Correlates of Physical Activity in Young Adult Survivors of Childhood Cancers

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Purpose/Objectives: To examine correlates of participation in regular physical activities among young adult survivors of childhood cancers.

Design: Descriptive, correlational.

Setting: Web-based survey.

Sample: 117 well-educated, predominately Caucasian survivors of various types of childhood cancers ($\bar{X}$ age = 24 years).

Methods: Participants completed four rating scales, a stages of change measure, and background questions. Logistic regression and graphical methods were used to examine relationships among physical activity correlates and physical activity.

Main Research Variables: Physical activity stages of change, autonomous motivation, physical activity pros and cons, self-efficacy, and self-reported worries.

Findings: More than 80% of participants reported that they were physically active. Survivors who were autonomously motivated and who perceived fewer cons to being physically active were more likely to report being active than survivors with lower autonomous motivation scores and higher physical activity cons scores. Worries about the present and future moderated the effect of physical activity cons on physical activity. The estimated probabilities of reporting being active for women and men changed as the collective contribution of autonomous motivation, physical activity cons, and worries varied from low to high values.

Conclusions: Engaging in physical activity willingly and without a sense of pressure (autonomous motivation), perceiving fewer cons to physical activity participation (cognitive appraisal), and worrying about the present and future (affective response) were important correlates of self-reported physical activity beyond the influence of gender.

Implications for Nursing: Interventions that promote autonomous motivation, decrease physical activity cons, and address present and future worries may increase physical activity in young adult cancer survivors and may have a greater impact on women than men.

Key Points . . .

- In young adult survivors of childhood cancers, worries about the present and future should be addressed when designing physical activity interventions, especially in survivors who perceive many cons to engaging in such activity.
- The collective contribution of three potentially modifiable variables (autonomous motivation, physical activity cons, and present and future worries) may have a greater impact on self-reported physical activity in female cancer survivors than in male cancer survivors.
- Translation of autonomy-supportive interventions that have been effective in fostering health-enhancing behaviors such as smoking cessation and promoting glycemic control may be an important next step in developing an autonomy-supportive intervention to promote physical activity in young adult cancer survivors.

Forty years ago, a diagnosis of cancer was fatal for many children. Today, although survival rates for most childhood cancers exceed 78%, the price of survival is high. Two-thirds of the more than 270,000 Americans who are childhood cancer survivors will face at least one treatment-related late effect (Hewitt, Weiner, & Simone, 2003). Lifestyle choices in combination with late effects put this vulnerable population at risk for premature development and accelerated progression of diseases associated with aging, such as hypertension, diabetes, coronary artery disease, and osteoporosis. In comparison to their siblings, survivors from the ongoing Childhood Cancer Survivor Study (CCSS) (a multi-institutional study of more than 10,000 childhood cancer survivors diagnosed from 1970–1986 who were five or more years postdiagnosis) were more than three times as likely to develop at least one chronic health condition and

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almost five times as likely to have two or more chronic conditions (Oeffinger et al., 2006). Engaging in regular moderate-intensity physical activity of at least 30 minutes on most days of the week may ameliorate some of these risks (McTiernan, 2004). Investigators of prior physical activity promotion research have identified correlates derived from multiple theories of health behavior change that have served as the basis for existing physical activity programs (Vandelanotte & De Bourdeaudhuij, 2003; Wilbur, Miller, Chandler, & McDevitt, 2003). None of the correlates, however, has been applied to physical activity promotion in young adult survivors of childhood cancer. The purpose of the present study was to examine correlates of participation in regular moderate-intensity to vigorous-intensity physical activities among young adult survivors of childhood cancer.

Background

In the general adult population, regular physical activity decreases the risks of developing heart disease, diabetes, colon cancer, breast cancer, osteoporosis, and depression (U.S. Department of Health and Human Services, 2000). Furthermore, growing evidence shows that physical activity is critical across the cancer continuum, from primary prevention through cancer survivorship (Brown et al., 2003; Courneya, 2003). In addition to its primary benefits, physical activity may serve as a gateway behavior, or catalyst, for changes in other lifestyle decisions, such as smoking (Marcus et al., 1995, 1999) and unhealthy eating (Boch, Marcus, Rossi, & Redding, 1998).

Although physical activity research is expanding in survivors of adult-onset cancers (Blanchard et al., 2003; Jones & Courneya, 2002; Mock et al., 2005; Schwartz, 2004; Thorsen et al., 2003) and adolescent survivors of childhood cancers (Hudson et al., 1999; Kadan-Lottick et al., 2002; Keats, Courneya, Danielsen, & Whitsett, 1999; Tyc, Hadley, & Crockett, 2001), few investigators in the published literature have examined physical activity behaviors in young adult survivors of childhood cancers. Mulhern et al. (1995) reported that 32 of 40 young adult cancer survivors exercised for at least three hours per week, but type and intensity of exercise were not described. As part of a larger study on current health behaviors, Demark-Wahnefried et al. (2005) surveyed 122 young adult leukemia, lymphoma, and central nervous system cancer survivors. Forty-three percent of the cancer survivors met the national guidelines for regular physical activity (30 minutes per day or more on most days of the week). As part of a smoking cessation intervention study, Butterfield et al. (2004) reported that 29% of 541 young adult survivors of childhood cancers who smoked did not engage in regular moderate (at least 150 minutes per week) physical activity. Smokers who did not engage in regular moderate physical activity had lower levels of self-efficacy for quitting smoking than smokers who were physically active for at least 150 minutes per week.

Conceptual Framework

The Interaction Model of Client Health Behavior (IMCHB) (Cox, 1982) has been proposed as a model of health behavior to guide studies of childhood cancer survivors (Cox, 2003) (see Figure 1). The IMCHB is a broad conceptual framework with three major elements that mutually influence one another during each client-provider interaction: client singularity, client-professional interaction, and health outcome. Tailoring interactions or interventions to match survivors' unique configurations of client singularity variables increases the likelihood that positive health outcomes such as increased physical activity will occur. The client singularity element contains four categories of background variables that are relatively static: demographic characteristics, social influence, previous healthcare experience, and environmental resources. In contrast, the dynamic client singularity variables (intrinsic motivation, cognitive appraisal, and affective response) are more amenable to change than the background variables. The central component of the IMCHB, the element of client-professional interaction, includes four components that vary according to the client singularity and the expressed healthcare need: affective support, delivery of healthcare information, decisional control, and professional-technical competencies.

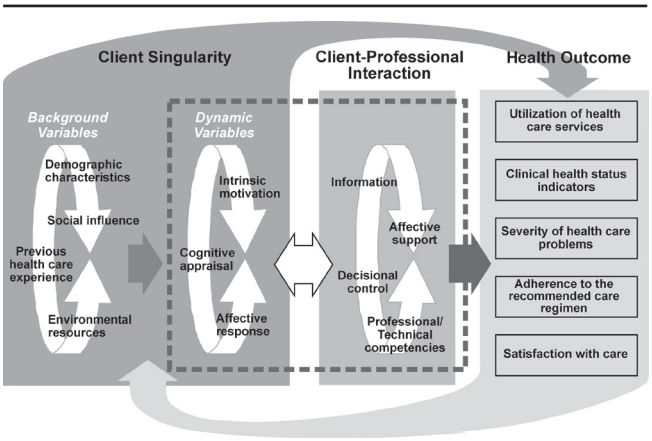


Figure 1. Interaction Model of Client Health Behavior

Note. From "A Model of Health Behavior to Guide Studies of Childhood Cancer Survivors" by C.L. Cox, 2003, *Oncology Nursing Forum, 30,* p. E93. Retrieved August 13, 2007, from http://www.ons.org/publications/journals/ONF/Volume30/Issue5/pdf/762.pdf. Copyright 2003 by the Oncology Nursing Society. Reprinted with permission.

In the present study, the client singularity element was used to guide the inclusion of background and dynamic variables that may explain physical activity behaviors in young adult cancer survivors. Four instruments that measured potentially modifiable correlates of physical activity adoption in young adult cancer survivors (autonomous motivation, self-efficacy, decisional balance, self-reported worries) represented the dynamic motivational, cognitive, and affective variables in the IMCHB. A measure of physical activity stages of change that incorporated Centers for Disease Control and Prevention definitions for moderate- and vigorous-intensity physical activities represented the health outcome variable (see Figure 2). The stages of change construct represented physical activity as a dynamic five-stage process, which ranges from no intention to engage in physical activity to sustained observable change in physical activity behavior (Prochaska & Velicer, 1997). In the first stage, precontemplation, an individual has no intention to become physically active. Individuals who are in the second stage, or contemplation, are thinking about becoming physically active in the next six months. During the preparation stage, an individual intends to participate in physical activity in the next month and makes small changes in behavior. The action stage involves participation in physical

Vigorous physical activities

- Include activities such as running, aerobics, wheelchair basketball, heavy yard work, or anything else that causes large increases in breathing or heart rate
- Regular vigorous physical activity means accumulating 20 minutes or more in these activities at least three days per week.

Moderate physical activities

- Include activities such as brisk walking, swimming, bicycling, vacuuming, gardening, manual operation of a wheelchair, or anything else that causes small increases in breathing or heart rate
- Regular moderate physical activity means accumulating 30 minutes or more of these activities at least five days per week.

Do you engage in either regular vigorous physical activities or regular moderate physical activities according to the definitions above?

- ☐ Yes, I have been for more than six months.
- ☐ Yes, I have been for less than six months.
- ☐ No, but I am planning to start in the next 30 days.
- ☐ No, but I am planning to start in the next six months.
- ☐ No, and I don't plan to start in the next six months.

Figure 2. Physical Activity Definitions and Stages of Change Measure From a Web-Based Survey

activity, usually in the past six months. Sustained participation in physical activity for more than six months is the hallmark of the maintenance stage. The ideal goal is a lifetime of maintenance, but most individuals progress and regress through the stages in a cyclical pattern. A brief review of the IMCHB dynamic variables (intrinsic motivation, cognitive appraisal, and affective response) in relation to stages of physical activity change follows.

Intrinsic Motivation

Intrinsic motivation is regulated autonomously (or self-determined) and undertaken willingly and with no sense of coercion (Deci & Ryan, 2002). In contrast, extrinsic motivation includes four subtypes that span a continuum from autonomous to controlled regulation. Rose, Parfitt, and Williams (2005) defined the four subtypes of extrinsic motivation in the context of exercise behavior. Controlled subtypes include external regulation (completely non–self-determined and controlled by external demands and expectations) and introjected regulation, (partially self-determined and characterizes exercise behavior that is undertaken to avoid guilt). When exercise becomes important and valued by an individual, the behavior becomes more autonomously regulated and is labeled as identified. Exercise behavior that is undertaken willingly and without a sense of pressure is completely autonomous and regulated through integrated or intrinsic motivation. Integrated motivation differs slightly from intrinsic motivation in that integrated motivation, although fully autonomous, is a type of extrinsic motivation because it is regulated by the importance attached to an outcome. In contrast, intrinsically regulated exercise is undertaken purely for the enjoyment and satisfaction gained from exercising. In several studies, autonomously regulated motivation has emerged as an important correlate of physical activity adoption and maintenance in healthy adults and adults who are cancer survivors (Ingledew, Markland, & Medley, 1998; Matsumoto & Takenaka, 2004; Mullan & Markland, 1997; Ntoumanis, 2002; Wilson, Blanchard, Nehl, & Baker, 2006). For example, Matsumoto and Takenaka explored the relationship between four motivational profiles (self-determined motivation, moderate motivation, non–self-determined motivation, and amotivation) and exercise stages of change. The self-determined (autonomous) motivational profile contained high numbers of long-term regular exercisers in the maintenance stage and low numbers of participants in precontemplation, contemplation, and preparation stages. More recently, Wilson et al. (2006) found that autonomous motivation was a strong predictor of physical activity behaviors in adult cancer survivors.

Cognitive Appraisal

Two cognitively based constructs have consistently explained a significant amount of variance in stages of change for physical activity: self-efficacy and decisional balance. In some studies, self-efficacy, or confidence to be active, increased with each stage of change (Dannecker, Hausenblas, Connaughton, & Lovins, 2003; Marcus, Selby, Niaura, & Rossi 1992). In a meta-analysis, a nonlinear pattern of increase in self-efficacy was present across the stages of change, suggesting that discontinuity of self-efficacy may exist (Marshall & Biddle, 2001). Decisional balance, or weighing the pros and cons of changing physical activity behavior, has emerged as a consistent correlate of stages of change in several studies (Marshall & Biddle; Prochaska et al., 1994). In precontemplation, the cons of changing a behavior outweigh the pros. In general, the pros begin to increase in contemplation, and continue to increase through maintenance, while the cons begin to decrease in contemplation and continue to decrease through maintenance.

Affective Response

Affective response (emotional response to a health concern) in childhood cancer survivors has been described as the metaphorical sword of Damocles (Koocher & O'Malley, 1981) in which celebration and hope are mixed with uncertainty and fear (Hasse & Rostad, 1994). After patients complete cancer therapy, worries surface about issues related to cancer survivorship, such as relapse, second cancers, late effects, fertility, and general health (Zebrack & Chesler, 2001). However, in spite of these cancer-related worries, the majority of childhood cancer survivors are psychologically healthy (Hudson et al., 2003) and some may even embrace this uncertainty with confidence, resilience, optimism, and a deepened appreciation for life (Hollen, Hobbie, Finley, & Hiebert, 2001; Parry, 2003; Woodgate, 1999). The relationship between self-reported worries and physical activity behavior in cancer survivors has not been explored explicitly; however, some survivors in a qualitative study reported that staying in strong physical shape and controlling weight allowed them to feel in control of their bodies and decrease stress, whereas others reported

Table 1. Geographic Distribution of Participants

Location	n	%
Northeastern United States	15	13
Midwestern United States	27	23
Southern United States	53	45
Western United States	20	17
Germany and Canada	2	2

N = 117

that keeping themselves too healthy might prolong illness if they contracted cancer again (Park, Emmons, Malloy, & Seifer, 2002).

Little is known about correlates of physical activity behavior in young adults who are survivors of childhood cancer. However, correlates of physical activity behavior in the general population, including young adults, have been researched extensively. Sufficient evidence confirms that the stages of physical activity change are associated with different levels of self-efficacy and decisional balance. Evidence also is emerging on the relationship between autonomous motivation and stages of physical activity change. The present study examined relationships between physical activity correlates and stages of change in young adult survivors of childhood cancers.

Methods

Design, Setting, and Sample

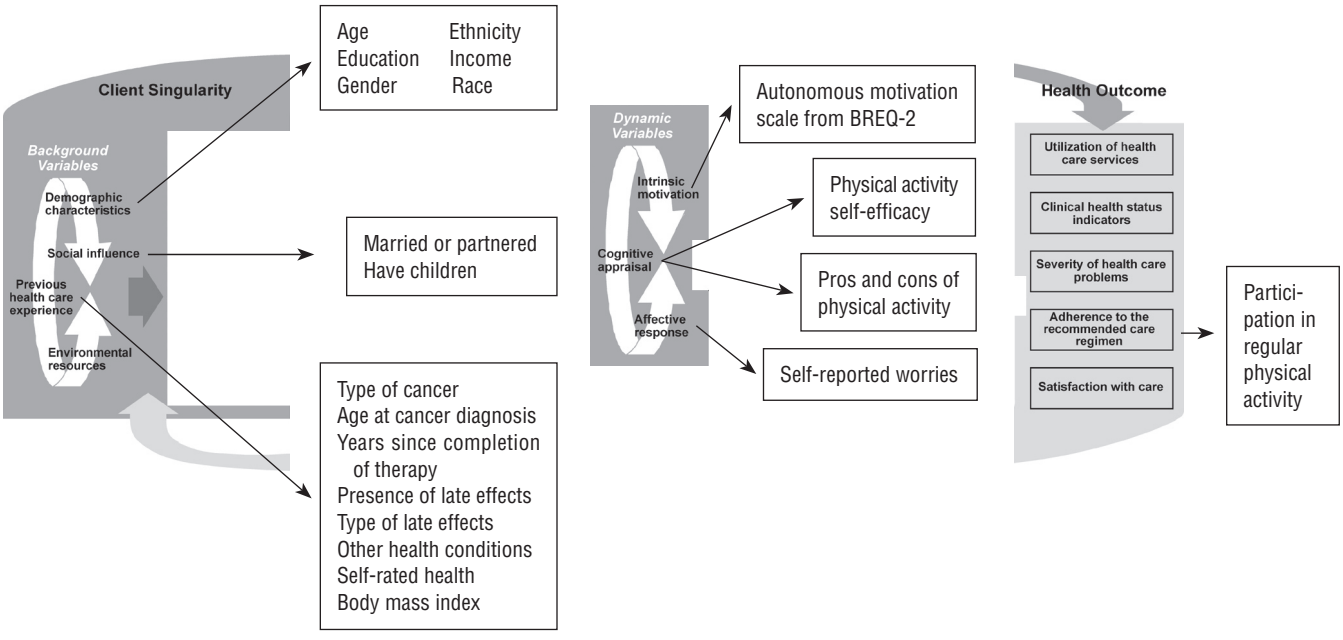
The present study was conducted over the Internet with a convenience sample of 117 young adult survivors of childhood cancers. Survivors were invited to participate if they (a) had a self-reported diagnosis of cancer, (b) were less than 21 years of age at time of diagnosis, (c) were able to specify the type of cancer, (d) were at least two years beyond completion of cancer therapy, (e) were between the ages of 18 and 39, (f) were able to speak, read, and write English, and (g) had access to the Internet. Participants were recruited through advertisements posted on cancer survivor-related Web sites, newsletters, list serves, a study Web site, and word of mouth. In addition to the Web-based recruitment strategies, specialty cancer survivor clinics and cancer camps forwarded study information to their patients and alumni. Potential participants contacted the study staff through a toll-free number or by e-mail if they were interested in participating in the study. Eligibility was screened over the telephone, and informed consent was reviewed with eligible participants.

Inquiries were received from 168 potential participants. The researchers were unable to contact 11 potential participants. Thirty-one potential participants were not eligible for the following reasons: no cancer diagnosis (n = 4), younger than 18 or older than 39 (n = 9), less than two years without treatment (n = 12), cancer diagnosis after age 21 (n = 5), and inability to read English (n = 1). Of 126 survivors who agreed to participate, 117 completed the study. The participants represented a convenience sample of 115 throughout the United States and two participants from outside the United States (see Table 1).

Variables and Instruments

Study instruments corresponded to the background, dynamic, and health outcome variables in the IMCHB framework (see Figure 3). Background questions, which were adapted from Zebrack and Chesler's (2001) childhood cancer survivor quality-of-life studies, included questions on demographic, social influence, and previous health characteristics. Measures of dynamic variables included an autonomous motivation scale (intrinsic motivation), a physical activity self-efficacy measure (cognitive appraisal), a decisional balance scale for physical activity (cognitive appraisal), and a self-reported worries scale (affective response).

Autonomous motivation was measured by combining the intrinsic (four items) and identified (four items) subscales



BREQ-2—Behavioral Regulation in Exercise Questionnaire-2

Figure 3. Correspondence of Study Variables and Instruments to Client Singularity and Health Outcome Interaction Model of Client Health Behavior Variables

Note. From "A Model of Health Behavior to Guide Studies of Childhood Cancer Survivors" by C.L. Cox, 2003, *Oncology Nursing Forum, 30,* p. E93. Retrieved August 13, 2007, from http://www.ons.org/publications/journals/ONF/Volume30/Issue5/pdf/762.pdf. Copyright 2003 by the Oncology Nursing Society. Adapted with permission.

Table 2. Scale and Subscale Descriptive Statistics

Scale	N	Alpha	Possible Range	Total Sample $\bar{X}$	Total Sample SD	Inactive $\bar{X}$	Inactive SD	Active $\bar{X}$	Active SD
Intrinsic Motivation: BREQ-2 Combined Intrinsic and Identified Subscales									
Autonomous motivation	116	0.92	0–4	2.71	0.92	1.93	0.68	2.90	0.88
Cognitive Appraisal: Physical Activity Self-Efficacy									
Total scale	106	0.91	1–5	2.70	0.81	2.27	0.56	2.74	0.83
Cognitive Appraisal: Decisional Balance									
Pros	115	0.68	1–5	3.60	0.81	3.36	0.85	3.67	0.79
Cons	115	0.62	1–5	2.10	0.76	2.61	0.65	2.00	0.74
Affective Response: Self-Reported Worries									
Cancer-specific and general health concerns	115	0.76	9–36	20.16	5.58	20.79	5.04	19.98	5.76
Present and future concerns	116	0.69	9–36	22.77	5.13	22.23	5.04	22.86	5.22

BREQ-2—Behavioral Regulation in Exercise Questionnaire-2

from the multidimensional Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2), a 19-item instrument that reflects a continuum of behavioral regulation ranging from amotivation to completely autonomous, intrinsic regulation (Markland & Tobin, 2004). Discriminant validity (with the stages of change for physical activity), construct validity, and reliability were supported in previous studies with young adults (Markland & Tobin; Wilson, Rodger, Fraser, & Murray, 2004). In the present study, internal consistency reliability for the combined intrinsic and identified subscales was 0.92. Participants responded to statements about their decisions to engage or not engage in physical activity by rating each item on a 5-point Likert scale (e.g., I am physically active because other people say I should be; 0 = not true for me to 4 = very true for me). A total score was computed by calculating the mean score for the eight items.

Self-efficacy for physical activity was measured with an 18-item instrument (Benisovich, Rossi, Norman, & Nigg, 1998) that was expanded from a shorter measure originally developed by Marcus et al. (1992). The original five-item measure has consistently discriminated the stages of change for physical activity across multiple populations (Rodgers, Courneya, & Bayduza, 2001; Wyse, Mercer, Ashford, Buxton, & Gleeson, 1995). The 18-item physical activity self-efficacy measure consists of six subscales with internal consistency reliabilities ranging from 0.77–0.87 (Benisovich et al.). Participants were asked to rate their confidence to engage in physical activities in various situations that might interfere with their abilities to engage in physical activities (e.g., when I am under a lot of stress; 1 = not at all confident to 5 = completely confident). A total score was computed by calculating the mean score for the 18 items.

The decisional balance scale contained five pros of engaging in physical activity (e.g., I would have a more positive outlook, physical activity could help me sleep better) and five cons of engaging in physical activity (e.g., daily responsibilities make me too tired to engage in physical activity, my time spent with friends and family would decrease if I was physically active) (Plotnikoff, Blanchard, Hotz, & Rhodes, 2001). Content, factorial, concurrent, and construct validity were supported in a longitudinal sample of 703 Canadian adults, aged 18–65 years (Plotnikoff et al.). In that study, internal consistency reliabilities at three time points were 0.82, 0.83, and 0.77 for the pros subscale and 0.72, 0.69, and 0.69 for the cons subscale. Mean scores were calculated separately for the pros and cons subscales.

Self-reported worries were measured with 18 items that were developed from a series of items and scales administered to three different samples of childhood cancer survivors over a 10-year period (Weigers, Chesler, Zebrack, & Goldman, 1998; Zebrack & Chesler, 2001). In a later study, Langeveld, Grootenhuis, Voute, de Haan, and van den Bos (2004) developed three subscales from the 18 items: cancer-specific concerns (five items), general health concerns (four items), and present and future concerns (nine items). Each item had four response options that assessed the extent to which survivors worried (1 = never to 4 = a lot). Cancer-specific concerns and general health concerns were combined, resulting in two subscales for the current study: cancer specific and general health concerns (e.g., relapse, fertility, fatigue) and present and future concerns (e.g., death, body image, relationships) (Langeveld et al.). Total scores were computed for each of the subscales.

Physical activity stages of change were measured with a single-item, five-choice algorithm that incorporated the Centers for Disease Control and Prevention recommendations for moderate or vigorous physical activities. The wording of the physical activity definitions was adapted from the physical

Cardiovascular: aortic insufficiency, congestive heart failure, cardiomyopathy, valve problems

Endocrine: diabetes mellitus, diabetes insipidus, adrenal insufficiency, thyroid insufficiency, infertility, endometriosis

Gastrointestinal: liver damage or problems, gallbladder problems, ulcerative colitis

General: depression, fatigue, sleep disorder, low platelets

Musculoskeletal: back pain, joint pain, leg problems or pain, hip pain, scoliosis, avascular necrosis

Neurologic: hand tremors, headaches, learning problems, memory loss, seizures, herpes zoster, stroke, balance problems

Respiratory: diminished lung capacity, asthma

Sensory: cataracts

Figure 4. Body System and Reported Late Effects of Cancer Treatments

activity questions used in CCSS (Robison et al., 2002). Each respondent was classified into a stage of physical activity change: (a) precontemplation (not active and not planning to start in the next six months), (b) contemplation (not active but planning to start in the next six months), (c) preparation (not active but planning to start in the next 30 days), (d) action (active for less than six months), or (e) maintenance (active for more than six months).

Study Procedures

The University of Illinois at Chicago Institutional Review Board approved the study, which was conducted over a 12-month period from 2005–2006. The Web-based data collection tool was developed on campus by a group of experienced programmers led by an individual with a background in programming and statistics. A usability test was conducted and the survey and Web pages were modified several times prior to implementation. Each eligible participant was assigned a unique identification number and password to gain access to the Web-based survey questions. Participants logged on to the study Web site and read and submitted the consent form. The survey questions were programmed so that respondents clicked on a response or typed in a text response for an open-ended question. The four rating scales (autonomous motivation, physical activity self-efficacy, decisional balance, and self-reported worries) were presented first, in random order by scale. Next, participants responded to the physical activity stages of change measure. Finally, participants completed the background questions. After completing the surveys, each respondent selected a $10 participation gift: an online gift certificate, a mailed check, or a donation to a foundation in the survivor's name.

Data Analysis

Responses to survey questions were electronically transmitted to a secure Microsoft® (Microsoft Corporation) Office Access database. Data were exported to Stata® (Stata Corporation) SE Version 9 for analysis. The background variables, measures that represented the dynamic variables, and the physical activity stages of change measure were summarized using descriptive statistics. Internal consistency reliabilities (Cronbach alpha) were computed for all scales. Physical activity stages of change were collapsed into two categories for subsequent analysis. Survivors who were in the action and maintenance stages were classified as active; survivors who were in the precontemplation, contemplation, and preparation stages were classified as inactive. Univariate logistic regression analyses were used to examine the relationships between each of the background and dynamic variables and physical activity. To examine the background and dynamic correlates of participation in regular physical activity, a series of multivariate logistic regression models were fit to the data.

Results

Sample Characteristics

Background variables: The final sample included 117 well-educated, predominately Caucasian cancer survivors aged 18–37 (see Table 3). Most participants were female and single. More than half of the participants were survivors of leukemia and lymphoma. Almost all of the participants received chemotherapy and nearly half were treated with radiation. More than half of the participants reported late effects from treatment

Table 3. Sample Characteristics

	Total Sample (N = 117)		Inactive (N = 23)		Active (N = 94)	
Characteristic	**$\bar{X}$**	**SD**	**$\bar{X}$**	**SD**	**$\bar{X}$**	**SD**
Age (years)	24	5	24	5	24	5
Age at cancer diagnosis (years)	10	5	11	4	10	5
Years off treatment	11	6	11	4	11	6
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**
Gender						
Female	79	68	21	91	58	62
Male	38	32	2	9	36	38
Race						
Caucasian	111	95	22	96	89	95
African American	3	3	–	–	3	3
Other	3	3	1	4	2	2
Hispanic or Latino	12	10	3	13	9	10
Marital status						
Married or partnered	44	38	11	48	33	35
Single	73	62	12	52	61	65
Have children	15	13	2	9	13	14
Education						
Less than or equal to high school	14	12	2	9	12	13
Some postsecondary	56	48	10	43	46	49
Completed college	46	40	11	48	35	38
Missing	1	1	–	–	–	–
Annual income ($)						
Less than 15,000	35	30	5	22	30	32
16,000–25,000	19	16	5	22	14	15
26,000–40,000	16	14	4	17	12	13
41,000–60,000	16	14	5	22	11	12
Greater than 60,000	30	26	4	17	26	28
Missing	1	1	–	–	1	1
Cancer type[a]						
Leukemia	47	40	6	26	49	44
Lymphoma	27	23	8	35	19	20
Central nervous system	12	10	1	4	11	12
Sympathetic nervous system	1	1	1	4	–	–
Retinoblastoma	1	1	–	–	1	1
Renal	6	5	–	–	6	6
Malignant bone tumors	13	11	5	22	8	9
Soft tissue sarcomas	3	3	1	4	2	2
Germ cell neoplasms	5	4	1	4	4	4
Carcinomas and other	2	2	–	–	2	2
Cancer treatment						
Chemotherapy alone	54	46	11	48	43	46
Radiation alone	3	3	2	9	1	1
Chemotherapy and radiation	57	49	10	43	47	50
No chemotherapy or radiation	3	3	–	–	3	3
Had bone marrow transplantation	12	10	4	17	8	9
Late effects from treatment	63	54	13	57	50	53
Self-rated health						
Poor	2	2	1	4	1	1
Fair	16	14	5	22	11	12
Good	38	32	8	35	30	32
Very good	47	40	7	30	40	42
Excellent	14	12	2	9	12	13
Overweight or obese (body mass index ≥ 25)	37	33	9	39	28	31

[a] International Classification of Childhood Cancers categories

Note. Because of rounding, not all percentages total 100.

that affected multiple body systems (see Figure 4). The majority of participants reported that their cancers were cured and rated their health as good or very good.

Dynamic variables: The reliability coefficients (Cronbach alpha) and mean scores for the measures representing the dynamic variables are presented in Table 2. Scale reliability coefficients for autonomous motivation, self-efficacy, and cancer-specific and general health concerns were above minimum acceptable levels of internal consistency ($\alpha > 0.70$). Reliability coefficients for pros and cons of physical activity and present and future concerns were more than 0.60 but less than 0.70.

In response to the physical activity stages of change question, 60% of the participants reported that they were active for more than six months (maintenance) and 21% reported that they were active for six months or less (action). The remaining 23 participants classified themselves as in preparation (9%), contemplation (5%), or precontemplation (5%). For subsequent analyses, the stages of change variable was collapsed into two categories: active (maintenance and action) and inactive (preparation, contemplation, and precontemplation).

Differences in Background Variables by Stages of Change

Distributions and mean scores for each of the background variables for active and inactive survivors are listed in Table 3. Active and inactive survivors had very few differences in the majority of the background variables. The only variable that differed significantly between active and inactive survivors was gender. When compared to females, males were more than six times as likely to report being active (unadjusted odds ratio [OR] [male] 6.5, 95% confidence interval [CI]: 1.4–29.5). Looked at differently, the unadjusted probability of being active was 0.95 for males and 0.73 for females.

Differences in Dynamic Variables by Stages of Change

Survivors who had higher scores for autonomous motivation were more likely to be active than survivors with lower autonomous motivation scores (unadjusted OR 3.39, 95% CI: 1.88–6.10). Similarly, survivors with higher self-efficacy scores were more likely to be active than survivors with lower self-efficacy scores (unadjusted OR 2.35, 95% CI: 1.18–4.66). Higher scores on the physical activity cons measure were associated with a decreased likelihood of being physically active (unadjusted OR 0.34, 95% CI: 0.18–0.65).

To examine the combined effects of the dynamic variables on the probability of being physically active after accounting for the influence of gender, a series of multivariate logistic regression models (outcome active or not active) were fit to the data. The best-fitting model contained male gender, autonomous motivation (linear and quadratic terms), physical activity cons, present and future concerns, and an interaction term for physical activity cons and present and future concerns (see Table 4). Higher scores on physical activity cons were inversely related to physical activity. Present and future concerns and physical activity cons were moderately correlated (r = 0.40). The significant interaction term (between physical activity cons and present and future concerns) implies that the more present and future concerns a survivor has, the stronger the effect of physical activity cons on physical activity behavior.

The Stata program, Visualizing Binary Logit Models (Mitchell & Chen, 2005) was used to visualize the relationship between the background variable, gender, and the probability of being active while taking into account the collective contribution of the dynamic variables (autonomous motivation, physical activity cons, and present and future concerns). The estimated probabilities of being active for females and males change as the collective contribution of autonomous motivation, physical activity cons, and present and future concerns varies from the 20th to 80th percentiles (see Figure 5). The collective contribution is the sum of the value of each dynamic variable multiplied by its regression coefficient to get to a composite variable representing the set of predictors. For example, when the collective contribution of the dynamic variables is at the 20th percentile, the predicted probability of being physically active is 0.88 for males and 0.52 for females. As the collective contribution of the dynamic variables increases, the gender gap in the predicted probabilities of being physically active narrows. At the 80th percentile, the predicted probabilities are almost equivalent.

Discussion

The high prevalence (more than 80%) of physically active participants in this study exceeded physical activity prevalence estimates that have been reported in previous studies with cancer survivors as well as the general population. For example, more than half of the young adult cancer survivors who participated in Demark-Wahnefried et al.'s (2005) health behavior survey did not meet national guidelines for regular physical activity. Compared to physical activity staging distributions across nine Behavior Change Consortium (BCC) studies (Nigg et al., 2005), the prevalence of participants at risk for sedentary behavior (precontemplation, contemplation, and preparation stages) in this study was substantially lower (19% in this study as compared to 55% across the BCC studies). The reactive recruitment method and Web-based survey in this study may have attracted health-conscious survivors who are more likely to participate in physical activity.

Consistent with findings from previous studies (Marshall & Biddle, 2001; Matsumoto & Takenaka, 2004; Prochaska et al., 1994), participants with higher autonomous motivation scores and those who perceived fewer cons (e.g., too tired, too much time) were more likely to be active than participants with lower

Table 4. Multivariate Logistic Regression on Physical Activity

Variable	Adjusted Odds Ratio	95% Confidence Interval	p
Male	8.676	1.407–53.483	0.020
Autonomous motivation (linear term)	0.002	0.000–0.7330	0.039
Autonomous motivation (quadratic term)	6.948	1.497–32.240	0.013
Cons of physical activity	0.001	0.000–0.1930	0.013
Present and future concerns	0.026	0.000–6.5260	0.195
Cons of physical activity and present and future concerns (interaction term)	9.766	1.031–92.482	0.047

N = 117

Note. Test of overall model fit is significant at $p < 0.0001$ (likelihood ratio = –29.38, $x^2 = 57.22$).

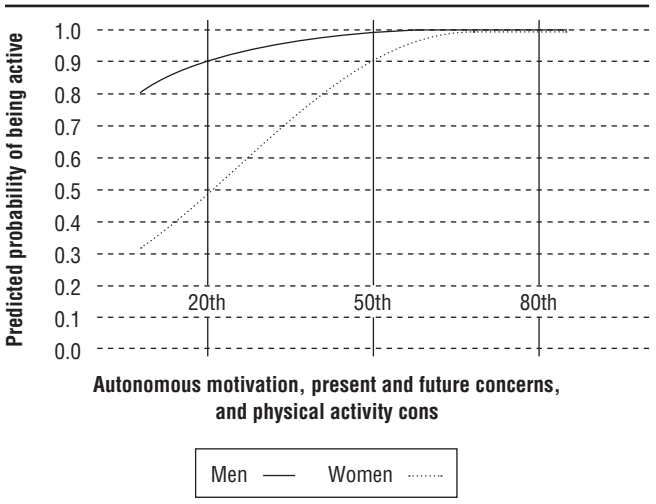


Figure 5. Predicted Probabilities of Being Active For Women and Men In Relation To Collective Contribution of Autonomous Motivation, Present and Future Concerns, and Physical Activity Cons

autonomous motivation scores and higher perceived cons. An important new finding that is specific to cancer survivors is the moderating influence of present and future worries on physical activity behavior. Cox, McLaughlin, Steen, and Hudson (2006) recently documented that higher levels of worry had a negative and positive influence on substance use (smoking and drinking) in adolescent survivors of childhood cancer. Adolescent survivors who worried about cancer and treatment effects were more likely to smoke and drink; however, worrying also contributed to decreased substance use indirectly through an effect on motivation to change. Young adult survivors in this study worried more about present and future concerns (e.g., dying, body image, parental health and finances, losing friends, having children, changing jobs, and obtaining insurance) than young adult survivors from a previous study (Langeveld et al., 2004). Worrying had a moderating effect on the relationship between physical activity cons and being physically active. Survivors who had higher levels of worry and perceived more barriers (cons) to physical activity were less likely to be physically active than survivors who worried less and perceived fewer barriers to physical activity.

Limitations

This study had several limitations. Although survivors were recruited from multiple regions of the United States, generalizability is limited to mainly well-educated Caucasian survivors who use the Internet and mostly report being active. The low reliabilities for the physical activity cons, physical activity pros, and present and future concerns scales and the single-item self-reported physical activity stage of change introduced measurement error that may have affected the study results. Finally, the multivariate model may not hold in larger samples with more equal representation of males and females.

Implications for Nursing Research and Practice

Engaging in physical activity willingly and without a sense of pressure (autonomous motivation), perceiving fewer barriers (cons) to physical activity participation (cognitive appraisal), and worrying about the present and future (affective response) were important dynamic correlates of self-reported physical activity beyond the influence of gender. These findings have important implications in relation to planning IMCHB-based, theoretically driven interventions to promote physical activity in cancer survivors. Cognitively based interventions that simply provide information on decreasing perceived barriers to physical activity may not be as powerful as interventions that also include affective and motivational components. Addressing affective concerns related to cancer survivorship may allow survivors to focus on decreasing their own barriers to physical activity participation. In the context of the IMCHB, an important role of a nurse during client-professional interactions is to promote self-determined motivation by maximizing decisional control and creating a care environment that supports autonomy (Cox, 2003). Translation of autonomy-supportive interventions that have been effective in fostering health-enhancing behaviors such as smoking cessation and promoting glycemic control (Williams et al., 2006; Williams, McGregor, Zeldman, Freedman, & Deci, 2004) may be important next steps in developing autonomy-supportive interventions to promote physical activity in young adult survivors of childhood cancers. Finally, given the gender differences in the impact of the combined contribution of the dynamic variables on physical activity behavior, multifaceted interventions that foster autonomous motivation, decrease perceived barriers to physical activity, and address worries related to cancer survivorship may have a greater impact on promoting physical activity in female survivors than in male survivors.

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