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Factors associated with non-compliance with long-term follow-up care among pediatric cancer survivors

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Abstract

Most childhood cancer survivors do not receive risk-based care through a survivorship program, but factors associated with dropping out of care are unclear. This study aimed to identify characteristics of pediatric cancer survivors who do not return to a cancer center survivorship program for recommended care after at least one visit compared with those who continue to attend. Patient characteristics (demographics, school functioning, psychiatric history) and treatment characteristics (diagnosis, treatment) were abstracted from medical records for all eligible patients. Unadjusted and multivariable logistic regression analyses examined the associations among patient and treatment characteristics and non-attendance. The charts of 400 eligible patients (children < 18, $n = 123$, adults, $n = 277$) were reviewed. Of these, 60.3% of patients had not been seen in clinic within one year of their last recommended follow-up appointment. Adult-aged survivors were less likely to return to clinic than child-aged survivors ($p < 0.001$). For child survivors, longer time off treatment was associated with non-compliance with follow-up. For adult survivors, current age, non-white race, and longer time off treatment were associated with non-compliance. Additional methods to identify survivors at risk for non-compliance with follow-up and interventions for at-risk survivors are needed to improve survivorship care.

Keywords

follow-up care; survivorship; clinic attendance

Introduction

Advancements in contemporary therapy have increased 5-year survival rates for children diagnosed with cancer, with approximately 80% of children surviving at least five years post-diagnosis. [1–3] This is a growing population within the health care system, with

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Conflict of Interest statement

The authors have no conflicts of interest to declare.

estimates of over 379,000 childhood cancer survivors currently alive in the US. [4] Despite this dramatic improvement in cancer mortality rates, childhood cancer survivors remain at risk for experiencing negative late health effects from treatment including premature or atypical presentations of common medical conditions, poor response to standard therapies, [5] as well as increased risk for development of secondary malignancies, cardiomyopathy, endocrine or metabolic dysfunction, and psychological and cognitive problems. [3, 6–11] Adverse health outcomes are prevalent based on self-report [7] and medical assessments. [6, 8] Most recent estimates based on clinical evaluations suggest that by age 45, the cumulative prevalence of any chronic health condition for adult survivors of childhood cancer is 95%, and the cumulative prevalence of a disabling or life-threatening condition is 80.5%. [8]

The Children's Oncology Group has developed evidence-based long-term follow-up guidelines for childhood cancer survivors. [12] These guidelines recommend that survivors be seen on a regular basis for individualized risk-based care tailored to specifically address a given patient's cancer and treatment history. Although this care could be done by primary care providers (PCP), most PCPs do not feel comfortable providing survivorship care without the collaboration of an oncologist or do not have adequate training or experience to do so. [13] Specialized survivor clinics have been endorsed by care providers as well as national organizations including the American Cancer Society and the International Society of Pediatric Oncology. [14–16] Risk-based care is critical, as a recent study showed that specialized cancer survivor clinics could identify previously undetected treatment-related health complications among survivors who already receive regular general medical care. [17] Although risk-based care is more likely to be received at a cancer center, [18, 19] only a minority of adult survivors of childhood cancer visit a cancer center where follow up childhood cancer care is provided. [20] Thus, it is important to determine what factors predict patients' attendance at appropriate risk-based follow-up care clinics.

Research has found some demographic and treatment-related factors to be associated with pursuing follow-up care by childhood cancer survivors. For example, adult survivors of childhood cancer in the Childhood Cancer Survivor Study (CCSS) who were male, uninsured, older, Black, and report no concerns about future health were less likely to obtain medical care in general, [20] and those who were uninsured, Black, or older were less likely to receive risk-based survivorship care. [18] Among child and young adult cancer survivors treated at a large children's hospital, those who had a brain tumor, were off therapy longer, or who lived at a greater distance from the hospital were less likely to complete a survivorship visit within the first five years post-diagnosis. [21] Another large children's hospital that provided free transportation and medical care for survivorship clinic found older age, lower SES, non-white race, lack of insurance, traveling by car vs. plane or bus, and shorter distance to the clinic were associated with non-attendance among pediatric and adolescent survivors. [22]

Inconsistencies in the literature may be due to different methodologies used (self-report vs. medical chart review), different age ranges of study samples, and the use of an attendance outcome capturing both initial transition into survivorship clinic and ongoing engagement. A gap in the literature is the lack of understanding of demographic, psychosocial, and treatment-related factors that might predict ongoing engagement in long-term follow-up care

for both adult and child survivors of pediatric cancers who have already transitioned into a survivorship clinic program. One important question that remains is whether data available in the medical record at the time of the last visit can predict whether or not a survivor will return for recommended survivorship care. Medical record data have been used to identify characteristics of patients who are compliant with other guidelines and treatment release protocols, [23] and may serve as a simple screening tool to identify those most at risk for not returning for survivorship care, thus informing future interventions to improve patient compliance. Therefore, this study aimed to use medical records to identify demographic, psychosocial, and treatment-related characteristics of survivors of childhood cancer who fail to return to a specialty pediatric cancer survivorship clinic after completing a visit compared with those who return to the clinic.

Methods

Medical charts of patients in the Pediatric Long-Term Survivors Clinic at a regional cancer center were reviewed. Patients are usually transferred to this clinic once they are disease-free and off-therapy for at least two to five years depending on their disease and treatment. They are typically seen annually for the first ten years off treatment. The time can be extended, and patients at this site can be followed into adulthood, as there is no upper age limit for long-term follow up. Inclusion criteria for this study were: (1) diagnosis of any cancer prior to age 21; (2) off-treatment between January 1, 1990 and November 30, 2008; and (3) attendance of at least one long-term survivorship appointment. Only those who completed at least one long-term visit were included to rule out patients who were lost in the transition from acute care to long-term follow-up care. Data from clinic visits through November 30, 2010 were examined. The following information was abstracted from each chart: date of birth (month/year); gender; race; type of insurance (i.e., private, public, or none); zip code to determine distance from clinic; history of academic problems (i.e., diagnosis of a learning disorder, failed classes, repeated grades, or individualize education plan [IEP] per physician or educational liaison notes); primary cancer diagnosis; age at diagnosis; treatment received (type [surgery, chemotherapy, radiation, stem cell transplant, corticosteroids], cumulative dose(s) of radiation, anthracyclines, and cyclophosphamide, date of completion of treatment [month/year]); history of relapse; secondary medical and psychiatric diagnoses; known late effects documented as such in the chart; patient weight, height, and blood pressure at last visit; and dates of up to three most recent completed follow-up visits.

Statistical Analysis

Descriptive analyses were conducted to characterize patients who failed to attend a follow-up appointment within one year of their last recommended follow-up visit. One year past due was chosen as a generous time frame within which to make an appointment and, because most survivors are recommended to have a yearly appointment, corresponds with other studies (such as the CCSS) that have examined receipt of survivorship care within the past two years. Unadjusted logistic regression analyses were conducted to determine the strength of association between demographic and cancer-related factors and non-compliance with recommended follow-up clinic appointments. Odds ratios with 95% confidence intervals were estimated for each variable. Multivariable logistic regression models were

then run using only the variables that were associated with non-compliance in the unadjusted models at $p < .10$ to allow for some flexibility in identifying potentially relevant variables for inclusion in the model. Analyses were run for the entire sample and separately for patients who were less than 18 years of age at the time of the study and those who were 18 years and older. Statistical significance was considered as $p < .05$.

Race was analyzed as a bivariate variable (i.e., White vs. Non-White) due to the distribution of the sample. Distance from clinic was calculated based on driving distance between the patient's home zip code and the zip code of the clinic and characterized as high (i.e., greater than the median) or low (i.e., below the median). Body Mass Index (BMI) was calculated using the CDC BMI percentile calculator for children and teens under 20 years old and the BMI adult calculator for adults 20 years of age and older. BMI was categorized as underweight (<5th percentile for children, <18.5 for adults), normal weight (5th to 85th percentile for children, 18.5 to 24.9 for adults), and overweight/obese (95th percentile for children; 25 for adults). Diagnosis was categorized as acute lymphoblastic leukemia (ALL), central nervous system tumor (CNS) or all others. Presence of late effects (yes/no) was treated as a dichotomous variable, with known late effects abstracted from the provider note from survivorship clinic or subspecialist consult. Risk of late effects was determined using COG LTFU guidelines. [24] Briefly, risk of cardiomyopathy was determined based on a history of anthracycline treatment (i.e., any anthracycline exposure was categorized as at-risk because the guidelines recommend screening for anyone exposed but at different frequencies depending on age at treatment, cumulative dose, and radiation exposure); risk of breast cancer was based on a history of chest radiation for females; risk of endocrine disorders was based on a history of cranial radiation; risk of orthopedic conditions was based on a history of a bone tumor in an extremity or corticosteroid treatment; and risk of fertility problems was based on a history of total body irradiation or radiation to the pelvis or cyclophosphamide treatment with a cumulative dose greater than 7.5 g/m². Inadequate school performance (e.g., a history of problems or documented IEP) was based on social history and/or notes from the educational liaison for the pediatric oncology service. Psychiatric diagnosis was defined as a diagnosis of a mental health condition in the medical record or provider-reported social history from the survivorship visit indicating that the patient sees a psychologist/psychiatrist for mental health issues. Seeing a specialist (yes/no) was treated as a dichotomous variable based on record of a visit or consult with a specialist for cancer-related late effects treatment, such as a cardiologist or endocrinologist.

Results

Of the 655 medical charts of potentially eligible patients in the clinic roster, 228 (34.8%) were excluded because the patient was off treatment before 1990; 15 (2.3%) did not have a cancer diagnosis; 8 (1.2%) were deceased; 7 (1.1%) had transferred their care according to chart documents; and 1 (0.1%) was actively being treated for a secondary malignancy. The final sample for analysis was 400.

Table 1 shows demographic and treatment characteristics. The sample was predominantly White (86.8%), and just over half of the sample was male (53.2%). About 31% of the sample was under the age of 18, 42% was between the ages of 18 and 25, and 26.5% was

age 26 or above. Similar to national prevalence rates, the predominant diagnosis was Acute Lymphoblastic Leukemia (ALL; 35.0%), which was similar for both the adult and child subsamples. There was a lower than expected number of CNS cancer patients (7.8%) as compared to national averages. [1,2] Nearly all patients (94.5%) had undergone chemotherapy, and over half (54.8%) had received radiation. Twenty-three patients (5.8%) had a stem cell transplant and thirty-four (8.5%) had a history of relapse.

About 90% of the sample was at risk for one or more late effects from their treatment, including cardiomyopathy (77.3%), orthopedic conditions (52.0%), endocrine disorders (35.0%), fertility problems (16.3%), and breast cancer (6.8%). The percentage of the sample at risk for these late effects was similar among our adult and child subsamples, except that adults had a higher risk of endocrine disorders ($p=0.04$).

Of the total sample, 60.3% had been not seen for follow-up care within one year of their last recommended follow-up. When analyzed separately by age group, only 39.0% of patients under the age of 18 had not been seen for follow-up as compared to 69.7% of adults ($p < 0.001$).

Unadjusted univariate analyses of the entire sample showed that age was a significant predictor of non-compliance, as adults were 3.59 times more likely to be non-compliant with follow-up care compared to their younger counterparts (see Table 2). Older age at diagnosis and a greater number of years off treatment were associated with increased likelihood of non-compliance. Additionally, BMI was a significant predictor of non-compliance ($p < .05$), with those who were underweight being about two and a half times more likely to be non-compliant compared to those of normal weight. Individuals who were overweight/obese were slightly more likely to be non-compliant compared to those of normal weight, but this was not statistically significant. Survivors who had a history of psychiatric illness (e.g., depression, anxiety) were more likely to be non-compliant. In contrast, those who had seen a specialist were less likely to be non-compliant. In the multivariable model, age at diagnosis ($p = 0.01$), years off treatment ($p < 0.001$), and having seen a specialist ($p = 0.04$) remained significant.

When analyzed separately by age, different predictors were significant for the child and adult survivor samples. For children, older current age and a greater number of years off treatment were significant predictors of non-compliance (see Table 3). In the multivariable model, only years off treatment remained significant ($p = 0.02$). For adults, older current age, non-white race, underweight BMI, greater distance from clinic, a greater number of years off treatment, and being at risk for endocrine disorders were associated with an increased likelihood of non-compliance, while seeing a specialist was associated with a reduced likelihood of non-compliance with follow-up care (see Table 4). In the multivariable model, current age, non-white race, and years off treatment remained significant ($p < .05$, see Table 4).

Discussion

Risk-based long-term follow up is extremely important for childhood cancer survivors. However, low rates of attendance are common. [12, 17, 18] Within this cohort, 60.3% of patients who completed treatment were not seen for a survivorship visit within one year of the recommended time for a visit. The overall rate of attendance at our regional clinic was higher than reports from the national CCSS [18] but lower than two studies from large regional childhood cancer centers that examined follow-up within a five-year period from diagnosis [21] and among survivors with a scheduled appointment for free survivorship care. [22] These results may differ from previous studies because patients in our sample had to have completed at least one survivorship clinic visit to be eligible and be within 20 years of completion of treatment, giving us a broader age range and reflecting engagement in survivorship care for those who had already transferred to the survivorship clinic. Rates of attendance in our child and adult subsamples are more similar to the rates in previous literature approximating those age ranges.[18, 21–22, 24] Additionally, referral patterns for our cancer center reflect patients who tend to live locally, which may lead to higher return rates than seen in a national sample.

Our data are unique in that we examined a mixed group of adult and child survivors of childhood cancers. Consistent with previous studies, [7, 18] age was a significant factor in clinic attendance, with about 39% of child-aged survivors showing non-compliance but almost 70% of adult survivors showing non-compliance. Interestingly, among the variables we investigated, the only statistically significant predictor of non-compliance for child-aged survivors was years off therapy. The further from therapy, the less likely they were to return to clinic. On the other hand, there were several predictors of adult non-compliance with clinic, including current age, non-white race, underweight BMI, and longer time off therapy. Consistent with other studies, [18, 20] longer time since treatment completion was associated with non-compliance with survivorship care. Prior studies also suggest that high-risk treatments or greater medical concerns are associated with obtaining survivorship care; [16,18, 20] our results partially support this hypothesis, as univariate analyses suggested that survivors who saw specialists (such as cardiologists or endocrinologists) were less likely to be non-compliant, but these findings were not significant in multivariable models. Unlike other studies, we did not replicate gender effects; however, among adults, we did replicate race as a predictor of survivorship clinic non-attendance. [18, 20, 21, 25] Race in the medical chart is often reported by a physician, who may make the decision based on appearance of the patient rather than ask the patient to self-report.[18] Based on the relative lack of diversity in our sample, we suspect that there may have been an over-reporting of “white” race in the medical records, which could have reduced power to detect any effects of race in our pediatric sample.

The lack of significant predictors of child survivors non-compliance is not entirely surprising given that parents are responsible for their child’s health care and medical record data speak little to factors that influence parents’ access to care for their child. High rates of attendance regardless of socio-demographic or treatment factors may also suggest that parents recognize the importance of survivorship care and surveillance. Additionally, children have nearly universal access to medical care and insurance, as evidenced by the

virtually negligible number of uninsured patients in our sample. Since attendance rates decline dramatically in adulthood, recent research has focused on the critical time period of transition for adolescent and young adult survivors as they begin to take on greater responsibility for their health care. [26] Our data also support this movement to educate and empower survivors to obtain appropriate risk-based care. Many adult survivors of childhood cancer lack detailed knowledge of their treatment history and risk for late effects. [16, 17] Survivorship clinics can improve this knowledge; [27] therefore, identifying those at risk for poor engagement and intervening to increase their engagement in care is critical. Many hospitals are working on survivorship care plan interventions [28] to improve survivor knowledge and survivorship care coordination.

Although we were able to identify several demographic, medical, and psychosocial predictors of compliance with follow-up care, medical records do not capture all of the factors associated with compliance with care. For example, it is reasonable to assume that logistic or attitudinal barriers exist but these are typically hard to glean from a medical chart and would more likely to be identified by a healthcare provider who has the opportunity to talk with a patient and/or parent about their beliefs about and barriers to survivorship care. Further investigations need to be done to explore if there are other simple methods of prediction, including healthcare provider prediction or the use of a brief screening tool that can be distributed to patients at each visit.

As a retrospective chart review, this study was limited to the data available in medical records. Thus, there tended to be significant missing data for psychosocial risk factors such as psychiatric history and school performance, since these were not required elements of the medical record. Further, data gathered from the social history of the physician report is influenced by patient recall and provider assessment of psychosocial functioning. Additionally, we had no way to contact patients to verify current medical care outside of our institution or affiliated network. It is possible that patients who did not return to survivorship clinic were receiving risk-based survivorship care elsewhere, in which case we would be underestimating true rates of survivorship care. However, given that national rates of receiving risk-based survivorship care are low (i.e., 13.7% report general survivor-focused care and 17.8% report risk-based survivor-focused care), [18] we do not believe that a large percentage of patients were receiving risk-based care elsewhere. Although our sample was largely representative of childhood cancer survivors, we had fewer brain tumor survivors than expected, and this group may be at greater risk for late effects requiring close follow-up care. We also were not able to gather reasons for non-compliance, which could give insight into barriers to target in future interventions.

In summary, over half of pediatric cancer survivors were not seen for a survivorship clinic visit within a year of recommended care, with adult survivors being less likely to return to clinic than child-aged survivors. Only time off therapy significantly predicted non-compliance for child survivors, but adults who were older, of non-white race, and were off therapy longer were less likely to return to clinic. It is of particular concern that, despite being at risk for significant late effects or having a history of a relapse or stem cell transplant, many adult and child patients do not return for survivorship care. Future prospective studies are necessary to identify relevant patient characteristics, beliefs, and

motivations that could be used to more accurately predict who will or will not return for risk-based survivorship care to inform interventions for the most high-risk patients.

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Abbreviations

LTFU	Long term follow-up
PCP	Primary care provider
CCSS	Childhood Cancer Survivor Study
BMI	Body Mass Index
ALL	Acute Lymphoblastic Leukemia
CNS	Central Nervous System
COG	Children's Oncology Group
IEP	Individualized Education Plan

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TABLE 1

Demographics

Variable	Total Sample (N = 400) n (%)	Children (n = 123) n (%)	Adults (n = 277) n (%)
Current Age in Years $M(SD)$	21.78 (6.82)	13.68 (2.93)	25.40 (4.60)
Gender			
Male	213 (53.2)	68 (55.3)	145 (52.3)
Female	187 (46.8)	55 (44.7)	132 (47.7)
Race/Ethnicity			
White	347 (86.8)	97 (78.9)	250 (90.3)
African American	28 (7.0)	13 (10.6)	15 (5.4)
Hispanic	10 (2.5)	6 (4.9)	4 (1.4)
Asian	4 (1.0)	1 (0.8)	3 (1.1)
Other	4 (1.0)	2 (1.6)	2 (0.7)
Insurance			
Private	313 (78.3)	95 (77.2)	218 (78.8)
Public	57 (14.3)	19 (15.4)	39 (14.0)
None/Self-Pay	17 (4.3)	7 (5.7)	10 (3.6)
BMI Category ^a			
Underweight	44 (11.0)	5 (4.1)	39 (14.1)
Normal	193 (48.4)	62 (50.4)	131 (47.3)
Overweight/ Obese	151 (37.7)	55 (44.7)	96 (34.7)
Diagnosis			
ALL	140 (35.0)	47 (38.2)	93 (33.6)
Wilms'	35 (8.8)	16 (13.0)	19 (6.9)
Hodgkin Lymphoma	24 (6.0)	0 (0.0)	24 (8.7)
Non-Hodgkin Lymphoma	39 (9.8)	10 (8.1)	29 (10.5)
Neuroblastoma	31 (7.8)	18 (14.6)	13 (4.7)
AML	19 (4.8)	5 (4.1)	14 (5.1)
CNS Tumor	32 (8.0)	4 (3.3)	28 (10.1)
Ewing's sarcoma	14 (3.5)	1 (0.8)	13 (4.7)
Osteosarcoma	10 (2.5)	0 (0.0)	10 (3.6)
Rhabdomyosarcoma	19 (4.8)	8 (6.5)	11 (4.0)
Germ cell tumor	8 (2.0)	1 (0.8)	7 (2.5)
Other	29 (7.3)	13 (11.3)	16 (5.8)
Age at Diagnosis $M(SD)$	7.22 (5.74)	3.05 (2.22)	9.07 (5.85)
Years Off Treatment $M(SD)$	13.24 (4.78)	9.3 (3.1)	14.9 (4.3)
Stem cell transplant	23 (5.8)	7 (5.7)	16 (5.8)
History of relapse	34 (8.5)	12 (9.8)	22 (7.9)
Distance from clinic in miles (median, range)	15.58 (0.00, 368.65)	17.6 (2.56, 690.37)	15.58 (0.00, 368.65)

Note.

^aBMI category was determined based on CDC guidelines for children <20 and adults ≥ 20 years: underweight = <5th percentile for children, <18.5 for adults, normal weight = 5th to 85th percentile for children, 18.5 to 24.9 for adults, and overweight/obese = ≥ 85th percentile for children; ≥ 25 for adults.

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Unadjusted and multivariable logistic regression models predicting clinic non-attendance among the total sample of childhood cancer survivors

TABLE 2

Variable	Unadjusted			Multivariable Adjusted		
	OR	95% CI	P	OR	95% CI	P
Age (adult vs. child)	3.59	(2.30, 5.60)	<0.001	0.60	(0.25, 1.41)	.24
Non-White Race	1.25	(0.66, 2.38)	0.49	---	---	---
Male Gender	1.12	(0.75, 1.67)	0.58	---	---	---
BMI (ref=Healthy Wt)			0.05			0.28
Underweight	2.57	(1.20, 5.49)	0.02	2.03	(0.85, 4.83)	0.11
Overweight/Obese	1.05	(0.68, 1.62)	0.81	1.09	(0.65, 1.83)	0.73
Insurance (ref=private)			0.21	---	---	---
Public	1.37	(0.76, 2.46)	0.30			
Self Pay	2.40	(0.77, 7.53)	0.13			
IEP/Inadequate School Performance	1.14	(0.72, 1.80)	0.57	---	---	---
Clinic distance median	1.23	(0.82, 1.84)	0.32	---	---	---
Diagnosis			0.85	---	---	---
ALL vs. Other	1.06	(0.69, 1.62)	0.80			
CNS vs. Other	1.24	(0.57, 2.72)	0.58			
Age at Dx	1.03	(1.00, 1.07)	0.09	1.09	(1.02, 1.16)	0.01
Years Off Treatment	1.22	(1.16, 1.28)	<0.001	1.26	(1.17, 1.37)	<0.001
Stem Cell Transplant	1.02	(0.43, 2.41)	0.97	---	---	---
Relapse	0.92	(0.45, 1.88)	0.82	---	---	---
Cardiomyopathy Risk	1.11	(0.69, 1.79)	0.66	---	---	---
Endocrine Risk	1.50	(0.98, 2.30)	0.06	1.30	(0.78, 2.16)	0.31
Breast Cancer Risk ^a	0.66	(0.29, 1.51)	0.33	---	---	---
Orthopedic Risk	0.91	(0.61, 1.36)	0.64	---	---	---
Fertility Risk	0.87	(0.51, 1.49)	0.61	---	---	---
Psychiatric Diagnosis	1.98	(1.05, 3.73)	0.03	1.69	(0.83, 3.46)	0.15
Late Effects	0.79	(0.53, 1.19)	0.27	---	---	---
Seen Specialist	0.70	(0.47, 1.06)	0.09	0.59	(0.36, 0.97)	0.04

Note. Sample size was 389 to 400 for all unadjusted models except school performance (n = 352) and psychiatric diagnosis (n = 370) due to missing data.

The analyses for breast cancer risk were limited to women only ($n = 187$). The sample size for the multivariable model was 352.

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TABLE 3
Unadjusted and multivariable models predicting clinic non-attendance among child-aged survivors

Variable	Unadjusted Model			Adjusted Model		
	OR	95% CI	p	OR	95% CI	p
Current Age (in years)	1.24	(1.08, 1.43)	0.003	1.09	(0.92, 1.31)	0.32
Non-White Race	0.89	(0.34, 2.32)	0.81	---	---	---
Male Gender	1.23	(0.59, 2.55)	0.59	---	---	---
BMI (ref=Healthy Wt)			0.65	---	---	---
Underweight	0.40	(0.04, 3.76)	0.42			
Overweight/Obese	1.14	(0.54, 2.39)	0.73			
Insurance (ref=private)			0.55	---	---	---
Public	1.25	(0.46, 3.39)	0.67			
Self Pay	2.29	(0.48, 10.81)	0.30			
IEP/ Inadequate School Performance	1.50	(0.69, 3.24)	0.30	---	---	---
Clinic Distance > median	0.95	(0.46, 1.97)	0.89	---	---	---
Diagnosis (ref=other)			0.82	---	---	---
ALL vs. Other	0.84	(0.39, 1.79)	0.65			
CNS vs. Other	1.48	(0.20, 11.13)	0.70			
Age at Dx	0.95	(0.81, 1.13)	0.58	---	---	---
Years Off Treatment	1.29	(1.12, 1.48)	<0.001	1.22	(1.03, 1.45)	0.02
Stem Cell Transplant	0.60	(0.11, 3.22)	0.55	---	---	---
Relapse	1.60	(0.48, 5.27)	0.44	---	---	---
Cardiomyopathy Risk	0.59	(0.26, 1.31)	0.19	---	---	---
Endocrine Risk	0.96	(0.42, 2.15)	0.91	---	---	---
Breast Cancer Risk ^a	---	---	0.99	---	---	---
Orthopedic Risk	0.78	(0.38, 1.61)	0.50	---	---	---
Fertility Risk	0.42	(0.11, 1.58)	0.20	---	---	---
Psychiatric diagnosis	1.61	(0.49, 5.33)	0.44	---	---	---
Late Effects	0.72	(0.35, 1.50)	0.38	---	---	---
Seen Specialist	0.61	(0.28, 1.31)	0.21	---	---	---

Note. Sample size was 118 to 123 for all analyses except school performance (n = 112) due to missing data.

The OR for risk of breast cancer could not be estimated due to too small of a sample at risk ($n = 2$). The sample size for the multivariable model was 118.

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Unadjusted and multivariable models predicting clinic non-attendance among adult survivors of childhood cancer

TABLE 4

Variable	Unadjusted Model			Adjusted Model		
	OR	95% CI	p	OR	95% CI	p
Current Age (in years)	1.09	(1.03, 1.16)	0.004	1.09	(1.02, 1.17)	0.02
Non-White Race	5.18	(1.19, 22.55)	0.03	6.33	(1.31, 30.71)	0.02
Male Gender	1.14	(0.69, 1.91)	0.61	---	---	---
BMI (ref=Healthy Wt)			0.09			0.09
Underweight	2.89	(1.12, 7.38)	0.03	3.06	(1.11, 8.41)	0.03
Overweight/Obese	1.10	(0.63, 1.92)	0.75	1.07	(0.57, 2.02)	0.83
Insurance (ref=private)			0.19	---	---	---
Public	1.62	(0.73, 3.61)	0.24			
Self Pay	4.53	(0.56, 36.45)	0.16			
IEP/ Inadequate School Performance	1.49	(0.78, 2.84)	0.23	---	---	---
Distance (median)	1.63	(0.97, 2.75)	0.07	1.72	(0.95, 3.10)	0.07
Diagnosis (ref=other)			0.67	---	---	---
ALL vs. Other	1.27	(0.72, 2.24)	0.41			
CNS vs. Other	0.93	(0.39, 2.23)	0.88			
Age at Dx	0.97	(0.93, 1.02)	0.21	---	---	---
Years off Treatment	1.17	(1.10, 1.25)	<0.001	1.16	(1.08, 1.25)	<0.001
Stem Cell Transplant	1.32	(0.41, 4.21)	0.64	---	---	---
Relapse	0.74	(0.30, 1.83)	0.51	---	---	---
Cardiomyopathy Risk	1.41	(0.76, 2.59)	0.27	---	---	---
Endocrine Risk	1.58	(0.92, 2.72)	0.10	1.65	(0.89, 3.08)	0.11
Breast Cancer Risk ^a	0.48	(0.19, 1.18)	0.11	---	---	---
Orthopedic Risk	0.91	(0.54, 1.52)	0.71	---	---	---
Fertility Risk	0.85	(0.44, 1.62)	0.61	---	---	---
Psychiatric Dx	1.82	(0.83, 4.01)	0.14	---	---	---
Late Effects	0.69	(0.40, 1.18)	0.18	---	---	---
Seen Specialist	0.65	(0.39, 1.08)	0.10	0.74	(0.41, 1.35)	0.32

Note. Sample size was 267 for all analyses except school performance (n = 240) and psychiatric illness (n = 251) due to missing data.

The analyses for breast cancer risk were limited to women only ($n = 132$). The sample size for the multivariable model was 262.

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