Published in final edited form as:

Qual Life Res. 2010 September ; 19(7): 995–1005. doi:10.1007/s11136-010-9666-9.

Stress-Mediated Quality of Life Outcomes in Parents of Childhood Cancer and Brain Tumor Survivors: A Case-Control Study

Whitney P. Witt, PhD, MPH[†], Kristin Litzelman, BA[†], Lauren E. Wisk, BS[†], Hilary A. Spear, BA[†], Kris Catrine, MD[£], Nataliya Levin, BA[†], and Carissa A. Gottlieb, MS[†]

[†] Department of Population Health Sciences, School of Medicine and Public Health, University of Wisconsin, Madison

[£] American Family Childrens Hospital, School of Medicine and Public Health, University of Wisconsin, Madison

Abstract

Purpose—To determine if caring for a child with cancer or a brain tumor affects parental health and mental health and if and to what extent stress mediates the relationship between case status and parental quality of life.

Methods—In person interviewer-assisted surveys were administered to 74 case dyads (children diagnosed with cancer or a brain tumor and their parents) and 129 control dyads (children without health problems and their parents from a community sample) to assess health-related quality of life and perceived levels of stress.

Results—Parents of children with cancer or a brain tumor had significantly worse health-related quality of life, including worse overall mental health. Overall physical health was no different between cases and controls. Staged multivariate analysis revealed that worse health-related quality of life is completely mediated by perceived stress in these parents.

Conclusions—The experience of caring for a child with cancer is not in itself related to poor quality of life, but is related to an increased level of stress that may adversely impact parental mental health and quality of life.

Keywords

parents; parental caregivers; caregiver burden; stress; quality of life; health-related quality of life; SF-12; C-SOSI; childhood cancer; health; mental health

INTRODUCTION

Improvements in treatment and subsequent survival rates for childhood cancer have dramatically improved over the past 30 years, from less than 50% in the 1970s to between 70% and 96% in this millennium [1]. However, because children now survive for longer periods of time, they face long-term risks to their health and well-being [2], some of which may affect and be affected by their family functioning and parent role functioning. It is

All communications and reprint requests should be directed to: Whitney P. Witt, PhD, MPH, Assistant Professor, Department of Population Health Sciences, School of Medicine and Public Health, University of Wisconsin, Madison, 610 North Walnut Street, Office 503, Madison, WI 53726, Telephone: (608) 265-6290, Fax: (608) 263-2820, wwitt@wisc.edu.

Disclosure: None of the authors has a conflict of interest with this research.

therefore increasingly important to understand the impact of cancer on the family and how this may impact the health-related quality of life (QOL) and health outcomes of the parents of survivors.

Parental caregivers of cancer survivors often experience long-term psychological stress and related health effects. Though studies indicate that parental distress decreases over time after the child's diagnosis [3–6], some parents continue to experience high levels of anxiety, sleep disturbance, depression, and social isolation, as well as long-term feelings of loss of control [3,7]. One longitudinal study found that parents of cancer survivors reported elevated psychological distress 5 years after diagnosis [6] and another recent study reported that some forms of distress (uncertainty, disease-related fear, and loneliness) do not diminish over time [3,5]. In fact, in one study of mothers of children with cancer, loneliness was found to increase over time [8]. Therefore, distress associated with long-term caregiving experiences may persist long after diagnosis and treatment and may have a lasting impact on parental caregivers' health and mental health.

Witt and colleagues recently demonstrated that caring for a child with health problems profoundly affects the physical health and mental health of parents [9]. However, few studies on childhood cancer survivors have considered the long-term health consequences of the illness and its treatment for parental caregivers. Several studies report worse psychological QOL in parents of children with cancer when compared to population norms [10–12]; a similar effect was observed among mothers of children with leukemia compared to a group of control mothers [13]. However, these studies may be limited by (1) an inability to control for potential confounders, (2) the sole examination of mothers of children with cancer (rather than the primary caregiver), or (3) the lack of a control group. Moreover, to our knowledge, no study has examined stress in relation to QOL in parents of children with cancer.

Substantial theoretical and empirical work supports the concept that childhood chronic health conditions and functional impairments are major life stressors [14–17] and can spillover to impact the health of all family members [18]. As seen in Figure 1, the conceptual model for this evolving field incorporates social-ecological systems theory [14,19,20], role theory [21,22], and stress theory [15,23,24] to highlight these interrelationships.

This integration emphasizes several key processes that inform our research questions and hypotheses. First, social-ecological systems theory supports the idea that children and parents are nested within families and that stress on any person in the family system has a major influence on the health and functioning of all family members. In our model, we posit that the impact of caring for a child with a health problem can adversely influence the role functioning (i.e., work) of the parent (as supported by role theory). Changes or challenges to parental role functioning can lead to chronic stress if they do not have the internal or external resources to meet these demands. As stress theory and research has shown, the long-term effect of chronic stress can negatively impact health outcomes. This model illustrates that chronic stress in the parent as a result of caring for the child may mediate, in part, the relationship between child health status and poor QOL and well-being among these parents.

Based on the empirical and theoretical literature, this study evaluated whether self-reported stress mediates the relationship between caring for a child with cancer or brain tumor and parental QOL. We hypothesized that parents of children with cancer or brain tumor would have impaired QOL when compared with controls and that stress would help explain this

difference. This information will further facilitate the development of effective and sustainable interventions to improve the QOL of children with cancer and their families.

METHODS

Study design, population, and data sources

This research used a case-control design and enrolled parents and their children living with cancer or a brain tumor and a control group of parents and their healthy children. The parent who was the most involved in providing support and care to the child was recruited into the study. Parents in this study were defined as biological, step, adoptive or foster parents, grandparents, or legal guardians of the child.

Participants

Case dyads—Case dyads consisted of parents and their children living with cancer or a brain tumor (hereafter “cases”). Cases were eligible to participate in the study if the child (aged 2–18) was currently or previously receiving care for cancer or brain tumor at a local pediatric hematology and oncology clinic, as determined from the medical record or clinic database. This clinic is part of a university affiliated and National Cancer Institute designated Comprehensive Cancer Center. Eligible families were invited to participate by clinical staff if they attended one of the following during the study period: (1) the child’s cancer or brain tumor outpatient visit or inpatient stay at the hospital; (2) a parent-provider advisory board meeting; (3) the hospital support groups for parents; or (4) a childhood cancer survivor reunion. Families were approached in person by clinicians participating in study recruitment, who informed the families about the study, provided them with an informational letter, and asked them to complete and return a participation interest form which confirmed whether or not the family was interested in participating. In addition, clinical staff mailed an invitation letter to eligible families in the clinic’s patient database who could not be contacted in person (either because they did not attend an appointment, advisory board meeting, support group, or reunion during the study period, or could not be approached in person during their visit), requesting that they complete and return the participation interest form. Interested participants were then contacted by research staff via telephone to confirm eligibility and schedule their study participation.

Of the 162 case families invited to participate in the study, 24 did not respond to the invitation, 46 declined to participate, 2 were ineligible due to their child’s age (> 18 years), and 8 could not be scheduled to participate before the end of the study period. Eighty families (49%) ultimately participated. Of those, 6 surveys were missing data and were removed from this analysis, resulting in a final sample of 74 cases.

Control dyads—Unmatched control dyads consisted of healthy children (aged 2–18) and their parents (hereafter “controls”). Controls were recruited from two community-based research registries. Children’s names were selected from the registry databases, and their families were mailed an informational letter by research staff inviting them to participate and asking them to complete and return a participation interest form. Families who responded and expressed interest in participating were contacted by phone and screened for eligibility based on the health status of all of the children in the family. Families who did not respond to the mailing within 3 weeks were also contacted by phone and asked about participation in the study, and interested families were screened for eligibility. Families in which one or more children reported having cancer, a brain tumor, a chronic condition, or an activity limitation or special healthcare need were excluded from the study.

Of the 768 control families invited to participate in the study, 344 responded to the invitation. Of these, 122 declined to participate, 50 were not eligible based on the health of one of the children in the family, and 31 could not be scheduled for participation before the end of the study period. 141 (41%) eligible control families ultimately participated. 12 participants were removed from this analysis due to missing data, resulting in a final sample of 129 unmatched controls.

Procedures

This study was approved by the Health Sciences Institutional Review Board of the University of Wisconsin-Madison. Written informed consent was obtained from all participants; case participants also provided written Health Insurance Portability and Accountability Act Privacy Rule (HIPAA) authorization for abstraction of the child's medical record. All participating parents completed an in person interviewer-assisted survey that included items about sociodemographic characteristics, health behaviors, and a series of validated self-reported measures. Interviews were completed between September 2008 and July 2009.

Measures

Outcome measure—The *Short Form-12* (SF-12) version 2, a widely used measure of health status, was used to assess the overall health-related QOL of the parents [25–27]. The *Short Form-12* has eight subscales that can be condensed into two summary scales: the physical health component score (PCS) and the mental health component score (MCS). The test-retest reliability for the summary scores is 0.89 and 0.76, respectively [26].

Independent variables—The caregivers' perceptions of stress symptoms in the week prior to the interview were measured using the 56-item Calgary Symptoms of Stress Inventory (C-SOSI) [28]. The C-SOSI has 8 subscales (depression, anger, muscle tension, cardiopulmonary arousal, sympathetic arousal, neurological/GI, cognitive disorganization, and upper respiratory symptoms) and explores both physical and psychological manifestations of stress. Responses for the C-SOSI are recorded on a 5-point Likert scale ranging from 0 (never) to 4 (very frequently) and summed across subscales. Internal consistency for the subscales ranges from 0.80 to 0.92, with an overall Cronbach's $\alpha = 0.95$ for cancer patients [28].

Perception of stress over the last month was measured using the 4-item version of the *Perceived Stress Scale* (PSS). Responses for the PSS 4 are recorded on a five-point Likert scale ranging from 0 (never) to 4 (very often) and summed across the four items to provide a total score. An individual yielding a higher score is considered to perceive more stress [29,30].

Sociodemographics and health behaviors—Age, gender, marital/partner status (partner/married or no partner/unmarried), race (white or non-white), Hispanic heritage (yes or no), educational attainment (some high school or less/high school graduate or GED; vocational college or some college; college degree; or professional or graduate degree), employment status (full-time work outside of the home; part-time work outside of the home; or not working outside the home), relationship to the child (biological versus adoptive, foster, or step parent, or grandparent), number of people in the household, and family income (mean and income tertiles), as well as smoking status, alcohol consumption, and exercise were evaluated in the survey. Smoking was categorized as non-smokers (had not smoked more than 100 cigarettes in their life), current smokers (smoked more than 100 cigarettes in their life and currently smoked some days or every day), or former smokers (smoked more than 100 cigarettes in their life but reported that they currently do not smoke).

at all). For alcohol consumption, participants were categorized as non-drinkers (reporting no alcohol consumption in the last year), moderate drinkers (women reporting less than 8 drinks per week or men reporting less than 15 drinks per week in the past year), or risky drinkers (women reporting 8 or more drinks per week or men reporting 15 or more drinks per week in the past year). Parents' exercise was categorized as inactive (reporting no leisure-time physical activity), active-irregular (reporting moderate or vigorous leisure-time physical activity but did not meet the definition of active-regular), or active-regular (reporting moderate leisure-time physical activity at least 5 times per week for 30 min or vigorous leisure-time physical activity at least 3 times per week for 20 min).

In addition, parents were administered validated self-reported measures of diet [31], sleep quality [32], somatization [33], negative life events [34], family functioning [35], and social support and stress [36]. Parent diet was collapsed into summary categories: meets national guidelines (participant reported consuming at least 5 fruits or vegetables per day and less than 35% of calories from fat) or does not meet national guidelines. Poor parental sleep quality was defined as scoring greater than 5 on the Pittsburgh Sleep Quality Index. All remaining measures were scored according to the validation studies as noted previously and for this study, mean values were used.

Parents were asked to report their child's age and gender in the survey. Key diagnosis and treatment variables were abstracted from the child's medical record by a trained and licensed clinician. These factors included type of cancer (leukemia/lymphoma, central nervous system (CNS) tumor, or non-CNS tumor), treatment status at the time of the interview (active/maintenance treatment or off treatment), time since diagnosis (time between date of diagnosis and date of interview), and any type of treatment received (chemotherapy, radiation, surgery, and/or transplant).

Analytic approach

Cross-tabulations and chi-square analyses were used to examine the relationship between cases and controls on parental sociodemographic and health behavior characteristics, and psychosocial factors. T-tests were performed to test for mean differences for parental QOL and stress between case and control parents.

Multiple linear regression analyses were conducted to evaluate the association between the case-control status and parental QOL, controlling for sociodemographics, health behavior, and psychosocial factors, as well as child age and gender (as presented in Table 2). Parsimonious models were constructed using simple linear regression. Specifically, single covariates that were statistically significant ($P < 0.05$) or impacted the QOL point estimate for case status (change in estimate $> 10\%$) were included in the final models (Model 1). For each outcome (mental health-related QOL and physical health-related QOL), self-reported stress variables were then added to Model 1 to test if stress mediated the relationship between case-control status and parental QOL (Model 2).

Results

The final sample included 203 parents, of whom 36.5% were parents caring for a child with cancer or a brain tumor ("case parents") and 63.5% were parents caring for a healthy child ("control parents"). Most were biological parents; the remainder was adoptive, step- or foster parents, or grandparents. All parents were living with the child at the time of the interview (data not shown).

The first set of analyses compared parents of children with cancer or brain tumors and parents of healthy children on key sociodemographic, health behaviors, support, family

functioning, and stress characteristics (Table 2). Case parents were more likely to be younger (40.85 vs. 42.81 years on average), less educated, and have a lower mean income (\$83,832 vs. \$123,450) when compared with control parents. These parents were also more likely to be current smokers (17.6% vs. 3.9%), engage in less regular exercise (48.6% vs. 66.7%), and have poor-quality sleep (54.1% vs. 23.3%). Case parents reported lower levels of social support and worse family functioning when compared with their control counterparts. Symptoms of stress, perceived stress, somatization, and negative life events were all more likely in case parents, as indicated by higher mean scores when compared with controls. There were no significant differences in parental gender, marital/partner status, race, Hispanic heritage, current employment status, their relationship to the child, the mean number of people in the household, alcohol consumption, diet, and social stress by case-control status.

Children with cancer or brain tumors did not significantly differ from healthy controls on age or gender (Table 3). Of the case children, almost half were diagnosed with leukemia or lymphoma, and over one-third were on active or maintenance treatment at the time of participation in the study. Time since diagnosis ranged from a few months to more than 14 years. Median time since diagnosis was approximately 3 years. Most children had received chemotherapy as part of their treatment.

Figure 2 shows the unadjusted health-related QOL among case and control parents. Compared with controls, cases had significantly lower QOL in all domains, except bodily pain. Case parents had significantly worse mental health but not physical health when compared with controls (norm-based mean MCS Score: 45.3 vs. 52.3, respectively; $P < 0.0001$).

To further evaluate the impact of case-control status on QOL, multivariate linear regression models were performed separately for the MCS and PCS of the SF-12. Multivariate analysis (Table 4) showed that on average, the case parents had significantly lower QOL (3.1 points lower; $P < 0.01$) on the mental health component summary score of the SF-12, accounting for potential confounders. As a second step in this regression, we added stress symptoms and perceived stress to the model to determine if stress mediated the relationship between case-control status and poor mental health. When stress symptoms and perceived stress were included in the model of poor mental health, the effect of being a case was eliminated and no longer statistically significant (Beta: -0.90 ; $P = 0.3445$). A separate regression analysis was performed to examine the impact of case-control status on physical health. This analysis revealed that case-control status was not significantly related to poor physical QOL (data available upon request).

COMMENT

This study of the impact of childhood cancer and brain tumors on parental QOL confirms previous research and contributes important new findings to the literature. Our results show that parents of children with cancer or brain tumors have worse health behaviors, lower levels of social support and family functioning, and greater stress than their control counterparts, confirming the findings of previous studies [37–39]. Our finding of worse parental mental health among parents of children with cancer also substantiates other studies from Canada [12], England [11] and Japan [13]. Reports of physical health QOL in these studies have been less consistent [11–13], with some results indicating a significant difference between parental caregivers and population norms on bodily pain or general health perception, while others were unable to find such differences. However, most children in these studies, as in the present study, had been recently diagnosed (less than 2 or 3 years). Among Taiwanese parents of children with brain tumors, those who were greater

than 5 years from diagnosis reported worse physical health scores than parents of children closer to initial diagnosis [10]. This indicates that physical health problems may manifest over a longer period of time, thereby potentially limiting our ability to accurately observe such problems in samples with a higher proportion of parents of children who were recently diagnosed.

To our knowledge, the present study is the first to examine the role of perceived and physiological symptoms of stress with respect to the QOL of parents of children with cancer or brain tumors. Our results suggest that stress mediates the relationship between caring for a child with cancer or brain tumor and mental health-related QOL. This indicates that the experience of caring for a child with cancer is not directly related to poor quality of life, but rather is related to the increased level of stress experienced by these parents (for example, due to hospital appointments, invasive procedures, and disease-related uncertainty), which in turn may impact parental QOL outcomes. Stress prevention, management, and reduction may be important points of intervention to improve the QOL of these parents, and potentially impact the long-term health and well-being of both parent and child.

The study's findings have important health, clinical, and policy implications for parents of children with cancer or brain tumors. First, failing to mitigate the negative effects of stress could result in adverse health and mental health outcomes. In fact, caregiving stress has been shown to impair parents' immune response to anti-inflammatory signals [40], and studies in the aging literature report that caregiving is associated with long-term endocrine and immune dysregulation among spouses of elderly patients [41–47]. This immune dysregulation in response to chronic stress can persist for years even after the caregiving ends [48]. Some parents of children who have survived cancer are also known to suffer long-term psychological effects, including post-traumatic stress disorder [49–52], and as a result may experience negative health effects [53,54]. As such, parents may be at risk for serious, negative health outcomes if their stress levels, and subsequent mental and physical health, are not monitored and treated.

While clinicians may be aware of the stress and reduced QOL experienced by parents of pediatric cancer patients, the implementation of systematic health and mental health screening may allow providers to identify parents who are most in need of support services. Pediatric oncology programs often provide support through licensed clinical social workers and health psychologists [55–58]; however, these services are often primarily focused on the child. Screening of parental caregivers of pediatric cancer patients and subsequent referral to external sources of mental health care or to the parent's primary care provider have been shown to be feasible [59] and may further improve parental outcomes. Moreover, research in mothers shows that they would be open to such assistance [60]. Policies that support child health professionals in parental screening and referrals, and reimbursement for such care, may help ensure that parental health and mental health needs are addressed.

In the hospital setting, targeted support and coping interventions have been shown to improve well-being in some parents [61,62]. External interventions, such as parent-to-parent support programs and summer camp respite care, have also been shown to improve parental psychosocial outcomes [63,64]. Although the evidence to support intervention programs is encouraging, further investigation into current programs and the development of novel approaches are clearly necessary.

This study has several limitations. First, the cross-sectional study design does not permit investigation into causality. As such, the relationship between stress and QOL could not be fully explored. Future studies will incorporate longitudinal data to better understand the

direction of these relationships. Furthermore, our findings may not be generalizable to other populations, and additional studies are needed to test the external validity of this research.

The present study has important strengths both methodologically and substantively. First, we recruited a community control group and controlled for known confounders in the analyses. Second, this study specifically examines the role of stress and therefore provides important insight into the potential mechanisms by which caring for a child with cancer adversely impacts parental QOL. This information will be critical in designing and implementing effective and sustainable interventions to support parents who are experiencing stress, which may ultimately prevent poor QOL outcomes.

Future research

Future research is needed to examine how cancer-specific factors may be particularly related to parental stress and QOL. In addition, longitudinal studies are needed to evaluate the temporality of this relationship and to determine important predictors of stress and coping. While this study did not find a relationship between caring for a child with cancer and overall physical QOL, we anticipate that the physical effects of caring for a child with cancer would not manifest until years after the initial stressor. Additional studies examining parents of long-term survivors may clarify whether the stress of caregiving exacts a physical toll on parents. Moreover, future research should evaluate the effectiveness, feasibility, and sustainability of stress reduction and coping techniques on parental stress and QOL.

CONCLUSION

In conclusion, this study extends previous clinical and population-based research on the impact of childhood cancer on the family by examining the role of stress on parental QOL in a sample of parents of children with cancer/brain tumors and community controls. The findings show that stress completely mediates the effect of being a parent of a child with cancer on parental mental health-related QOL, underscoring the importance of understanding how stress impacts parental QOL outcomes. This information is critical for effectively intervening with families and could ultimately help to improve health outcomes for children with cancer, reduce health disparities among these children, and address the health of parents and families of children with cancer.

Acknowledgments

We would like to thank the families who participated in this study, as well as the clinical and research staff who were instrumental to study recruitment. This research was supported by a grant from the National Institute of Child Health and Human Development (HD049533, W. P. Witt, Principal Investigator and Waisman Center P30 HD03352, M. M. Seltzer, Principal Investigator), UW Comprehensive Cancer Center Investigator Initiated Trial, and the UW Care for Kids Foundation.

Abbreviation

QOL Quality of life

References

1. American Cancer Society. Cancer Facts and Figures 2009. Atlanta: American Cancer Society; 2009.
2. Robison LL, Green DM, Hudson M, Meadows AT, Mertens AC, Packer RJ, et al. Long-term outcomes of adult survivors of childhood cancer. *Cancer* 2005;104(11 Suppl):2557–2564. [PubMed: 16247780]
3. Boman K, Lindahl A, Bjork O. Disease-related distress in parents of children with cancer at various stages after the time of diagnosis. *Acta Oncologica* 2003;42(2):137–146. [PubMed: 12801132]

4. Maurice-Stam H, Oort FJ, Last BF, Grootenhuis MA. Emotional functioning of parents of children with cancer: the first five years of continuous remission after the end of treatment. *Psychooncology* 2008;17(5):448–459. [PubMed: 17828715]
5. Norberg AL, Boman KK. Parent distress in childhood cancer: a comparative evaluation of posttraumatic stress symptoms, depression and anxiety. *Acta Oncologica* 2008;47(2):267–274. [PubMed: 17851875]
6. Wijnberg-Williams BJ, Kamps WA, Klip EC, Hoekstra-Weebers JE. Psychological adjustment of parents of pediatric cancer patients revisited: five years later. *Psychooncology* 2006;15(1):1–8. [PubMed: 15880477]
7. Van Dongen-Melman JE, Sanders-Woudstra JA. Psychosocial aspects of childhood cancer: a review of the literature. *The Journal of Child Psychology and Psychiatry* 1986;27(2):145–180.
8. Grootenhuis MA, Last BF. Predictors of parental emotional adjustment to childhood cancer. *Psychooncology* 1997;6(2):115–128. [PubMed: 9205969]
9. Witt W, Gottlieb C, Hampton J, Litzelman K. The impact of childhood activity limitations on parental health, mental health, and workdays lost in the United States. *Academic Pediatrics* 2009;9(4):263–269. [PubMed: 19487173]
10. Chien LY, Lo LH, Chen CJ, Chen YC, Chiang CC, Chao YMY. Quality of life among primary caregivers of Taiwanese children with brain tumor. *Cancer Nursing* 2003;26(4):305–311. [PubMed: 12886121]
11. Eiser C, Eiser JR, Stride CB. Quality of life in children newly diagnosed with cancer and their mothers. *Health and Quality of Life Outcomes* 2005;3:29. [PubMed: 15860126]
12. Klassen AF, Klaassen R, Dix D, Pritchard S, Yanofsky R, O'Donnell M, et al. Impact of caring for a child with cancer on parents' health-related quality of life. *Journal of Clinical Oncology* 2008;26(36):5884–5889. [PubMed: 19029424]
13. Yamazaki S, Sokejima S, Mizoue T, Eboshida A, Fukuhara S. Health-related quality of life of mothers of children with leukemia in Japan. *Quality of Life Research* 2005;14(4):1079–1085. [PubMed: 16041903]
14. Moos, RH. Coping with physical illness. New York, NY: Plenum; 1977. p. xiip. 440
15. Patterson, JM. A family stress model: The family adjustment and adaptation response. In: Ramsey, CN., Jr, editor. *Family systems in medicine*. New York, NY, USA: Guilford Press; 1989. p. 95-118.
16. Patterson J, Garwick A. Levels of family meanings in family stress theory. *Family Process* 1994;33:287–304. [PubMed: 7828712]
17. Wallander, JL.; Varni, JW. Adjustment in children with chronic physical disorders: Programmatic research on a disability-stress-coping model. In: La Greca, AM.; Siegel, LJ., editors. *Stress and coping in child health. Advances in pediatric psychology*. New York, NY, USA: The Guilford Press; 1992. p. 279-298.
18. Witt W, DeLeire T. A Family Perspective on Population Health: The Case of Child Health and the Family. *Wisconsin Medical Journal* 2009;108(5):240–245. [PubMed: 19743754]
19. Pless, IB.; Pinkerton, P. *Chronic childhood disorder: Promoting patterns of adjustment*. London: H. Kimpton; 1975.
20. Bronfenbrenner, U. *The Ecology of Human Development: Experiments by Nature and Design*. Cambridge, MA: Harvard University Press; 1979.
21. Biddle, B. *Role Theory: Expectations, Identities and Behaviours*. New York: Academic Press; 1979.
22. Major DA. Utilizing role theory to help employed parents cope with children's chronic illness. *Health Education Research* 2003;18(1):45–57. [PubMed: 12608683]
23. House JS. Occupational stress and coronary heart disease: A review and theoretical integration. *Journal of Health and Social Behavior* 1974;15(1):12–27. [PubMed: 4618851]
24. McEwen BS. Protective and damaging effects of stress mediators. *N Engl J Med* 1998;338(3):171–179. [PubMed: 9428819]
25. Brooks R. EuroQol: the current state of play. *Health Policy* 1996;37(1):53–72. [PubMed: 10158943]

26. Ware J Jr, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical Care* 1996;34(3):220–233. [PubMed: 8628042]
27. Ware JE Jr. SF-36 health survey update. *Spine* 2000;25(24):3130–3139. [PubMed: 11124729]
28. Carlson LE, Thomas BC. Development of the calgary symptoms of stress inventory (c-sosi). *International Journal of Behavioral Medicine* 2007;14(4):249–256. [PubMed: 18001241]
29. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *Journal of Health and Social Behavior* 1983;24(4):385–396. [PubMed: 6668417]
30. Williams ES, Konrad TR, Linzer M, McMurray J, Pathman DE, Gerrity M, et al. Refining the measurement of physician job satisfaction: results from the Physician Worklife Survey. SGIM Career Satisfaction Study Group. Society of General Internal Medicine. *Medical Care* 1999;37(11):1140–1154. [PubMed: 10549616]
31. Thompson FE, Midthune D, Subar AF, Kahle LL, Schatzkin A, Kipnis V. Performance of a short tool to assess dietary intakes of fruits and vegetables, percentage energy from fat and fibre. *Public Health Nutrition* 2004;7(8):1097–1105. [PubMed: 15548349]
32. Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh Sleep Quality Index. *Journal of Psychosomatic Research* 1998;45(1 Spec):5–13. [PubMed: 9720850]
33. Fink P, Ewald H, Jensen J, Sorensen L, Engberg M, Holm M, et al. Screening for somatization and hypochondriasis in primary care and neurological in-patients: a seven-item scale for hypochondriasis and somatization. *Journal of Psychosomatic Research* 1999;46(3):261–273. [PubMed: 10193917]
34. Norbeck JS. Modification of recent life event questionnaires for use with female respondents. *Research in Nursing and Health* 1984;7:61–71. [PubMed: 6565302]
35. Olson, DH.; Gorall, DM. Circumplex model of marital and family systems. In: Walsh, F., editor. *Normal Family Processes*. New York: Guilford; 2003. p. 514–547.
36. Parkerson GR Jr, Broadhead WE, Tse CK. Validation of the Duke Social Support and Stress Scale. *Family Medicine* 1991;23(5):357–360. [PubMed: 1884930]
37. Fotiadou M, Barlow JH, Powell LA, Langton H. Optimism and psychological well-being among parents of children with cancer: an exploratory study. *Psychooncology* 2008;17(4):401–409. [PubMed: 17828706]
38. Lahteenmaki PM, Sjoblom J, Korhonen T, Salmi TT. The life situation of parents over the first year after their child's cancer diagnosis. *Acta Paediatrica* 2004;93(12):1654–1660. [PubMed: 15841776]
39. Smith AW, Baum A, Wing RR. Stress and weight gain in parents of cancer patients. *International Journal of Obesity* 2005;29(2):244–250. [PubMed: 15654361]
40. Miller GE, Cohen S, Ritchey AK. Chronic psychological stress and the regulation of pro-inflammatory cytokines: a glucocorticoid-resistance model. *Health Psychology* 2002;21(6):531–541. [PubMed: 12433005]
41. Cacioppo JT, Poehlmann KM, Kiecolt-Glaser JK, Malarkey WB, Burleson MH, Berntson GG, et al. Cellular immune responses to acute stress in female caregivers of dementia patients and matched controls. *Health Psychology* 1998;17(2):182–189. [PubMed: 9548709]
42. Hadjiconstantinou M, McGuire L, Duchemin AM, Laskowski B, Kiecolt-Glaser J, Glaser R. Changes in plasma nerve growth factor levels in older adults associated with chronic stress. *Journal of Neuroimmunology* 2001;116(1):102–106. [PubMed: 11311335]
43. Kiecolt-Glaser JK, Dura JR, Speicher CE, Trask OJ, Glaser R. Spousal caregivers of dementia victims: longitudinal changes in immunity and health. *Psychosomatic Medicine* 1991;53(4):345–362. [PubMed: 1656478]
44. Kiecolt-Glaser JK, Glaser R, Gravenstein S, Malarkey WB, Sheridan J. Chronic stress alters the immune response to influenza virus vaccine in older adults. *Proceedings of the National Academy of Sciences* 1996;93(7):3043–3047.
45. Kiecolt-Glaser JK, Glaser R, Shuttlesworth EC, Dyer CS, Ogrocki P, Speicher CE. Chronic stress and immunity in family caregivers of Alzheimer's disease victims. *Psychosomatic Medicine* 1987;49(5):523–535. [PubMed: 3671639]

46. Kiecolt-Glaser JK, Preacher KJ, MacCallum RC, Atkinson C, Malarkey WB, Glaser R. Chronic stress and age-related increases in the proinflammatory cytokine IL-6. *Proceedings of the National Academy of Sciences* 2003;100(15):9090–9095.
47. Wu H, Wang J, Cacioppo JT, Glaser R, Kiecolt-Glaser JK, Malarkey WB. Chronic stress associated with spousal caregiving of patients with Alzheimer's dementia is associated with downregulation of B-lymphocyte GH mRNA. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 1999;54(4):M212–215.
48. Esterling BA, Kiecolt-Glaser JK, Glaser R. Psychosocial modulation of cytokine-induced natural killer cell activity in older adults. *Psychosomatic Medicine* 1996;58(3):264–272. [PubMed: 8771626]
49. Barakat LP, Kazak AE, Meadows AT, Casey R, Meeske K, Stuber ML. Families surviving childhood cancer: a comparison of posttraumatic stress symptoms with families of healthy children. *Journal of Pediatric Psychology* 1997;22(6):843–859. [PubMed: 9494321]
50. Norberg AL, Boman KK. Parent distress in childhood cancer: a comparative evaluation of posttraumatic stress symptoms, depression and anxiety. *Acta Oncologica* 2008;47(2):267–274. [PubMed: 17851875]
51. Pöder U, Ljungman G, von Essen L. Posttraumatic stress disorder among parents of children on cancer treatment: a longitudinal study. *Psychooncology* 2008;17(5):430–437. [PubMed: 17847123]
52. Stuber ML, Kazak AE, Meeske K, Barakat LP. Is posttraumatic stress a viable model for understanding responses to childhood cancer? *Child and Adolescent Psychiatric Clinics of North America* 1998;7(1):169–182. [PubMed: 9894086]
53. Spitzer, C.; Barnow, S.; Völzke, H.; John, U.; Freyberger, HJ.; Grabe, HJ. Psychosomatic Medicine. 2009. Trauma, Posttraumatic Stress Disorder, and Physical Illness: Findings from the General Population. [Epub ahead of print]
54. Breslau N. Epidemiologic studies of trauma, posttraumatic stress disorder, and other psychiatric disorders. *Canadian Journal of Psychiatry* 2002;47(10):923–929.
55. Ganz PA, Casillas J, Hahn EE. Ensuring quality care for cancer survivors: implementing the survivorship care plan. *Seminars in Oncology Nursing* 2008;24(3):208–217. [PubMed: 18687267]
56. Zebrack B. Information and service needs for young adult cancer patients. *Support Care Cancer* 2008;16(12):1353–1360. [PubMed: 18386075]
57. Zebrack B. Information and service needs for young adult cancer survivors. *Support Care Cancer* 2009;17(4):349–357. [PubMed: 18543006]
58. Zebrack BJ, Mills J, Weitzman TS. Health and supportive care needs of young adult cancer patients and survivors. *Journal of Cancer Survivorship* 2007;1(2):137–145. [PubMed: 18648954]
59. Olson AL, Dietrich AJ, Prazar G, Hurley J. Brief maternal depression screening at well-child visits. *Pediatrics* 2006;118(1):207–216. [PubMed: 16818567]
60. Kahn RS, Wise PH, Finkelstein JA, Bernstein HH, Lowe JA, Homer CJ. The scope of unmet maternal health needs in pediatric settings. *Pediatrics* 1999;103(3):576–581. [PubMed: 10049959]
61. Burke SO, Harrison MB, Kauffmann E, Wong C. Effects of stress-point intervention with families of repeatedly hospitalized children. *Journal of Family Nursing* 2001;7(2):128.
62. Dellve L, Samuelsson L, Tallborn A, Fasth A, Hallberg L. Stress and well-being among parents of children with rare diseases: a prospective intervention study. *Journal of Advanced Nursing* 2006;53(4):392–402. [PubMed: 16448482]
63. Ainbinder JG, Blanchard LW, Singer GHS, Sullivan ME, Powers LK, Marquis JG, et al. A qualitative study of parent to parent support for parents of children with special needs. *Journal of Pediatric Psychology* 1998;23(2):99. [PubMed: 9585636]
64. Meltzer LJ, Bennett Johnson S. Summer camps for chronically ill children: a source of respite care for mothers. *Children's Health Care* 2004;33(4):317–331.

Figure 1.
Conceptual Model of the Impact of Child Health Status on Parental Quality of Life and Well-Being

Figure 2.
Unadjusted Health-related Quality of Life (SF-12) Among Cases and Controls

Table 1

Summary of Concepts, Measures and Scales of Key Outcomes and Mediators

Concept	Measure	Scales (# of items)
Outcome		
Quality of Life	Short Form-12(SF-12)	Physical Component Summary
		Physical Functioning (2)
		Role -Physical (2)
		Bodily Pain (1)
		General Health (1)
		Mental Component Summary
		Vitality (1)
		Social Functioning (1)
		Role -Emotional (2)
		Mental Health (2)
Measures of Self-Reported Stress		
Symptoms of Stress	Calgary Symptoms of Stress Inventory(C-SOSI)	C-SOSI Total Score
		Depression (8)
		Anger (7)
		Muscle Tension (8)
		Cardiopulmonary Arousal (6)
		Sympathetic Arousal (9)
		Neurological/GI (6)
		Cognitive Disorganization (6)
Perception of Stress	Perceived Stress Scale (PSS 4)	Upper Respiratory Symptoms (6)
		PSS Total Score (4)

Table 2

Characteristics of Parents of Children with and without Cancer or Brain Tumors

	<u>Case</u>	<u>Control</u>	
	<u>%/Mean(SD)</u>	<u>%/Mean(SD)</u>	
Number of Participants (%)	203 (100%)	74 (36.5%)	129 (63.5%)
<i>Sociodemographic Factors</i>			
Age, mean (SD)	40.85 (6.46)	42.81 (5.99)	*
Gender, %			NS
Male	8.1%	12.4%	
Female	91.9%	87.6%	
Marital/Partner Status, %			NS
Partner/married	91.9%	97.7%	
No partner/unmarried	8.1%	2.3%	
Race, %			NS
White	93.2%	97.7%	
Non-white	6.8%	2.3%	
Hispanic Heritage, %			NS
Yes	2.7%	1.6%	
No	97.3%	98.4%	
Highest education level achieved, %			*
Some high school or less/High school graduate or GED	13.5%	4.7%	
Vocational college or some college	32.4%	20.2%	
College degree	29.7%	41.1%	
Professional or graduate degree	24.3%	34.1%	
Current employment status, %			NS
Full-time work outside of the home	47.3%	46.5%	
Part-time work outside of the home	35.1%	38.0%	
Not working outside the home	17.6%	15.5%	
Relationship to child, %			NS
Biological parent	95.9%	96.9%	
Adoptive/foster parent, stepparent, or grandparent	4.1%	3.1%	
Number of People in Household, mean (SD)	4.30 (1.14)	4.25 (0.87)	NS
Income, mean (SD)	83832 (44511)	123450 (119744)	***
Income (tertiles), %			*
Low	41.9%	24.8%	
Medium	31.1%	36.4%	
High	27.0%	38.8%	
<i>Health Behaviors</i>			
Smoking Status, %			**
Non-smoker	63.5%	79.8%	
Current smoker	17.6%	3.9%	

	<u>Case</u>	<u>Control</u>	
	<u>%/Mean(SD)</u>	<u>%/Mean(SD)</u>	
Former Smoker	18.9%	16.3%	
Alcohol Consumption, %			NS
Non-Drinker	9.5%	5.4%	
Moderate Drinker	87.8%	89.9%	
Risky Drinker	2.7%	4.7%	
Exercise, %			*
Inactive	4.1%	1.6%	
Active-irregular	47.3%	31.8%	
Active-regular	48.6%	66.7%	
Diet, %			NS
Meets national guidelines	24.3%	31.8%	
Does not meet national guidelines	75.7%	68.2%	
Sleep, %			****
Poor sleep quality (in the past month)	54.1%	23.3%	
<i>Psychosocial Factors</i>			
Somatization, mean (SD)	1.23 (1.49)	0.38 (0.91)	****
Conviction	0.53 (0.81)	0.26 (0.60)	*
Worrying	0.42 (0.74)	0.05 (0.21)	****
Negative Life Events, mean (SD)	9.89 (10.15)	4.59 (5.24)	****
Family Functioning mean (SD)			***
Total Ratio	2.02 (0.57)	2.35 (0.60)	
Social Support and Stress, mean (SD)			
Total Social Support	67.57 (18.63)	73.40 (16.48)	*
Total Social Stress	21.81 (12.02)	21.60 (12.51)	NS
<i>Stress and Health Related Quality of Life</i>			
Symptoms of stress, mean (SD)	36.64 (23.83)	18.23 (13.89)	****
Perceived Stress, mean (SD)	4.74 (2.89)	2.65 (2.29)	****

*
 $p < .05$;

**
 $p < .01$;

 $p < .001$;

 $p < .0001$;

NS= $p > 0.05$; SD=standard deviation

Table 3

Characteristics of Children with and without Cancer or Brain Tumors

	<u>Case</u>	<u>Control</u>	
	<u>%/Mean or Median (SD)</u>	<u>%/Mean or Median(SD)</u>	
Number of Participants (n)	74	129	
<i>Sociodemographic Factors</i>			
Age, mean (SD)	9.88 (4.95)	9.43 (3.96)	NS
Gender, %			NS
Male	52.7%	48.1%	
Female	47.3%	51.9%	
<i>Health characteristics</i>			
Diagnosis, %			NA
Leukemia/lymphoma	47.2%	-	
CNS tumor	36.1%	-	
Non-CNS tumor	16.7%	-	
Treatment Status, %			NA
Active/maintenance	37.5%	-	
Off treatment	62.5%	-	
Median time since diagnosis	2.96 (4.12)		NA
Time since diagnosis, %			
<1 year	23.0%	-	
1–2 years	27.0%	-	
3–4 years	12.2%	-	
5–9 years	24.3%	-	
10 or more years	13.5%	-	
Type of Treatment, % [†]			NA
Chemotherapy	87.5%	-	
Radiation	20.3%	-	
Surgery	51.4%	-	
Transplant	6.9%	-	

NS= $p>0.05$; NA=not applicable; SD=standard deviation; CNS=Central Nervous System;[†]Note: categories are not mutually exclusive

Table 4

Multivariate model of mental health by characteristics of parents of children with and without cancer or brain tumors

	Mental Component Summary					
	Model 1			Model 2		
	Beta	Standard Error		Beta	Standard Error	
Intercept	41.14	6.45	****	51.71	5.27	****
Case/control status (case = yes)	-3.13	1.14	**	-0.90	0.94	NS
Parent Characteristics						
Sociodemographic Factors and Health Behaviors						
Age (mean/SD)	-0.03	0.08	NS	0.00	0.06	NS
Marital/Partner Status	3.64	2.51	NS	4.19	2.01	*
Income			NS			NS
Low	Ref	Ref		Ref	Ref	
Medium	0.55	1.23		-0.64	1.00	
High	-0.40	1.25		-0.83	1.01	
Family Size	0.43	0.52	NS	0.28	0.42	NS
Diet	1.43	1.07	NS	1.43	0.87	NS
Exercise			NS			NS
Inactive	Ref	Ref		Ref	Ref	
Active-irregular	4.85	3.28		2.97	2.64	
Active-regular	4.54	3.27		3.12	2.63	
Poor Sleep Quality	-2.79	1.15	*	-0.63	1.00	NS
Somatization	-2.62	1.40	NS	-1.20	1.14	NS
Measures of Family Functioning and Social Support						
Social Support and Stress						
Total Social Support	0.06	0.03	NS	0.04	0.03	NS
Total Social Stress	-0.09	0.04	*	-0.03	0.03	NS
Family Functioning						
Total Ratio	0.64	0.94	NS	-1.39	0.79	NS
Negative Life Events	-0.27	0.07	***	-0.09	0.06	NS
Measures of Self-Reported Stress						

Mental Component Summary				
Model 1		Model 2		
Beta	Standard Error	Beta	Standard Error	
Symptoms of stress		-0.11	0.03	***
Perceived Stress		-1.44	0.21	****

* $p<.05$;
** $p<.01$;
*** $p<.001$;
**** $p<.0001$;
NS= $p>.05$