The perceived impact of cancer on quality of life for post-treatment survivors of childhood cancer

Brad J. Zebrack · Wendy Landier

Abstract

Purpose To examine whether childhood cancer survivors' perceptions of the impact of cancer are related to quality of life (QOL) and psychological distress.

Methods 621 survivors (aged 18–39 years) completed a mailed survey assessing distress and QOL. Hierarchical linear regression models analyzed the independent effects of perceived impacts of cancer on distress and QOL and the extent to which positive and negative perceptions attenuated the effects of covariates on outcomes.

Results After accounting for perceptions of cancer's impact on their lives, employment/occupation status, marital/relationship status, and health problems were observed to be significant predictors of QOL and distress. Psychological distress and the mental health component of QOL appeared to be less influenced by sociodemographic status and health problems and more a function of how survivors perceive cancer as impacting their lives.

Conclusions Results suggest that distress and QOL are partially a function of survivors' perceptions of how cancer has affected them and continues to affect them in both positive and negative ways. Future research is needed to

B. J. Zebrack (✉)
University of Michigan School of Social Work, 1080 S. University, Ann Arbor, MI 48109-1106, USA
e-mail: zebrack@umich.edu

B. J. Zebrack
University of Michigan Comprehensive Cancer Center, 1080 S. University, Ann Arbor, MI 48109-1106, USA

W. Landier
City of Hope National Medical Center, 1500 Duarte Rd., Duarte, CA 91010, USA

examine combinations of pharmacological, psychological and/or social interventions that are likely to result in better outcomes in this population.

Introduction

Existing studies of late effects in childhood cancer survivors have drawn attention to adverse physiological conditions such as increased risk of death at an early age [1–3], compromise to vital organ systems, including reproduction [4–6], visible physical impairments and disabilities [4, 7], and neuropsychological problems [8–11]. While investigations of the prevalence and severity of these and other long-term and late effects of cancer and its therapy continue, the psychosocial and quality of life (QOL) implications of these sequelae for post-treatment survivors are not as well understood.

Research suggests that most survivors of childhood cancer are psychologically healthy and score in the normal range on standardized psychometric measures of distress and quality of life [12–14]. However, studies also suggest that a subset of childhood cancer survivors are seriously troubled psychologically, with some exhibiting psychopathologic symptoms of depression or posttraumatic stress disorder [14–16], or social and behavioral challenges [17, 18]. For those survivors still struggling psychologically or socially, recent reports indicate that the risk factors contributing to their distress are the same as those observed in the general population: female gender, lower household income, lower educational attainment, and unemployment [12–14]. These findings suggest that it is not objective

characteristics of cancer nor its treatment per se that places a subset of survivors at risk for psychological distress but rather their lack of involvement in educational or employment opportunities that may be related to toxic chemotherapy exposures, social life disruptions, or exposures to societal prejudice, discrimination, or stigmatization occurring at critical developmental life stages [12, 13, 19].

Since Koocher and O'Malley's [20] seminal work documenting psychological distress among survivors of childhood cancer, the evidence suggesting that the effect of objective cancer-related factors (e.g., time since diagnosis, type or severity of treatment) on psychosocial outcomes is mixed or weak at best [21, 22]. In contrast, other studies suggest that survivors who report subjective appraisals, perceptions or experiences of how cancer has negatively affected their lives (e.g., as a result of treatment-related late effects or impacts on social functioning) also experience more distress [16, 22–24] and worse quality of life [25–27]. The current state of research suggests that subjective appraisals of cancer's impact on one's life may be more salient as contributors to psychosocial and quality of life outcomes than objective cancer-related clinical factors. This notion is grounded in theories of cognitive adaptation and coping [28], and has been examined and observed in early studies of breast cancer survivors [29, 30].

In this report we first describe prevalence of distress, quality of life, and their correlates in a moderately-sized sample of disease-free post-treatment survivors of childhood cancer, using standardized measures. Then, utilizing a new impact of cancer measure designed specifically for childhood cancer survivors, we examine whether survivors' reported perceptions of the impact of cancer on their lives are related to, and possibly predict, QOL and psychological distress, after controlling for select medical and sociodemographic conditions.

Methods

Subjects and data collection

A potential pool of 2,864 survivors of childhood cancer was derived from records maintained at three US hospitals that treat pediatric oncology patients. Study eligibility criteria included survivors who had completed treatment and were disease-free at the time of study, were between the ages of 18–39 years at time of study, and 21 years of age or younger when diagnosed with and treated for cancer at a pediatric facility. Potential subjects were mailed a survey questionnaire, informed consent form and a self-addressed stamped return envelope. IRB approval was obtained from all participating institutions.

Survey booklet

A 24-page mailed questionnaire consisted of well-established measures of QOL and distress that have been used in healthy populations, ill populations, and in cancer patients and survivors specifically [14, 31–34]. It also included the *Impact of Cancer—Childhood Survivors (IOC-CS)*, a recently developed instrument designed to assess survivors' perceptions of how cancer has affected their lives in various quality of life domains [35, 36].

(1) *MOS SF-36*, a widely-used and well-validated instrument that assesses aspects of QOL across eight dimensions (physical functioning, role function-physical, bodily pain, social functioning, mental health, role function-emotional, vitality, and general health [37]. QOL is also represented by two factor scores: the physical component score (PCS) and the mental component score (MCS). Based on 1998 US population data, raw scores are transformed into T scores ranging from 0 to 100, with higher scores representing better QOL. A population mean score is set at 50 and standard deviation of 10. A deviation of 0.5 standard deviations from the mean is generally considered clinically significant [38].

(2) *Brief Symptom Inventory (BSI-18)*, an 18-item self-report scale that assesses psychological distress [39]. Scores are summarized by three subscales (depression, anxiety, and somatic distress) and a global symptom index (GSI) representing an overall distress score. Raw scores for each of the three subscales and the global index are summed and then converted to age and gender-corrected standard T scores, using adult non-patient community norms. A T score greater than 63 on any two of the three subscales or an overall GSI score of 63 or greater signifies "caseness for distress," a score suggestive of clinically diagnosable distress symptoms.

(3) *The Impact of Cancer—Childhood Survivors (IOC-CS)* consists of 45 items comprising 8 subscales (life challenges, body and health, talking with parents, personal growth, thinking and memory problems, health literacy, socializing, and financial problems). The individual items represent distinct survivor-specific content that, for the most part, is not present in standardized measures administered and reported in childhood cancer survivor studies (see "Appendix 1"). Across 45 items, respondents endorsed the perceived impact of cancer along an ordinal scale, where 1 indicated no impact at all, and 5 indicated great impact. Items were suggestive of either positive or negative outcomes. The eight subscale scores were created by calculating the mean of all items in the subscale after reverse-coding items necessary for retaining the subscale's positive or negative orientation. Internal reliability coefficients (Cronbach's alpha) for each of the 8 IOC subscales ranged from 0.70 to 0.86. Correlation coefficients (absolute

values) for the IOC subscales and the SF-36 Physical Component Scale (PCS) ranged from 0.03 to 0.31. For the SF-36 Mental Component Scale (MCS), correlation coefficients ranged from 0.01 to 0.54. Correlation coefficients for each of the IOC subscales and the BSI-18 subscales and the overall GSI ranged from 0.01 to 0.56. These wide-ranging correlations suggest that content assessed by the *IOC-CS* was not necessarily the same as that assessed by the SF-36 and BSI-18. The two overarching Positive Impact and Negative Impact scores utilized in the analyses reported here were created by calculating the means of 25 items suggestive of positive outcomes and 20 items suggestive of negative outcomes. In all cases, higher values indicated a greater impact of cancer, whether positive or negative. Details regarding the development, psychometric evaluation and scaling of the *IOC-CS* are reported elsewhere [35, 36].

Finally, respondents provided sociodemographic data as well as information about their type of cancer, date of diagnosis, and report of whether they were experiencing any recent health problems for which they have seen a doctor (yes/no).

Statistical analysis

All statistical analyses were done using PASW Statistics 17.0 (formerly SPSS). *T* tests were used to compare mean values of QOL and distress outcome scores by demographic/medical covariates with two values (e.g., gender, health problems). ANOVA was used when covariates had more than two values (e.g., type of cancer). Pearson product-moment correlations were computed between outcomes, current age, age at diagnosis and years since diagnosis. General linear models (GLMs) were conducted separately on physical health (PCS), mental health (MCS), and psychological distress (GSI) to determine which covariates (selected a priori and based on findings reported in the childhood cancer survivor literature) were significantly related to any of these outcomes. Covariates included in the GLMs were: gender, race, employment status, educational attainment, income, marital/relationship status, cancer type, report of health problems, age at diagnosis and years since diagnosis. Hierarchical multivariate linear regressions were then performed separately on three outcomes (PCS, MCS, and GSI) and included only those covariates which were significantly associated (at $P < 0.10$) with at least one of the outcomes in the GLMs. These covariates included all of the same variables included in the GLM models. When assessing the significance of covariates, a Bonferroni correction was used to adjust for multiple comparisons, when applicable. Hierarchical multivariate regression models then analyzed the independent effects of these covariates, followed by models inclusive of the

IOC-CS negative and positive impact scales. In addition, given the ability to determine "caseness for distress" from the BSI-18, cross-tabulations and Chi-square analyses permitted examinations of the extent to which "caseness for distress" was associated with sociodemographic and health-related variables, the positive and negative impact scales of the *IOC-CS* and all SF-36 subscales.

Results

Subject characteristics

From 2,864 mailed surveys in 2006–2007, the US postal service returned 576 (20.3%) unopened surveys, indicating they were undeliverable. An additional 22 returned surveys were marked "deceased." Among 2,266 assumedly live subjects for whom surveys were not returned, 666 (29.3%) consented to participate and completed a self-report questionnaire (Fig. 1). The remaining 1,600 subjects were deemed "non-respondents." Of the 666 respondents, 45 were eliminated from subsequent analyses due to surveys being completed by individuals who did not fit eligibility criteria with regard to age at study (18–39 years old), age at diagnosis (21 years or younger) or treatment status (not currently receiving treatment), or because the questionnaire was completed by a surrogate. Thus, the analyses reported here are based on responses from 621 young adult survivors of childhood cancer.

The demographic and medical characteristics of the sample and non-respondents are presented in Table 1. A comparison of 621 eligible respondents to 1,546 non-respondents for whom we had adequate descriptive data from each of the participating institutions showed that respondents were significantly more likely to be female. Respondents and non-respondents also differed significantly in terms of cancer diagnoses, with a larger than
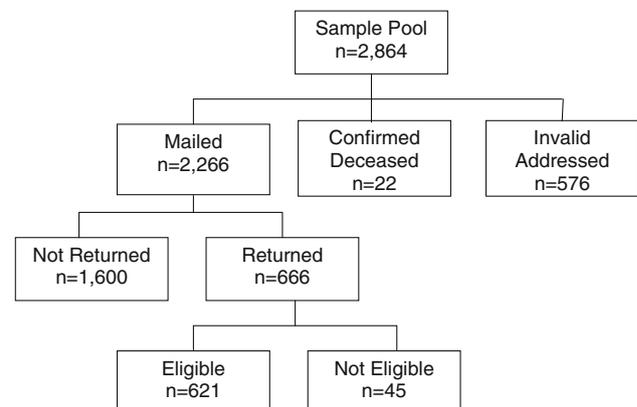

Fig. 1 Flow chart of survey respondents

expected proportion of hematological survivors and a smaller than expected proportion of brain tumor survivors comprising the respondent group ($P < 0.001$). No statistically significant differences were observed with regard to age at study, age at diagnosis or years since diagnosis. Median time since diagnosis was 16.0 years, with a range of 2–37 years.

QOL and distress outcomes

Tables 2 and 3 summarize the eight subscale scores and two component scores of the SF-36 (PCS and MCS) and the extent to which they appear significantly associated with select sociodemographic and health status variables and "caseness for distress." This sample of post-treatment survivors of childhood cancer appears comparable to the general population in terms of physical and mental health status in that mean scores on the SF-36 subscales center around 50, the standardized mean score for population norms on the SF-36. BSI-18 scores indicated that 22.2% of respondents exceeded the threshold for "caseness for distress" (Table 3). Survivors whose BSI-18 scores suggested "caseness for distress" also reported significantly lower PCS and MCS. They also were significantly more likely to report more negative impacts and fewer positive impacts of cancer (Table 5).

Health problems, cancer type

Survivors reporting health problems had significantly lower QOL scores on 7 of 8 SF-36 subscales (Table 2) and on the PCS and MCS (Table 3). Survivors reporting health problems also were significantly more likely to report symptoms of anxiety and somatization (but not depression) and more likely to report GSI scores indicative of "caseness for distress" on the BSI-18 (Table 4). Finally, self-reported health problems were associated with a higher negative impact score and a lower positive impact score (Table 5).

At the bivariate level, significant differences in QOL were observed across cancer type categories, with post-hoc (Bonferroni) analyses suggesting that brain tumor survivors reported lower QOL when compared to all other survivors with regard to physical functioning, social role interruptions attributable to physical symptoms, bodily pain and social functioning (Table 2). PCS, but not MCS, scores were significantly lower for brain tumor survivors (Table 3). While brain tumor survivors were also significantly more likely to report somatization and higher symptomatic GSI scores, the probability of reporting "caseness for distress" did not differ across diagnostic categories (Table 4). Brain tumor survivors were no more likely than survivors of other cancer types to demonstrate

clinically-diagnosable symptoms of distress. Negative IOC scores were worse for brain tumor survivors but positive IOC scores did not differ significantly across diagnostic categories (Table 5). Survivors of any type of cancer were equally likely to report positive impacts of cancer, but brain tumor survivors were more likely to report negative impacts.

Gender, age, age at diagnosis, years since diagnosis

Males reported significantly higher PCS scores (Table 3); otherwise, no significant gender differences were observed for QOL, distress or reporting a positive or negative impact of cancer. Age at study, age at diagnosis and years since diagnosis did not appear to be significantly correlated (at $P < 0.05$) with any of the 8 SF-36 subscales or the PCS or MCS. In contrast, survivors who were older at diagnosis and fewer years since diagnosis were more likely to report depressive symptoms and to indicate greater distress as measured by the GSI score (Table 4). Reporting an impact of cancer was negatively associated with years since diagnosis, in that the likelihood of reporting positive or negative impacts of cancer diminished as survivors moved further in time from their diagnosis (Table 5).

Socioeconomic factors: employment, education, income, marital/relationship status

Employment status, educational attainment, income, and marital/relationship status were significantly associated with almost all 8 SF-36 subscales (Table 2), and in almost all cases were significantly associated with both the PCS and MCS (Table 3). In general, survivors who were married/partnered, employed, of higher levels of formal education, and who earned higher incomes reported significantly better QOL. Similarly, distress symptoms were significantly higher among survivors who were unemployed, of lower income and education levels, and not married/partnered.

Employment status, education, income and marital/relationship status also were observed to be significantly associated with reporting positive and negative impacts of cancer (Table 5). Positive impact scores were lower and negative impact scores were higher among survivors who were unemployed, of lower income, and not married/partnered.

Impact of cancer as predictor of outcomes

Three multivariate hierarchical regression models reporting standardized beta coefficients for each outcome of interest are presented in Tables 6 and 7. The standardized beta coefficients reported in the models permit an evaluation of each variable's influence on outcome relative to all other

Table 1 Sample characteristics of respondents and non-respondents

Variables	Respondents n = 621 Freq (%)	Non-respondents n = 1,546[4] Freq (%)
*Gender***		
Female	328 (52.8)	614 (39.7)
Male	293 (47.2)	932 (60.3)
Race/ethnicity		
White	386 (62.2)	NA
Black	26 (4.2)	
API	40 (6.4)	
Hispanic/Latino	146 (23.5)	
AmerInd	8 (1.3)	
Employment status		
Unemployed[1]	78 (12.6)	NA
Employed/Occupied[2]	526 (84.7)	
Education		
High School Grad or less	122 (19.6)	NA
Some college	279 (44.9)	
4-year college grad	204 (32.9)	
Marital/Relationship Status		
Yes	282 (45.4)	NA
No	328 (52.8)	
Income		
≤$25 K	209 (33.7)	NA
$25–$75 K	243 (39.1)	
>$75 K	139 (22.4)	
*Cancer Type***		
Hematological	379 (61.0)	735 (47.5)
Brain tumor	79 (12.7)	341 (22.1)
Solid tumors/soft tissue tumors/other[3]	163 (26.2)	402 (26.0)
Age at study, in years		
Mean (SD)	26.9 (5.5)	26.5 (5.5)
Range (years)	18–39	18–39
Age at diagnosis, in years		
Mean (SD)	11.1 (6.0)	10.8 (6.1)
Range (years)	0–21	0–21
Years since diagnosis		
Mean (SD)	15.8 (7.0)	15.7 (6.8)
Range (years)	2–37	2–38

* Indicates statistically significant differences at $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

NA = not available from participating institutions; Frequencies do not always add up to 100% due to missing data

[1] includes those "on leave/disability," "unemployed," or "permanently unable to work."

[2] includes "full-time employment," "part-time employment," "student," or "homemaker."

[3] Includes: germ cell tumors, retinoblastoma, neuroblastoma, and other tumors not specified

[4] Descriptive data not available for 54/1,600 non-respondents included in institutional databases

variables in the model. Coefficients in model 1 always indicate the relative amount of change in outcome that is attributable to each independent predictor variable. Model 2 represents the independent effect of each predictor variable once negative impact score is taken into account. Similarly, model 3 represents the relative effect of each variable on the outcome when also accounting for the positive impact score. Notable is the significant and often substantial increase in variance explained (R^2) when the negative and positive impact subscales were entered into the regression models.

In all multivariate models, employment/occupational status maintains a significant effect throughout, with QOL scores being higher and distress scores lower among those who are employed or occupied (Tables 6 and 7). Females tended to report significantly lower PCS but not lower MCS or distress scores. Those with at least a college level education reported significantly higher PCS as compared to those with less formal education. Marital/relationship status was not related to PCS but was related to MCS and distress, with those not in significant or committed partnerships being significantly more likely to report distress

Table 2 Bivariate comparisons of mean standardized T scores (and standard deviations) for SF-36 subscales by select independent variables

	Physical Function	Role—Physical	Bodily Pain	General Health	Vitality	Social Function	Role—Emotional	Mental Health
All Respondents	51.5 (8.8)	50.8 (9.3)	52.5 (10.1)	47.2 (11.4)	50.3 (10.5)	47.8 (10.9)	47.7 (11.2)	47.8 (10.7)
Gender								
Female	50.7 (9.5)	50.6 (9.4)	52.1 (10.1)	46.2 (11.7)	48.8 (9.8)	47.5 (10.4)	46.9 (11.5)	47.6 (10.2)
Male	52.7 (7.6)	51.1 (9.1)	53.4 (9.7)	48.2 (11.1)	52.0 (10.9)	48.3 (11.3)	48.5 (11.1)	48.2 (11.1)
p-value	0.004	0.417	0.096	0.036	0	0.301	0.089	0.474
Race								
White, non-Hispanic	51.8 (8.7)	51.4 (9.2)	52.8 (9.9)	47.7 (11.5)	50.1 (10.6)	48.1 (10.7)	48.3 (11.0)	47.9 (10.7)
Hispanic/Latino	50.5 (9.5)	49.9 (9.5)	51.8 (11.3)	45.7 (11.5)	50.8 (10.8)	47.0 (11.5)	46.2 (12.5)	47.1 (11.4)
Other	51.5 (8.2)	49.5 (9.5)	52.6 (8.9)	46.8 (10.6)	50.3 (9.5)	47.4 (10.6)	47.1 (9.7)	48.5 (9.4)
	0.348	0.134	0.574	0.217	0.797	0.538	0.144	0.644
Employment								
Unoccupied[1]	45.1 (12.2)	43.2 (13.1)	47.1 (11.9)	41.2 (12.9)	46.5 (10.3)	38.6 (12.9)	40.8 (14.7)	42.7 (12.1)
Employed/Occupied[2]	52.5 (7.7)	51.9 (8.1)	53.5 (9.3)	48.2 (10.8)	50.8 (10.4)	49.2 (9.8)	48.6 (10.4)	53.0 (10.2)
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Education								
High School grad or less	48.5 (11.6)	49.0 (10.7)	50.8 (11.7)	44.8 (11.8)	50.0 (11.2)	44.9 (13.0)	45.9 (13.1)	46.3 (12.2)
Some college	51.7 (8.4)	50.2 (9.8)	51.8 (10.0)	47.0 (11.6)	50.0 (10.5)	47.0 (11.0)	47.2 (11.5)	47.5 (11.0)
4-year college grad	53.0 (6.6)	52.5 (7.4)	54.6 (9.0)	48.7 (10.8)	51.1 (10.1)	50.4 (8.7)	49.3 (9.6)	49.0 (9.3)
	0.000	0.002	0.001	0.016	0.349	.000	0.021	0.087
Income								
≤$25,000	50.2 (9.8)	48.6 (10.7)	50.4 (11.1)	46.1 (11.7)	48.8 (10.2)	45.2 (12.1)	44.6 (13.3)	45.7 (11.4)
>$25,000	52.4 (7.8)	52.1 (8.1)	54.1 (8.9)	47.8 (11.1)	51.0 (10.6)	49.2 (9.9)	49.2 (9.9)	49.0 (10.1)
	0.001	0.000	0.000	0.089	0.013	0.000	0.000	0.000
Marital/Relationship status								
No	50.6 (9.8)	50.1 (9.7)	51.9 (10.4)	47.0 (11.3)	49.4 (10.6)	46.9 (11.5)	46.4 (12.0)	46.5 (10.9)
Yes	52.7 (7.2)	51.6 (8.8)	53.6 (9.2)	47.6 (11.4)	51.3 (10.2)	49.0 (10.0)	49.1 (10.3)	49.5 (10.1)
	0.002	0.035	0.03	0.475	0.023	0.02	0.003	0.000
Cancer type								
Hematologic	52.8 (7.0)	51.5 (8.8)	53.1 (9.7)	47.3 (11.4)	50.6 (10.8)	48.6 (10.5)	48.1 (11.0)	48.1 (11.2)
Brain tumor	48.7 (11.1)	47.4 (11.6)	49.2 (11.8)	47.1 (11.3)	48.9 (10.2)	44.1 (11.9)	46.2 (11.6)	46.9 (9.4)
Solid tumor, soft tissue tumors, other	49.6 (10.7)	50.8 (8.8)	52.7 (9.9)	46.8 (11.5)	50.1 (9.7)	47.8 (10.9)	47.7 (11.2)	47.3 (10.1)
	0.000	0.002	0.008	0.918	0.462	0.008	0.394	0.567
Reports current health problems								
No	52.5 (8.9)	52.5 (7.7)	55.3 (8.5)	51.0 (9.6)	52.9 (9.5)	50.3 (9.5)	48.4 (10.7)	49.4 (10.1)
Yes	50.8 (8.6)	49.5 (10.2)	50.6 (10.4)	44.1 (11.7)	48.2 (10.8)	45.7 (11.4)	46.9 (11.8)	46.5 (11.0)
	0.033	0.000	0.000	0.000	0.000	0.000	0.062	0.001
Caseness for distress from BSI								
No	52.5 (8.0)	52.3 (7.9)	54.4 (9.0)	49.8 (10.3)	53.1 (9.0)	51.0 (8.1)	50.7 (8.5)	51.4 (7.9)
Yes	48.8 (9.8)	45.9 (11.4)	47.1 (10.1)	38.7 (10.5)	40.3 (9.4)	37.2 (11.9)	37.1 (13.4)	35.5 (10.0)
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

[1] includes those "on leave/disability," "unemployed," or "permanently unable to work."

[2] includes "full-time employment," "part-time employment," "student," or "homemaker."

Bonferroni adjustment for multiple and post-hoc comparisons

Abbreviations: Brief Symptom Inventory (BSI)

Table 3 Bivariate Comparisons of Mean Standardized *T* Scores (and standard deviations) for Physical Component Scores (PCS) and Mental Component Scores (MCS) from the SF-36 by select independent variables

	QOL (SF-36) 0–100	
	PCS	MCS
All Respondents	52.1 (8.8)	46.8 (11.9)
Gender		
Female	51.4 (9.0)	46.2 (11.3)
Male	52.9 (8.5)	47.4 (12.5)
p-value	0.039	0.202
Race		
White, non-Hispanic	52.4 (9.1)	46.9 (11.9)
Hispanic/Latino	51.5 (8.7)	46.0 (12.7)
Other	51.5 (7.6)	47.0 (10.3)
	0.470	0.746
Employment		
Unoccupied[1]	45.8 (12.3)	40.9 (13.8)
Employed/Occupied[2]	53.0 (7.8)	47.6 (11.3)
	0.000	0.000
Education		
High School grad or less	49.9 (10.9)	45.2 (14.2)
Some college	51.9 (8.4)	46.2 (11.9)
4-year college grad	53.7 (7.7)	48.2 (10.3)
Income	0.001	0.077
≤$25,000	50.7 (9.5)	44.2 (13.2)
>$25,000	52.9 (8.1)	48.0 (11.0)
	0.004	0.000
Marital/relationship status		
No	51.7 (9.4)	45.5 (12.3)
Yes	52.6 (8.1)	48.2 (11.2)
	0.208	0.005
Cancer type		
Hematologic	53.0 (7.8)	47.0 (12.1)
CNS/Brain tumor	49.1 (11.8)	45.7 (11.0)
Solid tumor, soft tissue tumors, other	51.4 (9.0)	46.7 (11.7)
	0.002	0.695
Reports current health problems		
No	54.3 (7.3)	48.4 (11.1)
Yes	50.2 (9.5)	45.3 (12.4)
	0.000	0.002
Caseness for distress (from BSI)		
No = 469 (77.8%)	52.9 (7.8)	50.7 (8.5)
Yes = 134 (22.2%)	49.8 (10.5)	32.8 (12.0)
	0.001	0.000

[1] includes those "on leave/disability," "unemployed," or "permanently unable to work."

[2] includes "full-time employment," "part-time employment," "student," or "homemaker."

Bonferroni adjustment for multiple and post-hoc comparisons

Abbreviations: Brief Symptom Inventory (BSI)

and lower MCS. While this effect was attenuated once accounting for positive and negative impact scores, survivors who were not married/partnered still reported significantly greater distress even after accounting for perceived impact scores. Similarly, reporting health problems was significantly associated with lower PCS, MCS and distress; however, the relative effect of reporting health problems on MCS and distress was lessened by the inclusion of the positive and negative impact subscales. In addition, survivors who were younger at diagnosis were significantly more likely to report higher PCS; otherwise, age at diagnosis, years since diagnosis and cancer type were not observed to be significantly associated with QOL and distress. In most instances, perceived impact of cancer was observed to be significantly associated with QOL and distress. Reporting more negative impacts was associated with a greater likelihood of reporting lower PCS and MCS and more distress. Reporting more positive impacts was associated with a greater likelihood of reporting higher MCS and less distress.

Discussion

The primary purpose of this study was to investigate QOL in post-treatment survivors of childhood cancer, and to examine the extent to which positive and/or negative perceptions of cancer's impact on survivors' lives influences the quality of their lives. Analyses of outcomes and their correlates demonstrated results comparable to population norms and results reported in prior studies of childhood cancer survivors [40, 41]. The finding that 22% of respondents indicated "caseness for distress" is consistent with the 20–32% range reported in childhood cancer survivor studies using a variety of distress outcome measures [16, 42–44]. The findings also are consistent with prior childhood cancer survivors studies and research on health outcomes in the US in that statistically significant associations between adverse psychosocial outcomes (e.g., poor quality of life, distress, poor psychosocial adaptation) and physical health problems [45, 46], socioeconomic status (including income, educational attainment, employment status) [12, 19, 33, 47–49] and social attainment (e.g., marital or relationship status) [33, 49] were observed. However, in multivariate models (Tables 6, 7), after accounting for assessments of survivors' perceptions of cancer's impact on their lives, only employment/occupation status, marital/relationship status, and health problems remained as significant predictors of QOL and distress.

These findings suggest that perception is a critical predictor of distress and QOL for young adult survivors of

Table 4 Bivariate comparisons of standardized mean scores (and standard deviations) for distress subscales and overall GSI (means/SD) from the Brief Symptom Inventory (BSI-18) by select independent variables

	Depression	Anxiety	Somatization	GSI	Caseness for Distress No	Yes
All Respondents	52.9 (11.1)	51.0 (10.6)	53.5 (10.4)	53.2 (11.2)	469 (77.8%)	134 (22.2%)
Gender						
Female	52.6 (10.6)	50.8 (10.4)	53.9 (10.7)	52.8 (11.2)	255 (80.4%)	62 (19.6%)
Male	53.3 (11.7)	51.3 (10.8)	53.0 (10.0)	53.6 (11.3)	214 (74.8%)	72 (25.2%)
p-value	0.399	0.531	0.267	0.336		0.098
Race						
White, non-Hispanic	52.6 (11.0)	50.9 (10.3)	52.7 (10.0)	52.8 (10.9)	309 (80.5%)	75 (19.5%)
Hispanic/Latino	52.7 (11.2)	51.5 (10.9)	54.7 (10.9)	53.7 (11.5)	104 (74.3%)	36 (25.7%)
Other	55.0 (11.6)	50.6 (12.0)	55.3 (11.3)	54.2 (12.5)	52 (70.3%)	22 (29.7%)
	0.233	0.795	0.046	0.464		0.082
Employment						
Unoccupied[1]	58.1 (12.8)	55.1 (12.0)	59.0 (11.2)	59.5 (11.2)	48 (62.3%)	29 (37.7%)
Employed/Occupied[2]	52.1 (10.6)	50.4 (10.3)	52.6 (10.0)	52.2 (10.9)	417 (80.3%)	102 (19.7%)
	0.000	0.000	0.000	0.000		0.000
Education						
High School grad or less	53.9 (11.8)	51.2 (11.1)	54.9 (11.0)	54.3 (11.6)	88 (73.3%)	32 (26.7%)
Some college	53.9 (11.4)	51.7 (10.9)	55.0 (10.6)	54.4 (11.4)	203 (74.1%)	71 (25.9%)
4-year college grad	51.1 (10.1)	50.2 (10.0)	50.8 (9.2)	51.0 (10.5)	171 (85.1%)	30 (14.9%)
	0.014	0.315	0.000	0.003		0.008
Income						
≤$25,000	55.7 (12.0)	53.1 (11.8)	55.9 (10.8)	56.0 (11.7)	145 (70.0%)	62 (30.0%)
>$25,000	51.4 (10.3)	50.0 (9.7)	52.1 (9.9)	51.6 (10.6)	311 (82.1%)	68 (17.9%)
	0.000	0.001	0.000	0.000		0.001
Marital/relationship status						
No	55.5 (11.4)	52.2 (10.9)	54.1 (10.6)	55.2 (11.0)	236 (72.8%)	88 (27.2%)
Yes	50.0 (10.1)	49.6 (10.1)	52.8 (10.2)	50.8 (11.0)	232 (83.5%)	46 (16.5%)
	0.000	0.004	0.127	0.000		0.002
Cancer type						
Hematologic	52.5 (11.2)	50.8 (10.9)	52.9 (10.0)	52.7 (11.3)	294 (78.8%)	79 (21.2%)
Brain tumor	55.8 (10.9)	52.0 (10.1)	56.5 (11.1)	56.5 (9.9)	53 (71.6%)	21 (28.4%)
Solid tumor, soft tissue tumors, other	52.6 (10.9)	50.9 (10.3)	53.5 (10.7)	52.8 (11.5)	122 (78.2%)	34 (21.8%)
	0.068	0.709	0.022	0.022		0.392
Reports current health problems						
No	52.2 (10.8)	49.3 (10.3)	51.8 (9.8)	51.6 (11.0)	223 (81.3%)	51 (18.7%)
Yes	53.6 (11.4)	52.5 (10.7)	55.0 (10.7)	54.6 (11.3)	239 (74.5%)	82 (25.5%)
	0.153	0.000	0.000	0.001		0.043

Table 4 continued

	Depression	Anxiety	Somatization	GSI	Caseness for Distress	
					No	Yes
Age at study[3]	-0.005	-0.021	-0.041	-0.018	27.0 (5.5) years	26.7 (5.3) years
	0.908	0.606	0.31	0.661		0.644
Age at diagnosis[3]	0.083	0.048	0.024	0.061	11.0 (6.1) years	11.8 (6.0) years
	0.042	0.241	0.552	0.138		0.14
Years since diagnosis[3]	-0.092	-0.072	-0.062	-0.084	16.1 (6.9) years	14.7 (7.2) years
	0.024	0.077	0.131	0.039		0.055

* Standardized T Scores for the BSI

ns Not statistically significant at $p < 0.05$

[1] includes those "on leave/disability," "unemployed," or "permanently unable to work"

[2] includes "full-time employment," "part-time employment," "student," or "homemaker"

[3] Pearson product-moment correlations used for bivariate comparisons to BSI-18 scores; means and standard deviations reported for the categorical "caseness" indicator of the BSI-18, and independent t tests used to determine statistically significant differences

Bonferroni adjustment for multiple and post-hoc comparisons

Abbreviations: Global Symptom Index (GSI)

childhood cancer. First, the negative impact score of the *IOC-CS* instrument had the greatest influence in terms of affecting distress and QOL relative to all other variables. The same was true for the positive impact score of the *IOC-CS* but only in its relationship to psychological distress and the mental health component of QOL, as measured by the SF-36. Furthermore, the inclusion of the positive and negative perception scores in the hierarchical regression models substantially increased the variance explained in QOL and distress outcomes.

When QOL scores are partitioned into physical and mental health components, as they are in scoring the SF-36, the relative impact of reporting health problems differs when examining its effect on physical health, in contrast to mental health and well-being. When accounting for negative and positive perceptions, survivors who reported having health problems for which they were seeing a doctor also reported significantly worse physical health. However, once accounting for survivors' subjective perceptions of how cancer has affected them in both positive and negative ways, the influence of reporting health problems was no longer a significant predictor of the mental health component score, and was significantly reduced in its influence on psychological distress. These data suggest that the *perception* of how much a health problem is impacting one's life is more important than the actual existence of the health problem.

This study is limited in that clinical characteristics derived from medical records or other objective sources (e.g., treatment modalities, treatment-related late effects) were not available to confirm respondent self-reports. Also, as is often the case with studies of long-term survivors (the median and average time since diagnosis in this sample was 16 years), the overall response rate was low relative to studies of patients in active treatment or survivors who recently completed therapy. The response rate reflects the difficulty in locating and recruiting a geographically-mobile young adult population that in most cases is many years beyond therapy and no longer living with their parents. We also observed that survivors of hematological cancers were over-represented when compared to non-respondents, while survivors of brain tumors, assumedly those who were too cognitively impaired to complete the survey, were under-represented. The differences in age at diagnosis and years since diagnosis, while statistically significant, did not appear to be meaningful in light of theories of human development, suggesting that the sample is representative of the population of long-term survivors of childhood cancer at least with regard to age and time since diagnosis. Yet, future studies utilizing more representative samples of the population of childhood cancer survivors are still needed.

Table 5 Bivariate comparisons of mean (and standard deviation) positive and negative impact of cancer scores by select independent variables

	Impact of Cancer 1–5	
	Positive	Negative
All respondents	3.6 (0.6)	2.2 (0.7)
Gender		
Female	3.61 (0.53)	2.26 (0.70)
Male	3.60 (0.60)	2.23 (0.70)
p-value	0.698	0.672
Race		
White, non-Hispanic	3.61 (0.56)	2.17 (0.67)
Hispanic/Latino	3.60 (0.61)	2.42 (0.73)
Other	3.59 (0.46)	2.31 (0.73)
	0.950	0.001
Employment		
Unoccupied	3.37 (0.60)	2.62 (0.78)
Employed/Occupied	3.64 (0.55)	2.19 (0.67)
	0.000	0.000
Education		
High School grad or less	3.52 (0.60)	2.42 (0.75)
Some college	3.61 (0.58)	2.30 (0.70)
4-year college grad	3.66 (0.51)	2.07 (0.64)
	0.108	0.000
Income		
≤$25,000	3.52 (0.59)	2.39 (0.73)
> $25,000	3.65 (0.55)	2.16 (0.67)
	0.011	0.000
Marital/relationship status		
No	3.54 (0.57)	2.30 (0.71)
Yes	3.68 (0.54)	2.18 (0.68)
	0.002	0.032
Cancer type		
Hematologic	3.64 (0.58)	2.22 (0.67)
Brain tumor	3.49 (0.55)	2.45 (0.72)
Solid tumor, soft tissue tumors, other	3.58 (0.58)	2.22 (0.75)
	0.092	0.031
Reports current health problems		
No	3.67 (0.58)	2.16 (0.69)
Yes	3.56 (0.54)	2.32 (0.71)
	0.017	0.004
Caseness for distress (from BSI)		
No = 469 (77.8%)	3.71 (0.52)	2.06 (0.59)
Yes = 134 (22.2%)	3.22 (0.54)	2.91 (0.64)
	0.000	0.000
Age at study[1]	−0.07 (0.079)	−0.06 (0.142)
Age at diagnosis[1]	0.04 (0.343)	0.07 (0.072)
Years since diagnosis[1]	−0.09 (0.033)	−0.13 (0.002)

Bonferroni adjustment for multiple comparisons

[1] Pearson product-moment correlations used for bivariate comparisons to positive and negative impact scores

Abbreviation: Brief Symptom Inventory (BSI)

Implications for clinical practice and future research

While we have discussed perceptions as antecedent to distress and QOL, we acknowledge that QOL or distress may conversely influence self-perception, thereby suggesting that psychotherapeutic or psychopharmacological interventions aimed at reducing distress symptoms may lead to changes in one's perceptions of how cancer has

Table 6 Multivariate hierarchical regression models examining simultaneous relationships of select independent variables and the Impact of Cancer to Physical Component Score (PCS) and Mental Component Score (MCS)

	PCS			MCS		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Gender (1 = male)	0.091*	0.082*	0.082*	0.035	0.019	0.024
Employment Status (1 = occupied)	0.211***	0.177***	0.176***	0.182***	0.120**	0.098**
Education (1 = some college)	0.117*	0.090	0.090	0.034	−0.014	−0.018
Education (1 = college grad)	0.194**	0.134*	0.134*	0.093	−0.015	−0.015
Marital/Relationship status (1 = yes)	0.048	0.033	0.030	0.122**	0.094*	0.054
Income (1 ≥ $25,000)	0.091*	0.076	0.075	0.079	0.051	0.040
Health problems (1 = yes)	−0.255***	−0.210***	−0.209***	−.137**	−0.057	−0.042
Age at Diagnosis	−0.127*	−0.125*	−0.123*	0.001	0.005	0.031
Years since Diagnosis	−0.037	−0.064	−0.060	−0.002	−0.050	0.012
Cancer type (1 = Brain tumor)	−0.054	−0.037	−0.036	0.006	0.036	0.049
Cancer type (1 = solid tumor)	−0.062	−0.070	−0.069	0.040	0.025	0.046
Impact of Cancer (NEG)		−0.264***	−0.256***		−0.476***	−0.351***
Impact of Cancer (POS)			0.018			0.302***
Model F value	10.02	13.34	12.31	4.86	17.80	22.45
Overall model significance	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Adjusted R²	0.16	0.22	0.22	0.08	0.28	0.35
Change in R²		0.06***	0.0		0.20***	0.07***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Standardized beta coefficients

affected their lives. However, regardless of whether interpretations or perceptions influence or are influenced by distress, interventions that achieve cognitive reframing of the cancer experience may be of benefit. Opportunities for survivors to re-frame or better understand the context of cancer in their lives may offer a potential to facilitate social (re)-engagement, normalization, and successful accomplishment of developmental tasks like finding a job or starting a career, completing school, starting a family, or dating. Since perceptions are maleable, cognitive behavioral therapy or peer support programs may potentially enhance psychological and QOL outcomes for childhood cancer survivors, as might psychotherapeutic or psychopharmacological interventions that address psychiatric symptoms directly.

We note that survivors were less likely to report positive and negative impacts of cancer, as well as distress symptoms, as they moved further in time from their cancer experience. Thus, the years just after completion of therapy may be the time of greatest risk for distress but also the greatest potential for assessing and addressing survivors' perceptions and experiences of the ways that cancer has disrupted their lives. Future research is needed to examine the potential effects of cognitive re-framing or peer support programs on psychosocial functioning and quality of life outcomes, and to answer the question of whether and when psychopharmacological or community-based psychosocial

support or vocational rehabilitation interventions, or some combination thereof, are most likely to result in increased QOL and reductions of psychological distress in this young adult survivor population.

Finally, we discuss these results in light of the realities of the US health care system and what is known about follow-up care for childhood cancer survivors. Adolescent and young adult access to psychotherapeutic and/or pharmacological treatments for clinical distress, and even medical treatment for late effects and other health problems, is limited by possession of health insurance. Combined with other factors that preclude childhood survivors from accessing or utilizing follow-up care (e.g., geographic mobility, belief that they do not need follow-up care) [50, 51], many survivors who may be in need do not benefit from biomedical and psychopharmacological interventions. Indeed, evidence suggests that many long-term survivors of childhood cancer do not receive adequate or appropriate long-term follow-up care [52–54]. In contrast, community-based and online services offering educational support, vocational rehabilitation, employment services and peer support are more easily accessible and certainly less costly to the survivor and to society, at large. These services may serve to facilitate achievement of developmental tasks, promote positive self-perceptions and reduce negative ones, and are more-easily delivered through community settings where young people find themselves (e.g., online/

Table 7 Multivariate hierarchical regression models examining simultaneous relationships of select independent variables and the Impact of Cancer to Distress (GSI)

	GSI		
	Model 1	Model 2	Model 3
Gender (1 = male)	0.046	0.071*	0.065
Employment Status (1 = occupied)	−0.172***	−0.094**	−0.075*
Education (1 = some college)	0.047	0.089	0.097*
Education (1 = college grad)	−0.054	0.060	0.062
Marital/Relationship status (1 = yes)	−0.173***	−0.145***	−0.115**
Income (1 ≥ $25,000)	−0.096*	−0.065	−0.053
Health problems (1 = yes)	0.177***	0.089*	0.077*
Age at Diagnosis	0.041	0.043	0.022
Years since Diagnosis	−0.036	0.030	−0.019
Cancer type (1 = Brain tumor)	0.059	0.032	0.024
Cancer type (1 = solid tumor)	−0.026	−0.001	−0.018
Impact of Cancer (NEG)		0.552***	0.443***
Impact of Cancer (POS)			−0.253***
Model F value	7.87	30.60	34.29
Overall model significance	<0.001	<0.001	<0.001
Adjusted R^2	0.12	0.40	0.45
Change in R^2		0.18***	0.05***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Standardized beta coefficients

Internet, schools, social settings). However, the mobilization of or referral to such support is not often initiated by clinicians and thereby left to survivors to locate or learn about on their own. Investigations that determine which survivor sub-groups might benefit from which types of programs and services are warranted.

Appendix 1: Impact of Cancer—CS, 45 items

Negative

Life challenges

1. Worry about health
2. Want to forget cancer
3. Wonder why I got cancer
4. Wonder why I survived

5. Something I did caused cancer
6. Angry about cancer
7. Cancer controls my life
8. Time is running out
9. Afraid to die
10. Worry I will die at young age
11. Missed out on life
12. Unsure about future

Thinking/memory problems

13. Easy to make decisions[a]
14. Easy to learn[a]
15. Hard time thinking
16. Trouble w/long-term memory
17. Trouble w/short-term memory

Financial problems

18. Financial problems from cancer
19. Parents financial problems from cancer
20. Trouble getting assistance/services

Positive

Body and health

21. Lead healthy life
22. Eat healthy diet
23. Exercise
24. Healthy as those w/o cancer
25. Believe I'm attractive
26. Like my body
27. Self-confident
28. Feel in control

Talking with parents

29. Can talk with mom about cancer
30. Can talk with dad about cancer
31. Mom comfortable talking about cancer w/me
32. Dad comfortable talking about cancer w/me

Personal growth

33. Cancer part of self
34. More mature than those without cancer
35. Special bond with others with cancer
36. Good things came from cancer
37. Learned about self

Health literacy

38. Know who to see for medical problems
39. Feel doctor knows cancer effects
40. Easy to talk to doctor about cancer
41. Have all cancer info I need
42. Know where to find cancer info

Socializing

43. Make friends easily
44. Avoid social activities[a]
45. Left out of friends' lives[a]

[a]Reverse scoring

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