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Eating Behavior and BMI in Adolescent Survivors of Brain Tumor and Acute Lymphoblastic Leukemia

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Abstract

Objectives—Elevated BMI has been reported in pediatric cancer survivors. It is unclear whether this is related to altered energy intake (via disordered eating), decreased energy expenditure (via limited exercise), or treatment-related direct/indirect changes. The aims of this study are to describe the occurrence of overweight and obesity, exercise frequency, and the extent of disordered eating patterns in this sample of survivors, and to examine relationships among BMI,

eating patterns, exercise frequency and demographic and disease and treatment-related variables to identify those survivors most at risk for overweight/obesity.

Methods—This cross-sectional study recruited 98 cancer survivors (50 ALL, 48 Brain Tumor), aged 12-17 years and >12 months post-treatment from a large pediatric oncology hospital. Survivors completed health behavior measures assessing disordered eating patterns and physical activity. Clinical variables were obtained through medical record review. Univariate analyses were conducted to make comparisons on health behaviors by diagnosis, gender, treatment history, and BMI category.

Results—Fifty-two percent of ALL survivors and 41.7% of BT survivors were classified as overweight/obese. Overweight/obesity status was associated with higher Cognitive Restraint (OR=1.0, 95%CI:1.0-1.1). Only 12% of ALL survivors and 8.3% of BT survivors met CDC guidelines for physical activity. Males reported more physical activity ($t(96)=2.2$, $p<.05$).

Conclusions—Overweight/obese survivors may attempt to purposefully restrict their food intake and rely less on physiological cues to regulate consumption. Survivors should be screened at follow-up for weight-related concerns.

Keywords

BMI; disordered eating; physical activity; health behaviors

Introduction

Brain tumors (BT) and acute lymphoblastic leukemia (ALL) are the two most commonly occurring pediatric cancers (Siegel, Naishadham, & Jemal, 2013). This population of survivors has continued to grow with treatment advances that have led to cures or longer survival (Mariotto et al., 2009). Unfortunately, late effects of treatment are common, with two of every three childhood cancer survivors developing at least one therapy-related complication (Oeffinger et al., 2006). To this end, the “Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent and Young Adult Cancers, Version 3.0 (www.survivorshipguidelines.org) was developed to assist primary care physicians in screening for health behaviors and providing anticipatory guidance on health promotion issues. One of the recommendations includes counseling and monitoring survivors who are at risk of obesity, given its high prevalence among survivors and its relationship to increased risk for diabetes, cardiovascular disease, and secondary cancers (American Academy of Pediatrics Section on Hematology/Oncology Children’s Oncology, 2009)

Estimates of the prevalence of overweight and obesity among BT and ALL survivors vary across studies. Much of the research examining weight-related health behaviors and outcomes in this population has been conducted with samples of adult survivors of childhood cancer. In the Childhood Cancer Survivor Study (CCSS), 22.5% of adult female ALL survivors (ages 20-47) were overweight and 18.5% were obese (Nathan et al., 2009). More than one third (36.2%) of adult male ALL survivors were overweight and 16.5% were obese. Among adult survivors of childhood brain tumors, 24.9% of females were overweight and 17.1% obese, while 38.1% of male survivors were overweight and 13.2% were obese (Meacham et al., 2005). Changes in contemporary treatment (e.g., avoidance of cranial

radiation therapy (CRT) for non-high risk ALL, reduction in irradiation doses for brain tumors) since the era of the original CCSS cohort may have important implications for risk factors and rates of overweight/obesity in survivors treated more recently.

Although less has been reported on survivors treated with contemporary protocols, overweight and obesity appear to remain a consistent concern. Among ALL survivors (age 2-18 diagnosed between 1993 and 2003), 21.2% were overweight and 20.0% were obese 5 years post, diagnosis (Chow, Pihoker, Hunt, Wilkinson, & Friedman, 2007). Among survivors of pediatric suprasellar brain tumors, 43% were obese four years post-diagnosis (Lek et al., 2010).

The high occurrence of overweight and obesity in this population is particularly disturbing because long-term health risks can develop in relation to obesity. Childhood cancer survivors are already at risk for chronic health conditions (Oeffinger et al., 2006), and unhealthy weight may exacerbate this risk. Overweight/obese pediatric BT and ALL survivors are at risk for early clinical features of metabolic syndrome, which is related to development of cardiovascular disease and type 2 diabetes (Siviero-Miachon, Spinola-Castro, & Guerra-Junior, 2008).

Risk Factors Associated with Elevated Body Mass Index

Several risk factors have been proposed for the development of elevated (Body Mass Index (BMI) and corresponding clinical outcomes in the survivor population, including disease- and treatment-related factors and health behaviors. Reports examining treatment-related factors suggest adult survivors of childhood ALL treated with CRT are at increased risk for higher BMI as compared to siblings (Oeffinger et al., 2003). Brain tumor survivors treated with CRT for pilocytic astrocytoma, craniopharyngioma, or medulloblastoma are also at increased risk for obesity (Lustig et al., 2003). While, historically, treatment with chemotherapy agents alone has not been associated with increased obesity risk (Garmey et al., 2008; Oeffinger et al., 2003; Sklar et al., 2000), recent findings demonstrated risks for obesity in ALL survivors who were treated on modern protocols with chemotherapy agents only (Breene et al., 2011). Other research points to the use of corticosteroid treatment in ALL survivors as a risk for BMI elevation post-treatment (Chow et al., 2007). Demographic associations for increased risk for obesity include female gender and earlier age at diagnosis for both ALL and brain tumor survivors (Didi et al., 1995; Garmey et al., 2008; Meacham et al., 2005).

Changes in health behavior patterns, including physical inactivity, may contribute to weight gain in survivors. Decreased physical activity during ALL treatment could be due to steroid and vincristine-related neuropathy, decreased interest in participating in recreational activities, over-protectiveness of parents (Iughetti, Bruzzi, Predieri, & Paolucci, 2012), or fatigue (Arroyave et al., 2008). Although, it is not universally accepted that ALL survivors are less physically active than healthy children (Heath, Ramzy, & Donath, 2010), research suggests that 45% of leukemia, lymphoma and brain tumor survivors (11-18 years old) do not meet national guidelines for exercising one hour or more most days of the week (Demark-Wahnefried et al., 2005). In general, less physical activity was associated with

being female, non-Caucasian, and an older age at diagnosis (Stolley, Restrepo, & Sharp, 2010).

Unhealthy eating may also contribute to elevated BMI in survivors. Research suggests childhood cancer survivors have an increased intake of calories from fat, with older age and lower SES identified as risk factors for unhealthy eating patterns (Stolley et al., 2010). Altered eating patterns may develop in cancer patients over the course of their treatment. For instance, ALL survivors exhibit a consistent increase in BMI during the first two years of treatment, possibly related to increased caloric intake from corticosteroid use (Baillargeon et al., 2007). Survivors and their families may continue a pattern of overfeeding through steroid-induced increases in appetite or family patterns of eating out and overindulging the survivor due to treatment-related alterations to taste (Rose, 2003). However, at the present time, no known research examines possible eating pathology as a cause for increased BMI in pediatric cancer survivors.

The present study seeks to examine whether elevated post-treatment BMI is related to altered energy intake (via possible disordered eating patterns), decreased energy expenditure (via physical inactivity), or cancer and treatment-related factors. This study reports on a sample of adolescent BT and ALL survivors. The aims of this study are to describe the occurrence of overweight and obesity, exercise frequency, and the extent of disordered eating patterns in this sample of survivors, and to examine relationships among BMI, eating patterns, exercise frequency and demographic and disease and treatment-related variables to identify those survivors most at risk for overweight/obesity.

Methods

Participants

Participants were children and parents/guardians attending outpatient clinic visits at a large pediatric oncology hospital in the Midwest. Participants were part of a larger study examining cognitive outcomes (Kahalley et al., 2011) and health behaviors (Kahalley et al., 2011) among adolescent survivors. Eligibility criteria included: (1) diagnosis of brain tumor or ALL, (2) one year since completion of primary treatment with no evidence of active disease, (3) ages 12-17 years (inclusive), (4) English speaking, and (5) accompanied by an English speaking parent or legal guardian. Participants were excluded based on documentation of significantly impaired cognitive functioning (i.e., IQ<70) in the medical record.

The total sample included 50 BT survivors and 50 ALL survivors. In the present study, two participants (both BT survivors) were excluded from analysis due to difficulties understanding and completing questionnaire items. In total, the present study reports on 98 participants (48 BT, 50 ALL). Demographic and clinical characteristics for this sample are reported in Table 1. As reported previously, statistically significant differences have been identified between diagnostic groups in this sample (Kahalley et al., 2012): more BT survivors received CRT, while ALL survivors were younger at diagnosis and all received chemotherapy. No differences between groups were identified based on sex, race, or age at study participation.

Procedure

Survivors were enrolled on the original study at a large pediatric cancer hospital in 2008-2009. Research appointments were scheduled to coordinate with routine clinical follow-up visits. Study refusals were infrequent (12.3%). Participants completed neurocognitive evaluations and health behavior measures during the research appointment. Medical chart abstractions were conducted following participation. Findings from health behavior measures are examined here in this descriptive cross-sectional study.

Measures

Demographic and clinical variables:

Demographic variables included age, gender, and race. Race was categorized as Caucasian and non-Caucasian due to the low frequency of minority groups in this sample. Clinical variables included cancer diagnosis, age at diagnosis, years since treatment, history of CRT and history of chemotherapy treatment. Clinical and treatment variables were obtained through medical record review.

BMI

BMI was calculated based on height and weight from the medical record at time of study enrollment. BMI classifications were made using CDC age and gender growth charts, categorizing underweight (<5th %ile), normal weight (5th-<85th%ile), overweight (85th-<95th%ile), and obese (≥95th%ile) based on the general healthy population (Kuczmarski et al., 2002).

Physical Activity

Physical activity was assessed by adolescent report of the number of days in the past week that he/she had been physically active for more than one hour (cumulative). This question was designed to specifically elicit information for how survivors' physical activity levels compare with CDC national guidelines (≥60 minutes per day of moderate to vigorous physical activity) (Song, Carroll, & Fulton, 2013). The measure was taken directly from the Department of Health and Human Services Youth Risk Behavioral Surveillance System (Brener et al., 2004).

Disordered Eating

The Three Factor Eating Questionnaire-R18 (TFEQ-18) is an 18-item self-report measure designed to assess 3 different aspects of current eating behavior: Cognitive Restraint (conscious restriction of food intake in an effort to control weight), Emotional Eating (eating in response to emotional cues), and Uncontrolled Eating (a tendency to overeat due to a loss of control over dietary intake along with subjective hunger feelings). The four point scale offers choices along a continuum of definitely false, mostly false, mostly true, and definitely true. Raw scores are transformed to a scaled score ranging from 0-100, with higher scores indicating more disordered eating (Karlsson, Persson, Sjostrom, & Sullivan, 2000). The TFEQ-R18 was originally developed with an obese, non-cancer sample; however, it has been successfully used with a French sample of healthy adolescents and young adults (14-27

years old) (de Lauzon et al., 2004), with internal consistency reliability coefficients ranging from 0.78 to 0.87. Reported means (M) and standard errors of the mean (SEM) are: Cognitive Restraint for males (M=18, SEM = 16) and for females (M=34, SEM = 20), Uncontrolled Eating for males (M=39, SEM = 19) and for females (M=35, SEM = 19), and Emotional Eating for males (M=26, SEM = 23) and for females (M=46, SEM = 29) (de Lauzon et al., 2004).

Statistical Analysis

Univariate analyses (χ^2 , t-test, and Pearson correlation) examined demographic and clinical characteristics associated with health behavior variables (i.e., physical activity, disordered eating behaviors) and BMI. Univariate associations between health behavior variables and BMI were also examined. When multiple variables were found to be significantly associated with health behaviors or with BMI ($p<0.05$), a multivariate regression model was created, retaining only those predictors that remained statistically significant ($p<0.05$).

Results

Health Behaviors

Descriptive details of health behaviors by diagnostic group are presented in Table 2. No significant differences between diagnostic groups were identified on physical activity, disordered eating variables, or BMI. As such, BT and ALL survivors were not analyzed separately in the following analyses.

Disordered Eating Behaviors

Only two significant associations were identified between demographic and clinical variables and disordered eating variables (Cognitive Restraint, Uncontrolled Eating, and Emotional Eating). A significant correlation was found between higher Cognitive Restraint scores and longer time off treatment, $r=0.3$, $p<0.01$. Emotional eating was reported more frequently by girls (M = 29.8, SD = 23.7) than boys (M = 18.5, SD = 17.8), $t(96)=2.7$, $p<0.01$. No other significant demographic or clinical associations were found. The Emotional Eating scale was significantly correlated with the Uncontrolled Eating scale, $r = 0.4$, $p<0.001$, while the Cognitive Restraint scale was not significantly correlated with either of the other two scales.

Physical Activity

Only 8.3% of BT survivors and 12.0% of ALL survivors in this sample met the CDC guideline for physical activity (≥ 60 minutes per day) in the past week. Males reported more physical activity in the past week (M = 4.2 days, SD = 2.2) than females (M = 3.1, SD = 2.4) in this sample, $t(96) = 2.2$, $p<.05$. White participants also reported more activity (M = 3.8 days, SD = 2.2) than non-White participants (M = 2.7 days, SD = 2.7), although this difference did not reach statistical significance, $t(96)=1.8$, $p=0.080$. When both gender and race were entered into a multivariate linear regression model, only gender remained significantly associated with physical activity, while race did not reach significance ($p=0.062$). No other significant associations were found between physical activity and other demographic or clinical characteristics listed in Table 1.

BMI

Table 3 reports BMI means and standard deviations for the sample by diagnostic group. Univariate associations between BMI (treated as a continuous variable) and demographic/clinical characteristics, physical activity, and disordered eating scales were examined. Age at study enrollment was positively correlated with BMI in this sample, $r = 0.2$, $p < 0.05$. A significant association was also found between BMI and Cognitive Restraint, $r = 0.2$, $p < 0.05$. BMI and Emotional Eating did not reach statistical significance ($r = 0.2$, $p = 0.061$). Uncontrolled Eating was not associated with BMI nor were any other clinical or demographic variables from Table 1. When age, Cognitive Restraint, and Emotional Eating were combined in a multivariate model, only age remained significantly associated with BMI, $R^2 = 0.1$, $F(2,95) = 4.2$, $p < 0.05$. Emotional Eating became non-significant and was dropped from the model.

The number of survivors falling into BMI classifications (underweight, normal, overweight, obese) is reported in Table 3. No participants in this sample were classified as underweight. Demographic, clinical, and health behavior predictors of overweight/obese categorization (versus normal weight) were examined. Non-white participants were more likely to fall in the overweight/obese category (73.3%) compared to white participants (42.2%), $\chi^2(1, N=98) = 5.0$, $p < 0.05$. Scores on the Cognitive Restraint scale were significantly higher for patients categorized as overweight/obese ($M = 41.1$, $SD = 19.0$) versus patients in the normal BMI category ($M = 30.1$, $SD = 20.3$), $t(96) = 2.7$, $p < 0.01$. Physical activity, Emotional Eating, Uncontrolled Eating, and all other demographic and clinical variables were unrelated to BMI category. In a multivariate logistic regression model, BMI category remained significantly associated with both race ($\beta = 1.5$, $SE = 0.7$, $OR = 4.4$, 95% CI: 1.2-15.8) and Cognitive Restraint ($\beta = 0.03$, $SE = 0.01$, $OR = 1.03$, 95% CI: 1.01-1.06). Figure 1 compares BMI classification frequencies in this sample of BT and ALL survivors to U.S. population rates in 2007-2008 for 12-19 year olds reported by Ogden et al. (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010).

Discussion

Children in the U.S. are currently exposed to an obesogenic environment which leads to increased energy intake, decreased energy output, and decreased sleep (Tam & Ravussin, 2012). Despite the national problems with unhealthy weight, survivors of childhood cancer may be at an even greater risk for obesity. The present study examined health behaviors in survivors of childhood brain tumor and ALL with the goal to identify associations between BMI and eating patterns, physical activity levels, and demographic and clinical characteristics.

Nearly half (46.9%) of the survivors in this sample were overweight or obese, which exceeds the national rate (34.2%) reported for adolescents aged 12-19 years in the U.S. (Ogden et al., 2010). Contrary to other reports examining BMI in brain tumor survivors (Lek et al., 2010) and ALL survivors (Tonorezos et al., 2012), our study did not find that females were at greater risk of overweight/obesity, although they exhibited more frequent emotional eating and engaged in less frequent physical activity than males. Also, none of the participants in the current study were classified as underweight, while certain brain tumor

histologies have been associated with underweight status (Schulte et al., 2010). Non-white participants in this study were more likely to be overweight/obese. This is consistent with prior research that African American and Hispanic children with cancer are more at risk for significant weight gain during treatment than other groups (Withycombe et al., 2009). The finding that age at enrollment was associated with increased BMI is consistent with prior research in large epidemiological studies of children and adolescents demonstrating BMI increases with age in U.S. children (Rosner, Prineas, Loggie, & Daniels, 1998). Additionally, this association may indicate that older adolescence is a particularly vulnerable period for weight gain among survivors.

In examining physical activity in this population, we found that survivors reported an average of just under 4 days/week of physical activity. Only 8.3% of BT survivors and 12% of ALL survivors met CDC guidelines as compared to the national rate of 18.4% among U.S. high school students (Eaton et al., 2010). Our findings that female survivors were less physically active than males, as well as a trend for less activity among non-Caucasian participants supports earlier findings in the literature (Stolley et al., 2010). There are several additional reasons why physical activity in survivors may be low. For instance, ALL survivors are noted to have decreased muscle function development and strength from years of disease, and treatment, related activity limitations (Jarvela et al., 2010). Problems with oxygen consumption (VO_2 max) have also been reported in survivors and could contribute to decreased exercise capacity (De Caro et al., 2006). Finally, recent research has implicated the role of family, and particularly peer social influence on the exercise habits of survivors (Gilliam et al., 2012).

In terms of eating patterns in survivors, we found that BMI was related to cognitive restraint in eating. Scaled scores on the TFEQ-18 in this population of cancer survivors did not vary greatly from those described in the de Lauzon et. al, 2004 study, and the relationship we identified between restrained eating and BMI is consistent with findings in the general population (Stice, Ng, & Shaw, 2010). While various hypotheses have been proffered for this relationship (Tanofsky-Kraff et al., 2006), behavioral research suggests that restrained eating may lead to unrealistic goals and rigid thinking about health behaviors that set children up for failures and subsequent negative cognitions that result in a lack of engagement in continued healthy lifestyle behaviors (Mikhail et al., 2009). It is also possible that these survivors rely more on cognitive and less on physiological cues to regulate their eating. This is particularly notable since higher Cognitive Restraint scores were associated with longer time off treatment. Receiving repeated messages from the medical team about the importance of weight control could result in an awareness of the need to modify their eating behavior, but survivors may lack successful strategies to achieve weight loss. Of course, survivors who are already overweight or obese may also report greater cognitive restraint in an effort to portray themselves in a more positive light, knowing it is important for them to attempt some strategies for weight loss. For instance research suggests that childhood cancer survivors may respond to questionnaires on body image in a more positive manner than in a semi-structured interview where specific answer choices are not available (Puukko et al., 1997).

While there are disease, treatment, and likely genetic explanations (Chung, 2012) for variation in adiposity, health behaviors and eating patterns in survivors are clearly contributing factors. This is encouraging because these are the factors most amenable to potential change, and interventions show some early evidence of effectiveness. A majority of survivors have expressed interest in interventions aimed at healthy eating and getting into shape (Demark-Wahnefried et al., 2005). However, as in the general population of adolescents, many lack appropriate diet strategies (Rosen, 2010).

The majority of interventions to improve diet and exercise in childhood cancer survivors have been conducted with adults as participants (Stolley et al., 2010). Future interventions should recruit adolescents. A recent study of a home-based exercise intervention for ALL adolescent and young adult survivors demonstrated effects that included decreased insulin resistance, waist circumference, and percentage of fat (Jarvela et al., 2012). Interventions should also attempt to address possible barriers to healthy diets and participation in exercise. Specifically, research suggests that self-reported fatigue was the largest barrier to exercise while lack of knowledge about healthier food choices was also a significant barrier (Arroyave et al., 2008). Notably, activity enhancement is an important intervention to target fatigue (Berger et al., 2010).

Dietary interventions for survivors may borrow from techniques used in the general population of obese adolescents. Some of these include a focus on bodily awareness and recognizing differences between hunger which is more biological and appetite which is more subjective to external cues. They can also engage in activities such as self-monitoring with record keeping, goal setting, stimulus control, increasing self-esteem/self-efficacy, and assertiveness training to say “no” to people offering unhealthy food (Mikhail et al., 2009). Since children treated for ALL tend to gain weight during therapy which persists after treatment completion, it has been suggested that interventions targeted at healthy eating and exercise should be started in maintenance therapy where possible (Love et al., 2011) rather than waiting until treatment completion.

The present findings need to be considered in light of certain limitations. Health behaviors were self-reported and not assessed through more objective means (e.g., actigraphy) or through multiple reporters. Our single self-reported physical activity item does not distinguish between moderate and vigorous activity. The small and ethnically homogenous sample may have limited our ability to detect certain relationships among variables. Weight-related data on family members were not available in this study so we were unable to explore familial and genetic contributions to survivor BMI and health behavior. Additionally, research is moving away from using BMI as a measure of overweight/obesity in favor of using body fat measurement from dual energy X-ray absorptiometry (DEXA) (Aldhafiri et al., 2012; Patterson, Wasilewski-Masker, Ryerson, Mertens, & Meacham, 2012; Warner, 2008). Due to the small sample size, it is unclear whether racial/ethnic diversity or cultural factors may play a role in eating behavior (George & Franko, 2010), although it is interesting to note that unhealthy body composition is also present among ALL survivors from non-Western countries treated with modern protocols (Aldhafiri et al., 2012). Survivors followed at long-term follow-up oncology clinics on average tend to experience more significant health problems than other survivors (Ness et al., 2009). Therefore, this

study may represent survivors with more significant health problems than those in the community. Finally, this study was cross-sectional in nature, and longitudinal research is necessary to determine the direction of relationships and to track the development of health behaviors over time.

Implications for Nursing

This preliminary study highlights the presence of elevated BMI and health behavior concerns in survivors of pediatric BT and ALL in one pediatric cancer center. Nurses should include brief assessments of children's physical activity and nutrition, not only during long-term follow-up evaluations (as recommended by COG (Landier et al., 2004)), but also during active treatment clinic visits. Some children's hospitals have begun to operate cancer patient/survivor, specific physical activity training clinics (e.g., Play Strong at Nationwide Children's Hospital and Survivor Challenge at Dell Children's Hospital) that welcome referrals from patients in active treatment.

This study is the first, to our knowledge, to examine self-reported disordered eating patterns among childhood cancer survivors. While specific nutrition guidelines for pediatric cancer patients are still in development (Ladas et al., 2012), providers may wish to also assess for disordered eating as another possible target for intervention. Informal screening questions such as inquiring about frequency of family meals and weight concerns of caregivers may be a good starting point in clinic to see if further evaluation is warranted (Hanlan, Griffith, Patel, & Jaser, 2013). While evidence-based intervention for healthy weight and activity is still in its infancy, there is growing research about the importance of preventing and managing obesity in pediatric cancer patients and survivors (Co-Reyes, Li, Huh, & Chandra, 2012). One such study examined a multidisciplinary care clinic for brain tumor patients and survivors at risk of hypothalamic obesity with findings of lower weight gain and improved health-related quality of life (Rakhshani et al., 2010). This study represents an important first step towards addressing modifiable health behaviors to decrease morbidity and improve quality of life.

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Figure 1.
Percentage of Survivors Classified as Underweight/Normal, Overweight, and Obese versus Rates from a Published National Sample of Adolescents (Ogden et al., 2010).

Table 1

Sample Characteristics by Diagnostic Group (n = 98)

Characteristic	ALL Survivors		BT Survivors	
	<i>n</i>	%	<i>n</i>	%
Total	50	100.0	48	100.0
Gender				
Male	25	50.0	23	47.9
Female	25	50.0	25	52.1
Race				
White	43	86.0	40	83.3
Non-White	7	14.0	8	16.7
Cranial radiation therapy				
Yes	7	14.0	38	79.2
No	43	86.0	10	20.8
Chemotherapy				
Yes	50	100.0	25	52.1
No	0	0.0	23	47.9

	M (SD)	Range	M (SD)	Range
Age at study enrollment	14.9 (2.0)	12.2-17.9	15.1 (1.8)	12.1-17.9
Age at diagnosis	5.0 (3.1)	0.7-13.0	8.3 (3.7)	2.0-15.2
Years since treatment	7.1 (3.3)	1.5-15.5	5.6 (3.7)	1.1-16.0

Note. Some survivors are represented in more than one treatment category.

Table 2

Health Behaviors by Diagnostic Group (n = 98)

Health Behaviors	ALL (n=50)		BT (n=48)	
	M	SD	M	SD
Disordered Eating Behavior ^a				
Cognitive Restraint	35.0	17.5	35.5	23.1
Uncontrolled Eating	35.5	16.9	38.2	21.8
Emotional Eating	26.4	20.8	22.0	22.5
Physical activity in the past week (in days)	3.7	2.4	3.5	2.3
	<i>N</i>	%	<i>n</i>	%
Met CDC physical activity guidelines ^b	6	12.0	4	8.3

Note.

^a Disordered eating behavior is represented by the three scales (Cognitive Restraint, Uncontrolled Eating, and Emotional Eating) of the TFEQ-18. Scores range from 0 to 100.

^b CDC physical activity guidelines are met when children reported engaging in ≥ 60 minutes of physical activity each day.

Table 3

BMI and BMI Categories by Diagnostic Group (n=98)

BMI Variable	ALL (n=50)		BT (n=48)	
	M	SD	M	SD
BMI ^a	25.5	5.7	24.5	7.2
	<i>N</i>	%	<i>n</i>	%
BMI Categories ^b				
Underweight	0	0.0	0	0.0
Normal	24	48.0	28	58.3
Overweight	6	12.0	6	12.5
Obese	20	40.0	14	29.2

Note.

^aBMI=weight (kg)/[height (m)]².^bBMI categories were determined by CDC BMI-for-age growth charts for boys and girls.