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Neurocognitive and Behavioral Outcomes in Latino Childhood Cancer Survivors

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Abstract

Background—Children with brain tumors and leukemia are at risk for neurocognitive and behavioral late effects due to central nervous system-directed therapies. Few studies have examined these outcomes in ethnic minority samples, despite speculation that socio-demographic factors may increase vulnerability for adverse neurobehavioral outcomes. We evaluated the neurocognitive and behavioral outcomes and their impact on the health-related quality of life in survivors of childhood cancer drawn from Latino families in the Los Angeles region.

Procedure—Using culturally-relevant recruitment strategies, 73 predominantly Spanish-speaking parents of pediatric brain tumor or leukemia survivors completed standardized questionnaires, including the Conners Parent-Report and the Bidimensional Acculturation Scales. Clinical and socio-demographic factors influencing the development of neurocognitive and behavioral dysfunction were examined.

Results—Approximately 50% of the children placed at or above the “elevated” level for difficulties with attention, school-based learning, and peer relations. Younger age at diagnosis significantly predicted dysfunction in inattention, learning problems, and hyperactivity/impulsivity. Children whose parents were less adherent to the non-Hispanic white culture were more likely to have problems with peer relations and executive functioning. HRQL was significantly lower in survivors with neurocognitive and behavioral dysfunction relative to those with normal range scores on the Conners scale.

Conclusions—In addition to the child’s age at diagnosis, acculturation appears to predict select neurocognitive and behavioral outcomes in this socio-demographically homogeneous sample of Latino families. Further research is needed to understand the interaction of ethnic and cultural factors with therapeutic exposures in determining the adverse neurobehavioral outcomes, so as to optimally design interventions.

Keywords

childhood cancer; neurocognitive; late effects; Latino; health disparities

Survival rates for childhood cancer now exceed 80%.¹ However, the survivors are at increased risk for chronic health conditions due to treatment-related toxicities and one-third of the long-term survivors experience severe or disabling health conditions,² and also are at risk for adverse behavioral outcomes. Research has documented deficits among survivors in core neurocognitive processes that underlie developmentally appropriate learning, such as attention, executive functioning, memory, and processing speed.³ Such deficits in core functions interfere with age-appropriate acquisition of knowledge so that declines may emerge over time in IQ and academic achievement scores.³ Literature also supports select social and behavioral sequelae, including poor peer acceptance, fewer friendships, and greater social sensitivity-isolation.⁴

Central nervous system (CNS)-directed therapy (cranial irradiation and intrathecal chemotherapy) is primarily responsible for the adverse neurocognitive and behavioral outcomes. It is for this reason that adverse neurobehavioral outcomes are most frequently observed in children with brain tumor (cranial irradiation, brain surgery), acute lymphoblastic leukemia (cranial irradiation and/or intrathecal chemotherapy) and to a lesser extent acute myeloid leukemia (intrathecal chemotherapy). Younger age at exposure to these agents and female gender serve as key modifiers of the risk.³ Additional socio-demographic factors such as ethnicity and parental education are also thought to influence the long-term outcomes in this group.³

Very few studies, however, have examined neurocognitive or behavioral outcomes in childhood cancer survivors from ethnic/racially underrepresented populations despite speculation that socio-demographic factors may increase vulnerability for adverse neurobehavioral outcomes. The few studies that have examined this issue are limited by either extremely small sample size⁵ or by the consideration of all ethnic/racial minority populations as a single group⁶ without acknowledgement of the inherent heterogeneity between the ethnic/racial minority populations. Detailed characterization of homogeneous ethnic populations is needed as the life experiences and values impacting neurobehavioral outcomes are not equal across ethnicities. Importantly, detailed socio-demographic information is necessary to disentangle the effects of ethnicity from the effects of socioeconomic status, thus taking into account the variability *within* ethnic groups based on education, income, immigrant status, and acculturation, in order to identify the vulnerable subgroups in need of intervention. We addressed these issues by evaluating neurocognitive and behavioral outcomes among childhood cancer survivors with CNS-directed treatments in Latino families drawn from the Los Angeles region, which comprises mostly immigrants of Mexican origin.

The literature on engaging ethnic minorities in research, however, suggests recruitment may be complicated by language, cultural, and socioeconomic differences, decreased access to health-care services, and lack of trust and experience with the research enterprise.⁷ In particular, Latinos have the lowest educational attainment in the U.S.⁸ and a significant proportion may experience language barriers in interacting with community establishments such as the health care and school systems.⁹⁻¹⁰ With this background in mind, specific culturally-relevant recruitment strategies were employed to enhance participation, and the data collection was intentionally designed to minimize participant burden. In particular, we utilized a parent-report assessment of neurocognitive functioning in the pediatric survivors since performance-based, direct assessment would have required the parent to transport the child to the clinic.

We aimed to 1) describe neurocognitive and behavioral outcomes in a cohort of Latino survivors; 2) examine the clinical and sociodemographic factors associated with adverse

outcomes; and 3) evaluate the impact of neurocognitive impairment on health-related quality of life (HRQL). We hypothesized that sociodemographic factors such as age at diagnosis, gender, acculturation status, income, and parental education would have significant impact on the neurobehavioral outcomes in this cohort.

METHOD

Recruitment Strategies

As a recommended recruitment strategy,¹¹ we partnered with a community organization, PADRES Contra El Cáncer (Parents against Cancer), to optimally access eligible participants. PADRES is a non-profit organization providing educational and supportive services for Latino children with cancer and their families at various Los Angeles pediatric cancer centers and maintains a database of patient contact information. Approximately 60 percent of the families served by PADRES are Spanish-speaking only. Eligible families in the PADRES database served as the primary pool from which participants were recruited. Participants were also identified through the Childhood Cancer Survivorship Program at City of Hope.

Individuals from either organization were eligible if they were a parent or primary caregiver of a child between ages 6 to 18 years, who had completed treatment for acute leukemia (ALL or AML) or brain tumor, were in remission, and were enrolled in school. The caregiver had to live with the child, self-identify as Hispanic/Latino, and could be either English- or Spanish-speaking. A minimum reading proficiency was not required as study questionnaires could be read to the parent if preferred.

For participants identified through the PADRES, staff at the PADRES either communicated in person or mailed out a letter to the potentially eligible families informing them of their collaboration with the research team. The research assistant at City of Hope then followed up with a telephone call to assess study interest. Study documents were mailed to interested caregivers in their preferred language, and sometimes verbally read over the phone. The study was approved by the City of Hope Human Subjects Protection Committee. All participants provided informed consent before study participation.

Participants

A total of 186 eligible parents were identified from organizational databases; however, 82 could not be reached to assess interest as the telephone and mailing contact information had changed. A total 104 (55.6%) parents were approached, 94 (90.4%) agreed to participate, and 73 (70.2%) completed the study (56 mothers, 13 fathers, and 4 other relatives). Based on available data, non-participants were not significantly different in type of diagnosis or gender from participants. Demographic and clinical characteristics are presented in Table I.

Measures

Child and Family Information—Caregivers completed a survey describing sociodemographic information and the child's cancer-related information. Parents also completed questions related to parenting beliefs and behaviors,¹² the data for which will be presented in a paper with a separate research focus.

Acculturation Measure—The Bidimensional Acculturation Scale¹³ for Hispanics (BAS) is a 24-item published measure used to determine the caregivers' acculturation status.¹⁴ Twelve items measure the level of adherence to the Hispanic culture and 12 items measure adherence to the non-Hispanic white culture. The score ranges from 1 to 4 to reflect adherence to each of the two cultures, with a lower score indicating lower adherence.

Reliability coefficient was .90 for the Hispanic domain and .96 for the non-Hispanic domain.

Neurocognitive and Behavioral functioning—To reduce participation burden, a reliable and validated parent-report measure, the Conners 3 Parent Report Short Form¹⁵, Conners 3-P(S), was used as the primary tool to assess the child's neurocognitive and behavioral functioning. The Conners 3-P(S) consists of 43 items on a 4-point Likert scale (never/seldom to often/very frequently). The items are grouped into six scales, three of which tap into cognitive domains: 1) Inattention (ability to stay focused), 2) Executive Functioning (forgetfulness, organization, and initiation), and 3) Learning Problems (proficiency with academic skills such as math, comprehension, spelling, and reading). The remaining three subscales tap into more general behavioral issues and include 4) Hyperactivity/Impulsivity (motor activity/restlessness), 5) Aggression (aggressive and disruptive tendencies), and 6) Peer Relations (social skills and social connection). It has strong test-retest reliability and validity, with internal consistency coefficients above 0.80.¹⁵ A T-score ($M=50$, $SD=10$) can be calculated for all subscales.

Quality of life measure—The PedsQL™ 4.0 Generic Core Scales-Parent Report¹⁷ is a HRQL measure with strong reliability and validity.¹⁷ Caregivers rate their child's HRQL on a scale of 0 (never) to 4 (always). A total HRQL Full Scale Score composite is generated comprising psychosocial and physical domains, and has an overall reliability of 0.91.¹⁷

Hispanic representation—Additional information, including on the Hispanic representation in the normative samples for the above published measures, is presented in Table II.

Statistical Analyses

Each parent-reported assessment of their child's neurocognitive and behavioral functioning was compared to published normative means and converted to standardize T-scores for each of the Conners subscales. The percentage of children with scores in the “elevated” (i.e. T-score ≥ 60), and “very elevated” (i.e. T-score ≥ 70) range per guidelines in the publishers' manual, was calculated. Means and standard deviations of each subscale were computed.

Data from the subscales were dichotomized into two groups to represent “dysfunction” versus “no dysfunction”, where children with a T-score of ≥ 60 were viewed as having elevated scores, whereas children with T-scores below 60 were viewed as within the normal range. Binary logistic regressions were subsequently conducted to evaluate if clinical and sociodemographic factors significantly predicted the odds of dysfunction.

Prior to constructing the preliminary models for the logistic regressions, sets of variables which were hypothesized to measure similar or equivalent sociodemographic factors were evaluated using correlational analyses. The caregiver acculturation level was the only predictor that significantly correlated with all the other sociodemographic variables, including language most spoken in home ($r(68)=-0.54$, $p<0.001$), mother's education level ($r(65)=0.65$, $p<0.001$), father's education ($r(58)=0.60$, $p<0.001$), child's preferred language ($r(66)=-0.39$, $p=0.001$), and annual income ($r(65)=0.29$, $p=0.02$). To minimize collinearity and in keeping with the recommended ratio of 10 cases for each predictor in logistic regression¹⁸, we minimized the number of predictors by including only the acculturation variable as our primary focus. Of note, the BAS adherence to the non-Hispanic white culture scale ($M=2.5$, $SD=1.01$, Median=2.3) was used in our analyses instead of adherence to the Hispanic culture since the latter was highly skewed ($M=3.3$, $SD=0.7$, Median=3.7).

Correlational analyses also examined associations among the clinical factors. Child's age at study time was significantly correlated with length of time since treatment ($r(60) = 0.51, p < 0.001$) and age at cancer diagnosis ($r(72) = 0.62, p < 0.001$); thus only age at diagnosis was included. Since cancer therapy is linked to diagnosis, and we did not have access to medical records for patients from PADRES, cancer treatments were not included in the model. Binary logistic regressions were employed to examine the contribution of these variables in predicting the presence versus absence of neurobehavioral dysfunction. After exploring the effects of these predictors, gender and diagnosis were removed from the final logistic regression model as neither significantly impacted outcomes.

In sum, the final logistic regression analysis for each neurocognitive and behavioral scales included a model with two predictors: age of patient at cancer diagnosis and parent acculturation level. Power was estimated as adequate based on the sample size ($N=73$) and the limited number of predictor variables in each regression¹⁸. Of note, in addition to the previously mentioned problem of collinearity, the sample size was too small to permit inclusion of income and parent education as predictors since the number of cases in each cell would decrease to less than 10. However, we conducted exploratory hierarchical logical regression to evaluate the contribution of acculturation after controlling for the effects of family income and maternal education. Income and maternal education were skewed in our sample and so were dichotomized using \$20,000 annual income and 9th grade education as cutoffs in these exploratory models.

Finally, an ANCOVA was conducted to examine differences in HRQL between the group with neurocognitive and behavioral dysfunction and those with scores in the normal range on the Conners. The PedsQL Full Scale score was the dependent variable, and child's age at diagnosis was held as the covariate. All analyses were conducted using SPSS version 19.

RESULTS

Predictors of Cognitive Functioning: Inattention, Learning Problems, and Executive Functioning

Parent-reported neurocognitive and behavioral outcomes are presented in Table III and IV. In the logistic regression analyses predicting the odds of a child placing in the cognitive dysfunctional group for parent-reported cognitive functioning, the full model with both the predictors of child's age at cancer diagnosis and parent acculturation were significant for the Inattention subscale, $\chi^2(2, N=67) = 6.4, p = 0.04$, as well as the Learning Problems subscale, $\chi^2(2, N=67) = 8.6, p = 0.01$. Age at diagnosis was a significant *individual* predictor, indicating that children diagnosed at a younger age were more likely to be rated as having inattention problems ($p = 0.03$) and learning problems ($p = 0.03$). Acculturation was not a significant predictor for either subscale (Table V).

The full logistic regression model was also significant for the Executive Functioning subscale, $\chi^2(2, N=66) = 9.7, p = 0.008$. Acculturation was a significant predictor ($p = 0.022$), indicating that survivors whose parents were less adherent to the non-Hispanic white culture were more likely to be rated as having executive problems. Age of diagnosis was not significant as an individual predictor for this subscale ($p = 0.10$). Exploratory analyses showed that acculturation predicted an additional 5.2% of the total variance in this subscale after controlling for the effects of income ($B = 0.53, SE = 0.32, p = 0.095, OR = 1.70, 95\% CI OR = 0.91-3.19$) with the model approaching significance, but only 2.9% of the variance after controlling for the effects of maternal education ($B = 0.43, SE = 0.35, p = 0.21, 95\% CI OR = 0.78-3.05$).

Predictors of Behavioral Functioning: Hyperactivity/Impulsivity, Peer Relations, and Aggression

In the logistic regression analyses predicting the odds of a child placing in the behavioral dysfunctional group on the Conners behavioral scales, the full model was statistically significant for the Hyperactivity/Impulsivity subscale ($\chi^2(2, N=67) = 6.8, p=0.03$). Younger age at diagnosis was a significant predictor ($p=0.032$) while acculturation was not.

The full logistic regression model was also significant for the Peer Relations subscale: ($\chi^2(2, N=67) = 7.9, p=0.019$), with acculturation as the only significant individual predictor. Essentially, children whose parents were less adherent to the non-Hispanic white culture were more likely to be rated as having peer relations problems. In the exploratory hierarchical analyses, acculturation contributed 12.9% of the variance for Peer Relations after controlling for the effects of income ($B=0.75, SE=0.30, p=0.013, OR=2.11, 95\% CI OR=1.17-3.81$) with a significant model, but only 3.9% of the variance after controlling for the effects of maternal education ($B=0.47, SE=0.33, p=0.15, OR=1.59, 95\% CI OR=0.84-3.01$) The full logistic regression model was not significant in predicting the odds of dysfunction on the Aggression subscale ($\chi^2(2, N=67) = 3.5, p=0.17$) (Table V).

Impact of neurocognitive and behavioral outcomes on Health-related Quality of Life

ANCOVA results consistently showed significant differences in parent-reported HRQL (worse) for children with elevated scores relative to those with scores in the normal range on the Conners subscales (Table VI).

DISCUSSION

Approximately 50% of the childhood cancer survivors from Latino families assessed in this study placed at or above the “elevated” level for difficulties with attention, school-based learning, and peer relations, as assessed by the Conners scale. Younger age at diagnosis significantly predicted dysfunction in inattention, learning problems, and hyperactivity/impulsivity subscales. Children whose parents were less adherent to the non-Hispanic white culture were more likely to have problems with peer relations and executive functioning. HRQL was significantly lower in survivors with cognitive and behavioral dysfunction relative to those with normal range scores on the Conners scale.

Kahalley et al.¹⁶ described parent-reported neurobehavioral functioning in brain tumor and leukemia survivors using the Conners scales in an ethnic/racially homogeneous sample (86% self-identified as White/non-Hispanic). While their sample of 99 survivors had a much larger percentage of brain tumor patients, (50% relative to 26% in our sample), the mean T-scores reported on the Conners 3 subscales for their sample were consistently lower than the means obtained by our sample, representing better functioning relative to our sample. In general, a larger percentage of brain tumor survivors would bias the mean scores in an upward direction (i.e. worse functioning) as this group typically suffers from worse neurocognitive and behavioral late effects. Mean age at diagnosis was about 1.5 years older ($M=6.6, SD=3.8$)¹⁵ and mean age at study time was three years older ($M=14.9, SD=1.2$) in Kahalley et al.’s study relative to our sample. Although not an optimal comparison group, especially given possible differences in relevant clinical characteristics, it is notable that the percentage of survivors with elevated scores on the Conners observed in our sample of Latino children with fairly homogeneous socio-demographic background appears more pronounced. Interestingly, disparities between the two samples were greater on the behavioral functioning scales. For example, the mean score in our cohort was ten points higher on the Aggression subscale, six points higher on the Peer Relations subscale, and

eight points higher on the Hyperactivity/Impulsivity subscale. These differences approach a difference of one standard deviation and are viewed as clinically relevant differences.

Further research using a controlled comparison design is necessary to investigate the extent and nature of disparities in neurocognitive and behavioral outcomes among childhood survivors from Latino families compared with survivors from mainstream racial/ethnic backgrounds, as suggested by our data. At the same time, it would be wrong to infer that Latino membership by itself predicts worse outcomes, as our sample represents a specific subgroup of low SES Latino families in the Los Angeles area accessed from a community organization serving families of children with cancer in need of support. Latinos are overrepresented among the socio-economically disadvantaged, and many of the disparities attributed to Hispanic ethnicity may in fact reflect effects associated with lower SES, which typically reflect higher levels of stress, lower neighborhood quality, differences in home environment and parenting, and in family resources. Characterization of SES is particularly relevant in studying neurocognitive and behavioral outcomes, as SES is strongly associated with a child's neurocognitive abilities¹⁹. An optimal research design to assess disparities in neurocognitive and behavioral outcomes following childhood cancer would include several comparison groups representing varied socioeconomic strata among each ethnic group being studied (e.g. low SES non-hispanic whites compared to low SES Hispanics).

Our study demonstrates that the child's age at cancer diagnosis significantly predicted placement in the dysfunctional group for parent-reported inattention, learning problems, and hyperactivity/impulsivity, with younger age at diagnosis increasing the odds of dysfunction. This is consistent with what is known about the risk factors for adverse neurocognitive and behavioral outcomes in this patient group.^{3, 20} Our data did not show brain tumor diagnosis to predict worse outcomes as would be expected from prior research, most likely due to the small number of brain tumor patients relative to the leukemia survivors in our sample, or possibly due to CNS related factors (i.e. tumor type, treatment) which we were unable to characterize.

This study found that parent acculturation significantly predicted problems in executive functioning and peer relations, such that the lower the adherence to the non-Hispanic white culture, the greater the odds of dysfunction. That acculturation plays a role in peer relations among survivors seems reasonable as children who are assimilated and more similar to the peer group typically are more readily accepted and experience fewer conflicts. Why acculturation predicts executive functioning is less intuitive, but may make sense when one considers that behaviors such as high organization and efficient time-management are valuable attributes in the non-Hispanic white culture and often deliberately cultivated by individuals who identify with the mainstream culture. Perhaps children who are from less acculturated families do not have the same degree of structure and organization in the home environment to help compensate for their cancer-related neurocognitive difficulties, and thus present as more disorganized in their daily life (i.e., weakness in executive functioning). Irrespective of these speculations, understanding the interplay of cancer-related and socio-demographic factors in the association between acculturation and neurocognitive/behavioral outcomes in Latino survivors would be best investigated with a research design that compares these outcomes to a demographically-similar group of Latino children *without* cancer. We also found significantly lower HRQL in children with cognitive and behavioral dysfunction, compared to children with neurobehavioral scores in the normal range, highlighting the need for preventive and/or rehabilitative services.

Limitations of this study include reliance on parent-report of outcomes rather than child-directed objective assessments, and lack of access to survivors' medical records for more reliable and/or complete treatment data. Further, the small sample size necessitated limiting

the number of sociodemographic predictors to maintain the recommended standards for logistic regression modeling¹⁸. Our exploratory analyses suggests that the construct of acculturation may be entangled with maternal education to a greater degree than with family income in this sample. Future research is needed to evaluate the unique contribution of acculturation, which typically encompasses preferred language and ethnic self-identification, separate from related overlapping socio-demographic constructs, such as parent education. An additional limitation of this study is that while Hispanics were well represented in the normative data for other measures, the Conners is normed on a sample with only 15% Hispanics. Unfortunately there are few measures available with optimal norms for use with Hispanic samples; research using more controlled study designs (i.e., comparison groups) may help minimize the potential cultural confounds.

Our sample was fairly homogenous with the majority of parents endorsing adherence to the Hispanic culture and with a large percentage of parents who never attended school. This homogeneity restricted our ability to compare for differences related to socio-demographic factors. However, this homogeneity was also a strength of the study, as it allowed the study of a unique group of childhood cancer survivors for whom these data have not previously been reported. Results of this study could serve as a preliminary step toward hypothesis-driven research to identify the interaction between therapeutic exposures and environmental factors associated with poor neurobehavioral outcomes.

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Table I

Parent/Caregiver, Child Demographic and Clinical Characteristics.

Child Information	<i>n</i>	%		
Gender				
Male	42	57.5		
Female	31	42.5		
Age of child at time of study (years) ^a	12.0 (3.9)			
Age of diagnosis (years) ^a	5.0 (3.3)			
Type of diagnosis				
Acute leukemia	54	74.0		
Brain tumors	19	26.0		
Years since diagnosis (years) ^a	7.1 (3.18)			
Type of treatments				
Chemotherapy	67	91.8		
Surgery	31	42.5		
Radiation	25	34.2		
Bone marrow transplant	16	21.9		

Parent Information	<u>Mother</u>		<u>Father</u>	
	<i>n</i>	%	<i>n</i>	%
Marital status				
Single	9	13.0	3	4.7
Married	47	67.1	48	75.0
Other	14	19.9	13	20.5
Highest education level completed				
Never went to school	19	27.5	15	24.6
< 7 years	10	1.5	7	11.5
7–9 years	11	15.9	11	18.0
10–11 years	12	17.4	10	16.4
High school graduate	14	20.3	9	14.8
1–3 years of college	1	1.4	4	6.6
4-year college graduate	1	1.4	2	3.3
Graduate/professional school	1	1.4	3	4.8
Family annual income (\$) ^b				
0–10,000	13	18.6		
10,000–19,999	20	28.6		
20,000–49,999	31	44.2		
50,000–74,999	6	8.6		

Note.

^aMean (SD).^bMother and father combined. Totals of percentages are not 100 for every variable because of rounding.

Table II

Additional Description of Measures.

Measures	Description
The Bidimensional Acculturation Scale for Hispanics (BAS)	The BAS is normed on 254 adult Hispanic residents of San Francisco, California. Most respondents were born in Central America (52.8%) or in Mexico (24%). The average age of the respondents was 37.3 years, 54% were females, and the sample averaged 10.4 years of formal education. The BAS scales have high correlations with generation status, length of residence in the United States, amount of formal education, age at arrival in the United States, proportion of respondent's life lived in the United States, and ethnic self-identification, demonstrating good construct validity. ¹⁴
The Conner 3 Parent Report Short Form (Conners 3-P (S))	The Conner is available in Spanish. The normative sample included 1,200 parents, with 15.1% being Hispanic. It was originally developed to evaluate cognitive, learning, and behavioral issues typically manifested in children diagnosed with Attention Deficit Hyperactivity Disorder; however, the measure has applicability for a range of patient groups with similar symptoms, and has been used to assess cognitive functioning in children with cancer. ¹⁶ Deficits in neurocognitive functions such as attention and executive functioning, as well as in school-based/academic performance, have been extensively documented among survivors, and are components that are assessed in the Conners 3-P(S).
The PedsQL™ 4.0 Generic Core Scales-Parent Report (PedsQL)	The PedsQL is available in Spanish and normed on a sample of 1,677 families from pediatric healthcare settings, including survivors of childhood cancer, with strong reliability and validity. ¹⁷ The normative sample had heterogeneous race/ethnicity representation with 667 parents (39.8%) being Hispanic.

Table III

Means and Standard Deviations for Conners Subscales for Type of Diagnosis.

Subscale	Total (N = 73)		Leukemia (n = 54)		Brain Tumor (n = 19)	
	M	SD	M	SD	M	SD
Inattention	60.1	15.6	58.6	15.4	64.4	15.8
Learning Problems	60.4	13.8	59.6	14.4	62.5	12.0
Executive Functioning	57.3	15.8	56.8	14.7	58.6	18.9
Hyperactivity/Impulsivity	60.2	17.5	60.2	17.8	60.2	17.1
Peer Relations	67.0	17.7	65.2	17.4	72.0	18.1
Aggression	60.1	16.5	60.5	17.3	58.8	14.5

Table IV

Parents Reported Neurobehavioral Dysfunction in Childhood Cancer Survivors that Met Criteria of “Very Elevated” Range (T-score 70) and “Elevated” Range (T 60).

Subscale	<u>T-score 70</u>		<u>T-score 60</u>	
	<i>n</i>	%	<i>n</i>	%
Inattention	20	28.2	37	52.1
Learning Problems	21	29.6	36	50.7
Executive Functioning	18	25.4	27	38.0
Hyperactivity/Impulsivity	20	28.2	27	38.0
Peer Relations	31	43.7	39	54.9
Aggression	19	26.8	29	40.8

Table V

Summary of Logistic Regression Analysis Predicting Conners Subscales

Predictor	Inattention			Learning Problem			Executive Functioning		
	B	SE	p	B	SE	p	B	SE	p
Age of Diagnosis	0.19	0.09	0.029*	1.20	1.02	1.43	0.20	0.09	0.025*
BAS	0.17	0.26	0.52	1.19	0.71	1.97	0.36	0.27	0.18
							0.68	0.30	0.022*
							1.10	1.17	1.42
							1.10	1.97	3.51

Predictor	Hyperactivity/Impulsivity			Peer Relations			Aggression		
	B	SE	p	B	SE	p	B	SE	p
Age of Diagnosis	0.21	0.10	0.032*	1.23	1.02	1.49	0.12	0.08	0.15
BAS	0.24	0.27	0.38	1.27	0.74	2.16	0.56	0.27	0.036*
							1.75	1.04	2.94
							0.36	0.27	0.19
							1.43	1.43	0.84
							2.41		

Note. BAS = Bidimensional Acculturation Scale. Age of Diagnosis and BAS were entered as continuous variables. 95%CI = confidence interval for odds ratio (OR). T-score < 60 as the reference category.
* p < 0.05.

Quality of Life means for Group with Conners T-scores ≥ 60 and T-scores < 60 , and Analysis of Covariance of Quality of Life, with Age at Diagnosis as Covariate.

Table VI

Subscale	Quality of Life					
	T-scores ≥ 60		T-scores < 60		F	p
	M	SD	M	SD		
Inattention	76.94	15.59	61.20	17.79	22.06	1, 67 < 0.001***
Learning Problems	76.56	15.54	61.59	18.16	19.62	1, 67 < 0.001***
Executive Functioning	76.34	16.70	54.94	12.87	20.17	1, 66 < 0.001***
Hyperactivity/Impulsivity	76.99	14.43	62.00	18.81	17.47	1, 67 < 0.001***
Peer Relations	74.93	17.67	59.07	15.32	17.21	1, 67 < 0.001***
Aggression	72.51	17.17	62.70	19.19	7.36	1, 67 0.008**

**
 $p < 0.01$.

 $p < 0.001$