of 144 childhood cancer survivors aged 13–35 years identified through previous research. Surveys were returned by 118 participants (82% response rate).

Methods: Descriptive statistics with chi-square tests were performed between subgroups defined by age (< 18 years and ≥ 18 years) and diagnosis (leukemia, lymphoma, and central nervous system cancers).

Main Research Variables: Barriers to exercise, consuming less fat, and eating more fruits and vegetables, whole grains, and calcium-rich foods.

Findings: Proportionately more childhood cancer survivors reported barriers to exercise and following a low-fat diet than to consuming more fruits and vegetables, whole grains, and calcium-rich foods. Primary barriers to exercise included being too tired (57%), being too busy (53%), and not belonging to a gym (48%), whereas barriers for restricting high-fat foods were commercials that make high-fat foods look so appealing (58%) and having friends who eat a lot of high-fat foods (50%). Difficulty associated with ordering healthy foods when dining out also was a leading barrier to following a low-fat diet (50%), as well as eating more whole grains (31%), fruits and vegetables (30%), and calcium-rich foods (15%).

Conclusions: Childhood cancer survivors report several barriers to exercise and consuming a low-fat diet with more fruits and vegetables, whole grains, and calcium-rich foods.

Implications for Nursing: This study's findings may be helpful to nurses, health educators, and allied health professionals in developing effective interventions that promote healthful lifestyle change among childhood cancer survivors.

Key Points . . .

- Childhood cancer survivors are at increased risk of developing secondary cancers and other diseases, such as cardiovascular disease, osteoporosis, and diabetes.
- Barriers to healthy eating and exercise in childhood cancer survivors have not been addressed previously in research, but they are essential in developing effective interventions to improve survivors' overall health and well-being.
- Common barriers to exercise among survivors younger than age 18 include poor weather, worries about injury, and inexperience with exercise, whereas barriers to healthy eating include disliking the taste, availability when dining out, and not knowing how to choose lower-fat options.
- Larger proportions of childhood cancer survivors report barriers to exercise and consuming a low-fat diet than to increasing their intake of fruits, vegetables, whole grains, and calcium-rich foods compared to the general population.

Survival rates from all types of cancers have increased in recent years (American Cancer Society, 2007). The cure rate for childhood cancers is especially pronounced and has increased from approximately 30% to about 80% since the 1960s. Despite an improved initial prognosis, data provide evidence that childhood cancer survivors are at significantly greater risk of developing secondary cancers and other diseases, such as cardiovascular disease, osteoporosis, and diabetes (Bottomley & Kassner, 2003; Dow, 2003; Greving & Santacroce, 2005; Landier et al., 2004; Nelson & Meeske, 2005). Comorbid conditions are believed to result from cancer treatment, genetic predisposition, or common lifestyle factors (Aziz, 2002; Demark-Wahnefried, Aziz, Rowland, & Pinto, 2005). Diet and exercise interventions can reduce the likelihood of comorbid illness and prevent functional decline in childhood cancer survivors (Demark-Wahnefried, Aziz, et al.;

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Doyle et al., 2006). Exercise, for instance, consistently is associated with increased quality of life and improved physical functioning, body composition, and health-related biomarkers (e.g., blood pressure, blood lipids, cardiorespiratory markers) in general populations as well as in cancer survivors (Agency for Healthcare Research and Quality, 2004; American College of Sports Medicine, 2006; Courneya, 2003; Galvao & Newton, 2005). Furthermore, a diet low in saturated fat and rich in calcium, fruits and vegetables, and whole grains has proven benefit in reducing comorbidities, such as osteoporosis and cardiovascular disease (Doyle et al.; Institute of Medicine, 2003; Mertens et al., 2004). Moreover, growing evidence suggests that weight management through diet and exercise may be beneficial in prolonging disease-free survival in other cancer populations (Chlebowski, Aiello, & McTiernan, 2002; Courneya; Demark-Wahnefried, Aziz, et al.; Galvao & Newton; Kroenke, Chen, Rosner, & Holmes, 2005; McTiernan, 2004). Thus, a healthful weight and diet and regular exercise likely will contribute to the overall health and well-being of childhood cancer survivors.

In a survey of 209 survivors of childhood cancers, Demark-Wahnefried, Werner, et al. (2005) found that 84% of respondents did not meet guidelines for dietary fat consumption. Similarly, the majority of respondents did not meet recommendations for fruit and vegetable consumption, calcium intake, and exercise (79%, 68%, and 52%, respectively). Furthermore, 42% of respondents were overweight or obese, suggesting that childhood cancer survivors may constitute a key target population for lifestyle interventions—a population that could benefit from healthful changes in diet and exercise behaviors and a population in which the clear majority expressed extremely high to very high levels of interest in programs aimed at eating a healthy diet and getting in shape (Demark-Wahnefried, Werner, et al.).

Central to the development of successful behavioral interventions is a clear understanding of targeted health behaviors and their environmental context (Blue & Black, 2005; Cox, 2003). Overcoming barriers to healthful lifestyle practices is an important construct that is incorporated repeatedly in a host of robust theories that have been developed to support behavior change (e.g., social cognitive theory [Bandura, 1986], Transtheoretical Model [Prochaska et al., 1994], Theory of Planned Behavior [Ajzen, 1985]) and is a key component in influencing the environment and social interactions and enhancing self-efficacy. Thus, the identification of barriers that impede the practice of healthful behaviors is an initial step in developing effective interventions to promote behavior change and sustain the practice of long-term healthful lifestyle behaviors (see Figure 1). Given the dearth of existing data on barriers to healthful lifestyle practices among childhood cancer survivors, a multidisciplinary team of investigators at Duke University Medical Center conducted a survey study to explore common barriers to increasing exercise, consuming less fat, and eating more fruits and vegetables, whole grains, and calcium-rich foods as an initial step in gaining the insights needed to develop effective lifestyle interventions for this population. This exploratory survey study primarily aimed to examine barriers to the practice of healthful exercise and diet behaviors in childhood cancer survivors. Secondary aims included a further exploration of differences in broad categories of survivors, including those defined by gender (male versus female), age (younger than age 18 years versus 18 years and older), and major types of cancer diagnoses (leukemia, lymphoma, or central nervous system [CNS] cancers).

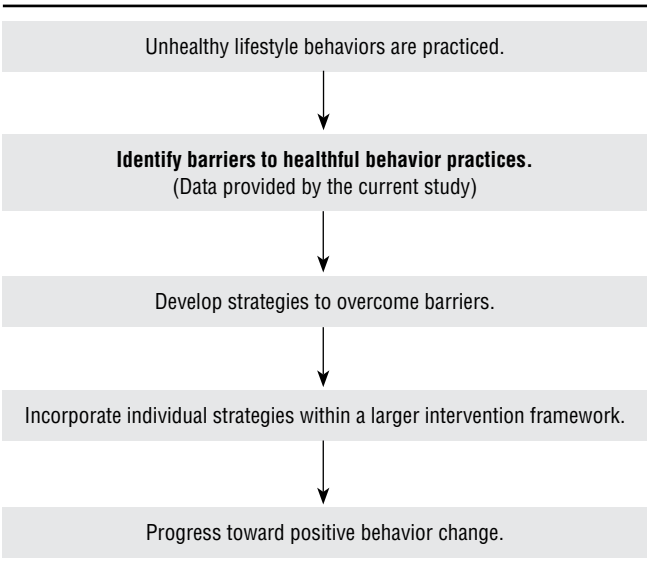

Figure 1. Conceptual Model to Enhance Behavior Change

Literature Review

In two independent articles on the challenges and opportunities of cancer survivorship research, Aziz (2002) and Dow (2003) suggested that the development of effective, evidence-based diet and exercise interventions in cancer survivors and childhood cancer survivors, in particular, are important areas of future research. To begin to develop effective interventions that are based on robust behavioral theory, research must be conducted on the common barriers to diet and exercise among childhood cancer survivors. However, no previous research findings have been reported that directly address perceived barriers to diet and exercise in this population. Barriers known to exist for diet and exercise among healthy populations of young adults, adolescents, and children can provide a starting point. The methods and instruments from this research then can be supplemented with those for adult cancer populations.

Barriers to Exercise in Healthy Adolescents

Multiple studies have addressed barriers to physical activity among adolescents. In 1989, Tappe, Duda, and Ehrnwald conducted a study to identify differences in barriers to exercise among 236 high school students according to gender and self-reported levels of physical activity. The researchers reported that time constraints were the most commonly reported barrier. They also observed some differences in activity levels according to gender. For young men, having a girlfriend and using alcohol and other drugs were the most important barriers to exercise. However, young women reported that they wanted to do other things with their time than exercise and noted a lack of desire or interest in exercise. Strategies were suggested to incorporate exercise into planned activities to overcome the time constraint barrier and to include activities that male and female teens enjoyed. Tergerson and King (2002) conducted a study on perceived

barriers to physical activity by gender and administered a survey to 535 healthy teens at two high schools. Among teenage girls, the most commonly reported barrier was time constraints, whereas teenage boys wanted to participate in other activities. In their study, Tergerson and King also found that significant gender differences existed not only for perceived barriers but also for strategies to overcome the barriers and the benefits realized for a more physically active lifestyle. Allison, Dwyer, and Makin (1999) examined perceived barriers to physical activity in three settings (overall physical activity, school activity, outside of school activity) among 1,041 high school students. As in other studies, time constraints were considered one of the most important barriers. Allison et al. concluded that perceived barriers may be predictive of physical activity participation among high school students under specific conditions. In 2000, Fotheringham, Wonnacott, and Owen examined computer use and physical inactivity among 697 young adults. Based on self-reported data, increased computer use was a significant barrier to physical activity; however, computer-mediated interventions were suggested as a method to increase physical activity in young adults.

Barriers to a Healthful Diet in Healthy Adolescents

In addition to physical activity, barriers to a diet low in fat and rich in fruits and vegetables, whole grains, and calcium have been reported in healthy adolescents and young adults. In one review, Adams (1997) concluded that the most common barriers to eating a healthful diet were reduced access to healthy food choices, the influence of peer groups, and familial and cultural barriers. Other studies have assessed barriers to a healthful diet among American youths, with many confirming Adams's findings (Anderson et al., 1998; Kearney & McElhone, 1999; Neumark-Sztainer, Story, Perry, & Casey, 1999). In a series of focus groups, Neumark-Sztainer et al. also found that taste preferences were a major barrier and recommended interventions that specifically addressed this issue (e.g., food preparation techniques to lessen strong-tasting vegetables, development of acceptable recipes and food products). Time and taste factors also were found to be predominant barriers by Kearney and McElhone in a survey conducted among more than 1,000 individuals aged 15 years and older. Most studies have focused on barriers related to diets that are low in fat and high in fruits and vegetables, but barriers to consuming adequate amounts of calcium also have been explored, although they have been conducted primarily with populations at high risk for lactose intolerance (Chapman, Chan, & Clark, 1995; Zablah, Reed, Hegsted, & Keenan, 1999). In those studies, gastrointestinal pain was found to be a significant barrier.

Barriers to Exercise in Adult Cancer Survivors

In 2003, Demark-Wahnefried et al. reported the design of the FRESH START diet and exercise randomized controlled trial that targeted 543 breast and prostate cancer survivors. They examined common barriers to diet and exercise behaviors among adult cancer survivors and the general adult population and also ascertained barriers from focus groups. Included in that report were the results of Leddy (1997), who studied incentives and barriers to exercise among women with a history of breast cancer. Findings of those studies showed that time constraints and fatigue comprised the primary barriers to exercise among cancer survivors. Indeed, fatigue is a well-known side effect of cancer therapy that can endure far beyond active treatment (Barton-Burke, 2006; Demark-Wahnefried, Aziz, et al., 2005). Interestingly, although fatigue is a barrier to exercise, it is reduced by regular physical activity (Agency for Healthcare Research and Quality, 2004; Courneya et al., 2005; Doyle et al., 2006). Courneya et al. reported findings of a longitudinal study of exercise barriers in 69 colorectal cancer survivors participating in a randomized clinical trial to test the effects of exercise on quality of life. In the study, 37 barriers to exercise were identified. Similar to previous studies, time constraints and fatigue were the most prevalent.

Barriers to a Healthful Diet in Adult Cancer Survivors

Comparatively little is known about the barriers to a healthful diet among cancer survivors; however, unreported data from Demark-Wahnefried et al. (2003) suggest that time constraints, availability, taste, and willpower are common barriers among cancer survivors and the general population. Thus, in exploring childhood cancer survivors' barriers to exercise and a healthful diet, barriers that are consistent with the general population, as well as those specific to cancer and its treatment, most likely will be encountered. Given the state of the science, an amalgamated approach that borrows instruments, items, and techniques from the wide array of research conducted to assess barriers to lifestyle change in healthy and cancer populations appears reasonable.

Methods

This survey study was in direct follow-up to a previously reported study that assessed lifestyle practices in 209 childhood survivors of lymphoma, leukemia, and CNS cancers (Demark-Wahnefried, Aziz, et al., 2005; Rosoff et al., 2005). The initial sample included individuals aged 11–33 years who completed treatment at least one year prior and had no evidence of disease. The current study sample included disease-free individuals aged 13–35 years who indicated an interest in participating in future research at the time of the initial survey (N = 189). The study was approved by the Duke University Medical Center's institutional review board (7673-05-10R0ER) and was conducted from October 2005–January 2006.

Two age-dependent methods of contact were employed: (a) Survivors aged 18 years or older were mailed a cover letter, a three-page survey, two consent forms, a preaddressed postage-paid return envelope, and a $5 cash incentive, and (b) legal guardians served as points of contact for survivors younger than 18 years and received a cover letter (along with an additional cover letter addressed to the child), two consent or assent forms, a three-page survey for the child to complete, a preaddressed postage-paid return envelope, and a $5 cash incentive (for both the guardian and child). Individuals failing to respond within three weeks received follow-up telephone calls and were offered the opportunity to complete the survey via telephone. Although 189 survivor surveys were mailed originally, 45 were unable to be contacted because of unknown current address. Thus, the total potential sample included 144 survivors.

The perceived barrier survey consisted of items from previous studies among adults (Demark-Wahnefried et al., 2003)

Table 1. Barriers to Increasing Exercise and Consuming Less Fat and More Fruits and Vegetables, Whole Grains, and Calcium-Rich Foods

Barriers	Studies
To exercise	
Too tired	Courneya et al., 2005; Tergerson & King, 2002
Too busy	Courneya et al., 2005; Robbins et al., 2003; Tappe et al., 1989; Tergerson & King, 2002; Zabinski et al., 2003
Do not belong to a gym	Tergerson & King, 2002; Zabinski et al., 2003
Rather watch television or read	Allison et al., 1999; Fotheringham et al., 2000; Tappe et al., 1989; Tergerson & King, 2002
No one to exercise with	Allison et al., 1999; Robbins et al., 2003; Zabinski et al., 2003
Bad weather	Courneya et al., 2005; Robbins et al., 2003; Zabinski et al., 2003
Feel self-conscious	Allison et al., 1999; Robbins et al., 2003; Zabinski et al., 2003
Do not enjoy it	Allison et al., 1999; Tergerson & King, 2002; Zabinski et al., 2003
Friends do not exercise.	Allison et al., 1999; Tergerson & King, 2002
No willpower	Robbins et al., 2003; Tergerson & King, 2002
No access to equipment	Zabinski et al., 2003
Worry about injury	Allison et al., 1999; Courneya et al., 2005
Do not like to sweat	Demark-Wahnefried et al., 2003
No support	Allison et al., 1999
Do not want to be sore	Allison et al., 1999
Unsure how to exercise	Zabinski et al., 2003
No place to exercise	Tergerson & King, 2002; Zabinski et al., 2003
To eating more fruits and vegetables	
Hard to get when dining out	Anderson et al., 1998; Neumark-Sztainer et al., 1999
Do not like the taste	Anderson et al., 1998; Kearney & McElhone, 1999
Not available at home	Anderson et al., 1998; Kearney & McElhone, 1999
Cost too much	Anderson et al., 1998; Kearney & McElhone, 1999; Neumark-Sztainer et al., 1999
Take too long to prepare	Anderson et al., 1998; Kearney & McElhone, 1999
Hurt stomach	Demark-Wahnefried et al., 2003 (adapted from Chapman et al., 1995)
Friends do not eat them.	Anderson et al., 1998; Kearney & McElhone, 1999
Family does not like them.	Anderson et al., 1998; Kearney & McElhone, 1999
To eating more whole grains	
Hard to get when dining out	Neumark-Sztainer et al., 1999
Do not like the taste	Kearney & McElhone, 1999
Family does not like them.	Kearney & McElhone, 1999
Not available at home	Kearney & McElhone, 1999
Friends do not eat them.	Kearney & McElhone, 1999
Cost too much	Kearney & McElhone, 1999
Take too long to prepare	Kearney & McElhone, 1999
Hurt stomach	Demark-Wahnefried et al., 2003 (adapted from Chapman et al., 1995)
To limiting high-fat foods	
Commercials make high-fat foods tempting.	Neumark-Sztainer et al., 1999
Hard to get low-fat foods when dining out	Neumark-Sztainer et al., 1999
Friends eat a lot of high-fat foods.	Kearney & McElhone, 1999
Family eats a lot of high-fat foods.	Kearney & McElhone, 1999
Low-fat foods do not taste good.	Kearney & McElhone, 1999; Neumark-Sztainer et al., 1999
No willpower	Kearney & McElhone, 1999
Low-fat foods do not fill me up.	Kearney & McElhone, 1999
Do not know how to choose lower-fat foods	Kearney & McElhone, 1999
Low-fat foods not available at home	Kearney & McElhone, 1999
To eating more high-calcium foods	
Hard to get when dining out	Neumark-Sztainer et al., 1999
Hurt stomach	Chapman et al., 1995; Zablah et al., 1999
Not available at home	Chapman et al., 1995
Do not like the taste	Kearney & McElhone, 1999; Neumark-Sztainer et al., 1999; Zablah et al., 1999
Friends do not eat them.	Kearney & McElhone, 1999
Family does not like them.	Kearney & McElhone, 1999

and was amended with child-specific perceived barrier items identified through a comprehensive literature search. As presented in Table 1, many of the barriers assessed in this survey were obtained and reported from multiple sources. Barriers had been tested and validated in prior studies. The resulting survey had a total of 53 items, with 48 specific barrier questions distributed as follows: increased exercise (17), dietary fat restriction (9), consumption of more fruits and vegetables (8) and whole grains (8), and consumption of more calcium-rich foods (6). In addition to the closed-ended items, participants were asked to respond to an open-ended item and list any barriers within each of the five behavioral domains. Four-point Likert scales, ranging from 1 (strongly agree) to 4 (strongly disagree), were used to capture responses. The survey was formatted with colorful headers to engage participants and enhance response rates (Edwards et al., 2002).

Survey data were double-key entered and descriptive statistics (percentages of affirmative responses) were generated for the total sample, as well as for subgroups of interest (i.e., gender, age [18 years or older and younger than 18 years], and cancer type [leukemia, lymphoma, and CNS cancers]). Chi-square testing was conducted ($\alpha < 0.05$) to determine significant differences within the various subgroups of participants responding with "agree" or "strongly agree" to each barrier.

Results

Responses were received from 118 respondents for a response rate of 82%. No differences were noted between respondents and nonrespondents based race, age, gender, or cancer type. Characteristics of the study sample are reported in Table 2, but most participants were aged 18 years or older, Caucasian, female, and survivors of leukemia and CNS cancers. In addition, leukemia, lymphoma, and CNS cancer survivors were similar in terms of race, gender, and age, athough a trend was noted toward older age among lymphoma survivors.

Percentages of participants who endorsed ("agree" or "strongly agree") barriers to exercise are presented in Table 3 in descending order of frequency. The most commonly reported barriers to exercise included being too tired or busy, not belonging to a gym, or preferring to do other activities (e.g., watch television, read a book, spend time on a computer). Top barrier rankings were preserved largely among cancer types; however, lymphoma survivors were more apt to report being too busy as their primary barrier (rather than being too tired) and to report that they did not enjoy exercise and would prefer to do other activities when compared to survivors of leukemia or CNS cancer. Relatively few differences were observed among cancer types for reported barriers to exercise, although leukemia survivors were significantly more likely to report a lack of equipment, whereas CNS survivors were more likely to report concerns regarding injury and soreness. Overall, younger cancer survivors reported more barriers and were significantly more likely to report poor weather, lack of exercise equipment, worry about injury, not wanting to sweat, not wanting to be sore, and unsure how to exercise as barriers to increasing their levels of exercise. The only significant difference noted between male and female survivors concerned the barrier related to perspiration; 26% of females versus 11% of males listed sweating as a barrier ($p = 0.048$). In the open-ended barrier item, two survivors of CNS cancer reported experiencing pain while exercising, and five survivors from all three cancer types listed physical limitations (e.g., wheelchair dependent) as barriers.

Table 4 features data on barriers to eating a diet rich in fruits and vegetables, whole grains, and calcium and low in fat. Compared to exercise-related barriers, far fewer survivors listed barriers to eating more fruits and vegetables. Still, the most frequently reported barriers were related to availability at home and when dining out and dislike of the taste. Among cancer types, barrier order differed, with lymphoma survivors more apt than others to report that fruits and vegetables take too long to prepare and were significantly more likely to report that fruits and vegetables cost too much. In the open-ended barrier item, a leukemia survivor reported experiencing pain associated with chewing and swallowing fruits and vegetables, whereas a CNS cancer survivor and a lymphoma survivor reported physical limitations. One significant difference in responses on the basis of age was that older survivors were more apt than younger survivors to report that fruits and vegetables were not available at home.

Table 2. Sample Characteristics

	All (N = 118)		CNS (N = 47)		Lymphoma (N = 22)		Leukemia (N = 49)		
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**p**
Age (years)									
Range	13–35	–	14–32	–	14–35	–	13–34	–	
$\bar{X}$	21.6	–	18.6	–	23.5	–	19.4	–	
SD	5.8	–	4.9	–	6.0	–	6.0	–	
< 18	33	28	14	30	2	9	17	34	0.08
≥ 18	85	72	33	70	20	91	32	66	
Gender									
Male	53	45	20	43	12	55	21	43	0.98
Female	65	55	27	57	10	45	28	57	
Race									
Caucasian	100	85	29	83	20	91	39	81	0.39
Non-Caucasian	18	15	6	17	2	9	10	19	

CNS—central nervous system

Table 3. Percentages of Affirmative Responses to Listed Barriers to Exercise

Exercise Barriers	All (N = 118)	Cancer Type				Age		
		CNS (N = 47)	Lymphoma (N = 22)	Leukemia (N = 49)	p	Younger Than 18 (N = 33)	18 or Older (N = 85)	p
Too tired	57	62	59	51	NS	64	54	NS
Too busy	53	49	68	51	NS	55	53	NS
Do not belong to a gym	48	53	32	49	NS	55	45	NS
Rather watch television or read	44	47	41	43	NS	46	44	NS
No one to exercise with	31	34	23	33	NS	27	33	NS
Bad weather	30	32	14	35	NS	46	24	0.02[a]
Feel self-conscious	29	26	32	31	NS	28	30	NS
Do not enjoy it	28	28	41	23	NS	18	32	NS
Friends do not exercise.	27	36	14	25	NS	33	25	NS
No willpower	25	26	24	23	NS	21	26	NS
No access to equipment	22	13	9	38	< 0.01[b]	36	17	0.02[a]
Worry about injury	20	32	14	13	0.04[c]	33	16	0.03[a]
Do not like to sweat	20	32	9	13	0.03[c]	39	12	< 0.001[a]
No support	19	17	18	20	NS	9	23	NS
Do not want to be sore	19	30	18	8	0.03[c]	30	14	0.04[a]
Unsure how to exercise	17	23	9	14	NS	30	12	0.02[a]
No place to exercise	9	11	5	10	NS	6	11	NS

[a] Chi square

[b] Cochran Mantel-Haenszel

[c] Fisher's exact test

CNS—central nervous system; NS—not significant

Significant gender differences existed related to reported barriers to increased fruit and vegetable consumption. Male survivors were more likely to report that they did not like the taste and that their friends did not eat fruits and vegetables, whereas female survivors were more apt to report that fruits and vegetables "hurt their stomach." Barriers to eating more whole grains were similar to those for fruits and vegetables, with availability when dining out and disliking the taste serving as the two most frequently reported barriers. No significant differences among cancer types were observed; however, younger survivors were more likely to report that they did not like the taste of whole grains, whereas those aged 18 years and older were more apt to report that whole grains are difficult to get when dining out. Compared to males, female cancer survivors were more likely to report that whole grains cost too much, and one cancer survivor reported an allergy to whole grains.

Participants in this study reported far fewer barriers to eating more calcium-rich foods than for other healthful behaviors. Availability when dining out and "hurt stomach" were the two most commonly reported barriers. Among diagnosis groups, leukemia survivors were significantly less likely than others to report "hurt stomach" with regard to the consumption of calcium-rich foods. Although no significant differences among age or gender subgroups emerged, one cancer survivor reported an allergy to calcium-rich foods.

The most frequently reported barriers to limiting high-fat foods were commercials that make high-fat foods look appealing, availability of low-fat foods when dining out, and having friends who eat a lot of high-fat foods. Although no significant differences among cancer types were observed, barrier order differed among cancer types (i.e., lymphoma survivors were more apt to report lack of willpower as a barrier). Again, younger survivors were more apt to affirm barriers and were significantly more likely to report (a) the persuasive influence of commercials, (b) the unavailability of low-fat foods when dining out, (c) the inability of low-fat foods to "fill one up," and (d) not knowing how to make better food choices. Compared to male survivors, females were more likely to report that low-fat foods were difficult to get when dining out and that their family eats a lot of high-fat foods.

Discussion

Although multiple studies have explored barriers to exercise and a healthful diet among healthy adolescents and adult cancer survivors, this seems to be the first reported study of barriers to healthful lifestyle practices among adolescent and young adult survivors of childhood cancers. Not surprisingly, childhood cancer survivors provided responses that were characteristic of their stage in the life cycle and that reflected their disease status.

Barriers to Exercise

Similar to responses of healthy adolescents and young adults, the childhood cancer survivors in this study frequently reported barriers to exercise such as being too busy and preferring to watch television or read. In a study assessing perceived cues, benefits, and barriers to exercise in a healthy population of 535 adolescents, Tergerson and King (2002) found that having no time to exercise or being too busy and preferring to do other things were the most commonly reported barriers. Those findings were reported in high frequency (i.e., by at least 50%

of the study sample) by other researchers (Robbins, Pender, & Kazanis, 2003; Tappe et al., 1989). Fotheringham et al. (2000) examined physical activity and computer use in 697 young adults (aged 18–30 years) and found that 43% listed their computer as a major barrier to exercise. In the current study, 44% of young cancer survivors reported that they would rather spend time engaged in more sedentary activities. Thus, the recommendations of Fotheringham et al. and Tergerson and King to emphasize the benefits of physical activity and suggest activities that teens enjoy (being fully aware that these activities may be gender specific) or to develop computer-mediated interventions may hold promise in increasing the physical activity levels of childhood cancer survivors.

In contrast to surveys conducted among healthy adolescents, the responses of the childhood cancer survivors in the present study differed in two respects. Self-consciousness was reported as less of a barrier to exercise, whereas fatigue was reported more often. In an ethnically diverse sample of female adolescents, Robbins et al. (2003) found that 57% of female teens reported that they were self-conscious about their looks while exercising, as compared to only 29% of the current sample. Although the discrepancy may be attributable to differences in age, ethnicity, and gender of the sample populations (e.g., females aged 11–14 years [48% African American, 36% European American, 16% other] versus males and females aged 13–35 years [85% Caucasian, 15% non-Caucasian], it also could reflect differences between youths who are healthy as compared to those with illness. Self-consciousness may be less of a concern among youths who have experienced a life-threatening illness or perhaps the disease itself may distance

Table 4. Percentages of Affirmative Responses to Listed Barriers to Eating a Healthful Diet

		Cancer Type				Age		
Barriers	All (N = 118)	CNS (N = 47)	Lymphoma (N = 22)	Leukemia (N = 49)	p	Younger Than 18 Years (N = 33)	18 or Older (N = 85)	p
To eating more fruits and vegetables								
Hard to get when dining out	30	36	32	22	NS	33	28	NS
Do not like the taste	19	19	23	16	NS	18	19	NS
Not available at home	12	15	18	6	NS	–	17	0.01[a]
Cost too much	11	11	27	4	0.02[a]	4	15	NS
Take too long to prepare	10	6	23	9	NS	7	12	NS
Hurt stomach	8	4	–	14	NS	9	7	NS
Friends do not eat them.	5	2	9	6	NS	9	4	NS
Family does not like them.	3	4	9	–	NS	3	4	NS
To eating more whole grains								
Hard to get when dining out	31	32	23	33	NS	52	22	< 0.01[b]
Do not like the taste	22	23	14	25	NS	36	17	0.02[b]
Family does not like them.	15	17	5	18	NS	18	14	NS
Not available at home	14	15	14	14	NS	15	14	NS
Friends do not eat them.	12	17	–	16	NS	18	9	NS
Cost too much	9	9	14	7	NS	–	12	NS
Take too long to prepare	5	4	5	7	NS	7	5	NS
Hurt stomach	4	2	–	8	NS	9	2	NS
To eating more high-calcium foods								
Hard to get when dining out	15	15	14	16	NS	24	12	NS
Hurt stomach	14	6	9	25	0.03[a]	15	14	NS
Not available at home	7	4	9	8	NS	3	8	NS
Do not like the taste	6	6	5	6	NS	3	7	NS
Friends do not eat them.	5	4	–	8	NS	9	4	NS
Family does not like them.	2	–	–	4	NS	3	1	NS
To limiting high-fat foods								
Commercials make high-fat foods tempting.	58	62	41	61	NS	77	52	0.01[b]
Hard to get low-fat foods when dining out	50	51	55	47	NS	70	42	0.01[b]
Friends eat a lot of high-fat foods.	50	49	41	55	NS	58	47	NS
Family eats a lot of high-fat foods.	43	43	41	45	NS	36	46	NS
Low-fat foods do not taste good.	42	39	5	41	NS	53	38	NS
No willpower	41	36	55	40	NS	44	41	NS
Low-fat foods do not fill me up.	29	34	23	27	NS	45	24	0.02[b]
Do not know how to choose lower-fat foods	23	28	18	20	NS	44	15	< 0.01[b]
Low-fat foods not available at home	11	15	14	6	NS	12	11	NS

[a] Fisher's exact test

[b] Chi square

CNS—central nervous system; NS—not significant

childhood cancer survivors from their peers and lessen the impact of peer pressure. Unfortunately, this survey was not conducted with a matched sample of healthy controls; therefore, that question cannot be answered. This study limitation points to a potential area of future research.

The responses of healthy adolescents and childhood cancer survivors appeared to differ regarding fatigue. In healthy populations, being too tired to exercise is not a commonly reported barrier; however, in childhood cancer survivors, fatigue is of paramount importance and was the leading barrier to exercise in this study, suggesting that childhood cancer survivors experience fatigue as reported in other cancer populations (Aziz, 2002; Barton-Burke, 2006; Courneya et al., 2005). In the current study, fatigue was reported by 57% of the sample, whereas in a study of 70 adult colorectal cancer survivors, fatigue, which was reported as one of the top three barriers to exercise, was reported by only 23% of the sample (Courneya et al.). Reasons for the discrepancy could be related to age or treatment, but the primary difference likely is attributed to the study populations. In the current study, a general population of survivors participated, whereas the data from Courneya et al. originated from survivors who were enrolled in an exercise intervention and therefore were more likely to be biased as a function of self-selection. Regardless, exercise interventions that target childhood cancer survivors need to address fatigue as a barrier to exercise and should assess the potential benefit of exercise as a means to manage this symptom.

The current study found significantly more barriers to exercise among several subgroups of childhood cancer survivors (i.e., those younger than age 18 years versus those age 18 or older and CNS cancers survivors compared to those with other diagnoses). Given the dearth of previous studies, data from the current study cannot be compared with others. Until more is known, the studied subgroups may have more barriers to exercise, which is important because interventions can be created, future studies designed, and data analysis conducted accordingly.

Barriers to a Healthful Diet

In general, the current study's results identify taste preferences, lack of availability (dining out and in the home), and commercial advertisements as barriers to a healthful diet among survivors of childhood cancers. Although general research about barriers to a healthful diet is not as well developed as that in the area of exercise, the findings confirm those of other studies (Adams, 1997; Anderson et al., 1998; Croll, Neumark-Sztainer, & Story, 2001; Siobhan, 2004; Story, Neumark-Sztainer, & French, 2002). For example, in a cross-sectional study of 1,000 participants aged 15 years and older, Kearney and McElhone (1999) found irregular work hours (24%), busy lifestyles (17%), and avoiding preferred foods (23%) to be the most common responses to a 14-item face-to-face interview focusing on barriers to healthful eating. Given the differences between the current study and Kearney and McElhone's in terms of possible barriers listed as choices for subjects as well as the sample populations, disparities when comparing results would be expected. Among the current population, 41% selected willpower as an explanation for failing to limit high-fat foods, compared to 18% in Kearney and McElone's survey. In addition, only 7% of Kearny and McElhone's sample reported not knowing how to make better choices as a barrier, whereas 23% of the current study's respondents listed lack of knowledge as a reason for not limiting high-fat foods. The results included written-in responses that "whole grain foods were fattening" as barriers, which points to the need for nutrition education in this population. With regard to cost as a barrier to healthy eating, results of the surveys are comparable (i.e., 16% in Kearny and McElhone's study and 11% in the current study).

Proportionately fewer subgroup differences in barrier prevalence to eating a healthful diet were noted between younger versus older and childhood cancer survivors of various types. Younger survivors were more likely to report that low-fat foods and whole grains were difficult to get when eating out and that alternatives were more filling, tasty, or tempting. Furthermore, younger survivors more often reported that they did not know how to choose lower-fat foods. Leukemia survivors were less likely to report that fruits and vegetables cost too much and were more apt to report pain on ingesting calcium-rich foods. As in the discussion regarding subgroup differences with exercise, studies that compare the data are lacking. However, until more is known, the data can be used to inform interventions and studies aimed at testing them.

Written-in Responses

Given the lack of research on barriers to exercise and healthful eating among childhood cancer survivors, respondents were provided with the opportunity to report additional barriers. Physical barriers and limitations outside of the participants' control were listed as barriers to exercise (n = 6) and included being wheelchair-bound or bedridden and suffering from pain or the side effects of illness, which is consistent with previous research on performance limitations in childhood cancer survivors (Ness et al., 2005) and barriers to exercise in breast cancer survivors (Leddy, 1997). In the current study, physical limitations also were listed by respondents as barriers to healthful eating (n = 7). Limitations included difficulty chewing, having gastroesophageal reflux disease, allergies related to whole grains, and lactose intolerance. Open-ended responses can inform subsequent surveys regarding diet and exercise barriers among childhood cancer survivors and point to a need to develop questions that systematically assess barriers.

Conclusions

The study findings may prove beneficial in future surveys aimed at assessing barriers to healthful lifestyle practices in childhood cancer survivors and in developing future interventions that target this population and their families as a means of empowering self-care and the adoption of healthy behaviors (Mertens et al., 2004). This research had several strengths (i.e., an intact cohort from previous research, an excellent response rate, and a broad range of questions about diet and exercise), but it was limited by lacking a healthy control group and the inclusion of a full compendium of items that may be instrumental in assessing barriers in childhood cancer survivors (i.e., systematic collection of data related to concerns obtained from written-in responses). More research is necessary; however, the data begin to provide a roadmap for designing effective interventions that must include strategies for overcoming fatigue and lack of time, as well as providing individuals with acceptable channels and opportunities

for exercise. Likewise, interventions aimed at healthy eating must address issues of the availability of appealing, tasty, and filling healthy food options. Clinic-based nurses in oncology, pediatric, and general medicine settings are particularly well positioned to educate childhood cancer survivors regarding their risk of developing secondary cancers and other diseases, such as cardiovascular disease, osteoporosis, and diabetes, but nurses should enlighten patients about the steps they can take to reduce their risks by increasing physical activity and consuming a low-fat diet with ample amounts of fruits and vegetables, whole grains, and calcium-rich foods. When designing nursing interventions for this expanding and vulnerable clinical population, the barrier data from this study suggest the importance of understanding what keeps survivors from adopting healthy behavior changes and then developing strategies to overcome them.

The identification of barriers is an initial step in designing interventions to improve the health of childhood cancer survivors. Nurses can be at the forefront of future research aimed at validating the findings and in ascertaining additional barriers to healthful lifestyle practices. In addition, through education and research, nurses can help survivors understand their risks and problem solve so that barriers to exercise and proper nutrition are reduced or eliminated.

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