

# Factors Related to Posttraumatic Stress in Adolescent Survivors of Childhood Cancer and their Parents

## Authors

Shuichi Ozono, M.D.,Ph.D.<sup>1,3</sup>

Toshinari Saeki, M.D., Ph.D.<sup>2</sup>

Tomoyuki Mantani, M.D., Ph.D.<sup>3</sup>

Akiko Ogata, M.A.<sup>4</sup>

Hitoshi Okamura, M.D., Ph.D.<sup>5</sup>

Shigeto Yamawaki, M.D., Ph.D.<sup>3</sup>

<sup>1</sup> Department of Pediatrics and Child Health, Kurume University School of Medicine

<sup>2</sup> Department of General Medicine, Hiroshima University Hospital

<sup>3</sup> Department of Psychiatry and Neurosciences, Hiroshima University

<sup>4</sup> Graduate School of Education, Hiroshima University

<sup>5</sup> Graduate School of Health Science, Hiroshima University

Corresponding Author:

Shigeto Yamawaki, M.D., Ph.D.

Department of Psychiatry and Neurosciences, Division of Frontier Medical Science, Programs for Biomedical Sciences, Hiroshima University

Address: 1-2-3 Kasumi, Minami-ku, Hiroshima 734-8551, Japan

Tel.: +81-82-257-5208

Fax: +81-82-257-5209

e-mail: [yamawaki@hiroshima-u.ac.jp](mailto:yamawaki@hiroshima-u.ac.jp)

## ABSTRACT

*Goals of work:* The purpose of this study was to investigate factors related to severe posttraumatic stress symptoms (PTSS) in adolescent survivors of childhood cancer and their parents.

*Patients and methods:* Eighty-nine families (88 adolescent survivors of childhood cancer, 87 mothers, 72 fathers) completed a self-report questionnaire. Multivariate logistic regression analyses were performed using the following risk factors for severe PTSS: trait anxiety, family functioning, demographic and medical variables.

*Main results:* Severe PTSS were reported by 10.9% (n=9) of the survivors, 20.7% (n=18) of the mothers, and 22.2% (n=16) of the fathers. Preliminary analyses found significant correlations of PTSS between mother-survivor (Spearman's  $\rho = -0.377$ ,  $p < 0.01$ ) and mother-father (Spearman's  $\rho = 0.483$ ,  $p < 0.01$ ). The results of multivariate analyses indicated that higher trait anxiety [odds ratio (OR) :1.16; 95% confidence interval (CI): 1.03-1.31;  $p < 0.05$ ] and having medical sequelae (OR: 5.85; 95%CI:1.02-33.72;  $p < 0.05$ ) were significant factors related to PTSS for survivors. For mothers, the significant PTSS-related factors were: higher trait anxiety (OR: 1.13; 95%CI:1.04-1.23;  $p < 0.01$ ); 5- to 9-year interval from the first diagnosis to the present investigation, as compared to more than a 10-year interval (OR: 6.45; 95%CI:1.67-24.89;  $p < 0.01$ ); and a relatively lower rating on "roles" of family functioning (OR: 12.34; 95%CI:1.11-136.97;  $p < 0.05$ ). For fathers, trait anxiety was a significant related factor (OR: 1.07; 95%CI:1.01-1.14;  $p < 0.05$ ).

*Conclusions:* Survivors and their parents suffered from PTSS after long interval from completion of treatment, and PTSS-related factors varied for each family member. Appropriate allocation of responsibility for family functioning may promote the ability to decrease PTSS, especially for mothers.

**KEYWORDS:** psychology, posttraumatic stress, long-term survival, Quality of Life, Parents

## INTRODUCTION

During the last three decades, the treatment of childhood cancer has dramatically improved, and the number of long-term survivors is increasing. A number of researchers have reported observing physical and psychological delayed adverse effects of treatment among survivors of childhood cancer [24]. Recent perspectives on the psychological outcomes for cases of childhood cancer have been based on the assumption that both cancer and its treatment are fundamentally traumatic events. In fact, “being diagnosed with a life-threatening illness” is mentioned as an example of a traumatic event that is included among the diagnostic criteria for posttraumatic stress disorder (PTSD) listed in the American Psychiatric Association’s diagnostic manual [1]. A cluster of symptoms (e.g., re-experiencing the traumatic event, hyperarousal, and avoidance of event reminders) is characteristic of PTSD. Previous research has revealed that the prevalence of clinically significant levels of PTSD and/or posttraumatic stress symptoms (PTSS) in survivors ranged from 2 - 20%, and young adult survivors tended to show higher levels of posttraumatic stress [27]. Cancer affects not only patients but also entire families. In cases of childhood cancer, 10 - 30% of parents of survivors showed symptoms of post-traumatic stress [27]. Several factors may predict PTSS, including the individual’s general level of anxiety [9,13], medical factors, posttreatment factors, maternal psychological vulnerability [17], family functioning, and social support [12,21]. Most studies have noted that predictors for PTSS were different for each family member.

In addition to the factors related to PTSS for each family member, oncology clinicians need to view the family as a system. The family system framework, as well as consideration of individual differences, is important for supporting families of childhood cancer survivors. Cancer might impact for multiple family members and it might be reasonable to concordant the level of PTSS within family members. Kazak et al. [14] reported that one-third of two-parent families had both parents fulfill criteria for the arousal symptom

cluster and 84% of families had both parents endorse symptom of reexperiencing, and suggested the importance of evaluating all family members for PTSS. As for family functioning, Pelcovitz et al. [21] found that PTSD symptoms are associated with chaotic family functioning among adolescent survivors. Brown et al. [4] found a significant correlation between PTSD symptoms and family supportiveness, and a negative correlation between PTSD symptoms and family conflict among the mothers of survivors of childhood cancer. In general, however, the relationship between PTSS and family functioning or framework is not well understood because few researchers have focused on this issue.

The purpose of this study was to investigate the prevalence of severe PTSS in a sample of 12- to 20-year-old childhood cancer survivors and their parents. We examined the contributions to severe PTSS of family functioning, trait anxiety, medical factors, and posttreatment factors. We also explored PTSS within the family members and assessed the impact of cancer for family. We predicted that medical factors, elevated trait anxiety, and impaired family function would account for a significant amount of the variance in PTSS. In addition, the relative influence of these factors was expected to differ among family members.

## PATIENTS AND METHODS

### Study sample and recruitment

Japanese pediatric cancer survivors and their parents were recruited from three large hospitals in urban areas located in western Japan. Survivors who met the following criteria were identified from the tumor registry of each hospital during the 15-month period from July 2003 to September 2004: (1) age of 12 - 20 years at the time of the investigation; (2) first diagnosis at least 5 years prior to the interview, and off treatment for a minimum of 1 year; (3) the cancer was in remission; (4) receiving regular medical follow-up treatment as an outpatient; (5) physical health was good enough for the patient to complete several questionnaires; (6) Eastern Cooperative Oncology Group performance status (PS) of 0-2; (7)

survivors of brain tumors were excluded; and (8) absence of cognitive impairment.

The registries of Research on the Treatment of Specific Chronic Childhood Diseases identified 144 eligible patients at three sites as follows: 65 at Hiroshima University hospital, 57 at Kurume University hospital, and 22 at Hiroshima Red Cross-Atomic Bomb hospital. When a patient and his/her parent(s) visited an outpatient clinic, a pediatric oncologist provided the family with an outline describing the purposes and protocol of the current study. The interviewer was allowed to meet with the participants, provided that the parent(s) agreed to participate in the investigation. Survivors who visited the outpatient clinic alone were handed letters for their parents that explained the study and invited them to participate. Written consent was obtained after the participants had been fully informed about the study. Then questionnaires were handed or mailed to the participants after a brief interview. A one thousand-yen book coupon was given to families upon agreement of study participation. The participants completed the questionnaires at home, and returned them by mail. A reminder card was mailed to those participants who did not return the questionnaires one month after they had been delivered. To maintain anonymity, the questionnaires were returned without names or any type of identification code on the envelope. The protocol was approved by the Institutional Review Board of each institution.

#### Questionnaires Completed by Parents and Children

The Impact of Event Scale-Revised (IES-R) is a 22-item self-report instrument that assesses three symptoms of PTSD: intrusion, avoidance, and hyperarousal [28]. Symptoms are rated on a five-point Likert scale for frequency of occurrence during the previous week. High scores indicate a high frequency of symptoms of PTSD. Participants were asked to focus on the child's cancer experience as the stressful event. The Japanese version of the IES-R [2] has a high internal consistency (Cronbach  $\alpha$  =0.92-0.95) and test-retest reliability (Pearson

=0.86). According to the standardization study, IES-R scores of 25 or more are indicative of severe posttraumatic stress.

The State-Trait Anxiety Inventory (STAI) is a 40-item self-report instrument that measures anxiety symptoms that are either current (state) or related to personality (trait) [25]. A higher score indicates a higher level of anxiety. The STAI has high internal consistency, as well as adequate construct and discriminative validity across diverse samples. The Japanese version of the STAI has yielded satisfactory internal consistency [20]. Only trait anxiety was evaluated in this study because prior studies reported that trait anxiety predicts PTSS/PTSD for childhood cancer survivors and their parents [9,12,13].

The Family Assessment Device (FAD) [7] is a 60-item self-report scale that assesses seven dimensions of family functioning based upon the McMaster Model of Family Functioning (MMFF) [6]. Seven of the scales on the FAD reflect the following dimensions of family functioning. (1) Problem Solving: the ability to resolve problems to maintain effective family functioning. (2) Communication: how the family members exchange information. (3) Roles: the repetitive patterns of behavior by which the individuals fulfill family functions; role allocation and role accountability are elemental components. (4) Affective Responsiveness: the ability to respond to a range of stimuli. (5) Affective Involvement: the degree to which the family shows interest in and values the activities and interests of family members. (6) Behavior Control: the pattern the family adopts for handling behavior. (7) General Functioning. Low scores indicate good functioning and high scores indicate poor functioning. The English and Japanese versions of the FAD have been shown to have adequate validity and reliability [23].

Life events data were obtained from the Japanese version of Holmes-Rahe

measure of social adjustment [11,18]. If a responder had had one or more life event(s) listed on the measure since the first diagnosis, the responder was classified as positive (+) for life events.

#### Variables Obtained from Medical Records

An intensity of therapy rating was based upon medical record review. Each child's medical information was obtained from the medical chart and rated by a pediatric oncologist (M.K.). The intensity of therapy was classified as follows: I (mild; 12%) = less than six months of chemotherapy only and/or surgery; II (intermediate; 62%) = therapy for standard to high-risk cancers according to the protocol of children cancer study groups in Japan; or III (severe; 25%) = stem cell transplantation, or extremely high-risk cancers. The medical sequelae were also assessed based on chart review by a pediatric oncologist (M.K.). Survivors were classified into two groups as follows: I (None; 64%) = Survivors who needed no limitations of activity and no special medical attention; II (Yes; 36%) = Survivors who needed medical attention because of disease or the longer-term effects of treatment. Information about patients' diagnosis, age at first diagnosis, age at the investigation, interval from diagnosis to the investigation, treatment of cranial irradiation, and relapse were picked up from charts and assessed as medical factors.

#### Statistical Analysis

All analyses were conducted with SPSS 11.5J for Windows (SPSS, Inc., Chicago, IL), and two-tailed probabilities were reported. Analyses were separately undertaken on data sets from survivors, mothers, and fathers. First, Spearman's correlation coefficients were calculated to examine intercorrelations among family members using the IES-R total score as continuous variables. Second, the IES-R was used to categorize subjects as having severe PTSS (25 or greater), or a mild-to-no PTSS (24 or less) [2]. Preliminary statistical

comparisons between the two groups used the Pearson chi-square (for categorical variables) and the non-parametric Mann-Whitney U-test (for continuous variables). To identify the final association factors, variables with a  $p$  value of less than 0.05 in the bivariate analysis were entered into a multivariate logistic regression model as independent variables. The independent explanatory values of the characteristics were expressed in odds ratios (OR), with 95% confidence intervals (CI). Before the study initiation, the necessary sample size was determined to detect differences in bivariate groups. Response rates were expected to be about 70%. Based on the review by Taïeb et al. [27], a prevalence of severe PTSS (P) of 0.20 and an OR of 2.5 were assumed. It was estimated that a minimum of 77 of each category of participants would be needed to detect a minimum difference with a power of 0.80 and an level of 0.05 calculated by Whittemore's formula [29]. A  $p$  value of less than 0.05 was set as the level of significance for all the statistical analyses.

We adopted a stepwise forward selection for the logistic regression model because the purpose of this analysis was to identify which variables were the most relevant risk factors associated with severe PTSS. For the stepwise selection, a "provisional model" was first applied, including all potential explanatory variables, and then the non-significant variables were removed, or significant variables were added one at a time, until those remaining in the model were found to contribute significantly.

## RESULTS

### Characteristics of the Study Sample

Among the 144 eligible families, 125 families visited the outpatient clinic during the study's entry period, and 103 families agreed to participate in the study. Finally, a total of 89 families (61.8%) returned the questionnaires. Characteristics of the study population and the reasons for non-participation are shown in Figure 1. All participants were Japanese.

A comparison of participants and non-participants revealed no significant

differences among survivors in terms of current age, age at diagnosis, gender, type of cancer, interval since the first diagnosis, interval since the end of treatment, treatment intensity, cranial irradiation, medical sequelae, and relapse.

There were also no significant differences in terms of survivor's age, gender, medical sequelae, family size, socioeconomic status, parents' age, and history of psychological care between each institution. However, several differences were found among the three samples. The site 1 and site 2 samples contained a higher number of infant neuroblastoma and other solid tumor survivors than the site 3 sample ( $\chi^2(8, n=89)=23.478, p<0.01$ ). The site 3 sample contained a higher number of survivors who received more intensive treatment ( $\chi^2(4, n=89)=29.185, p<0.01$ ) and cranial radiation ( $\chi^2(2, n=89)=10.938, p<0.01$ ). The demographic and medical factors of survivors which were combined are shown in Table 1.

#### IES-R Dimensional Scores and Intercorrelations of PTSS for Each Family Member

The means and SDs for the IES-R dimensional scores are shown in Table 2. Compared to survivors, mothers and fathers showed relatively higher ratings on intrusion and avoidance, and mothers and fathers showed comparable scores on each dimension. Using 24/25 as the cutoff for the IES-R, severe PTSS were present in 9 of the 88 survivors (10.9%), 18 of the 87 mothers (20.7%), and 16 of the 72 fathers (22.2%). Spearman's intercorrelation coefficients for the total IES-R scores were significant for survivor-mother and father-mother pairs. The survivor-father correlations were not significant.

#### Severe PTSS and Related Factors for Survivors

Results of bivariate comparisons of demographic characteristics, medical variables, trait anxiety, and family functioning between those with either severe PTSS or not severe PTSS are shown in Table 3. The results indicated that subjects with severe PTSS had higher trait anxiety, and exhibited a lower level of family functioning with respect to factors such as

roles and affective responsiveness. Also, these subjects were more likely to have medical sequelae. As predicted, no significant differences were found with respect to the ratings for treatment intensity, time lapse from diagnosis to the study, history of relapse, and cranial radiation.

Table 4 shows the results from the multivariate logistic regression model, in which severe PTSS was used as the bivariate outcome. Higher rating on trait anxiety and having medical sequelae were found to be significant factors related to severe PTSS, whereas family functioning was not found to be a significant PTSS-related factor.

#### Severe PTSS and Related Factors for Mothers of Survivors

The results of the bivariate comparisons of variables between those with severe or not severe PTSS are shown in Table 3. The results indicate that subjects with severe PTSS had higher trait anxiety, and lower levels of family functioning, as determined by the dimension of roles and general functioning. For mothers with severe PTSS, the child was diagnosed as having cancer at an older age, and the time interval since the first diagnosis to the present study was shorter. However, no other significant differences were found in terms of age of mother and life events ( $\chi^2(1, n=87) 0.5, p=0.47$ ).

The results of the multivariate logistic regression model yielded three significant factors for severe PTSS: higher trait anxiety; a 5- to 9-year period since the first diagnosis to the present investigation as compared to an interval of more than 10 years; and a relatively lower rating on “roles” of family functioning (Table 4).

#### Severe PTSS and Related Factors for Fathers of Survivors

The results of the bivariate comparisons of variables between those with severe or not severe PTSS are shown in Table 3. The results indicate that subjects with severe PTSS had higher trait anxiety scores. However, no other significant differences were found in terms

of any family functioning, medical variables, child's age at diagnosis(  $\chi^2(1,n=72) 2.6, p=0.11$ ), time since disease onset(  $\chi^2(1,n=72) 1.4, p=0.24$ ), life events (  $\chi^2(1,n=72) 0.8, p=0.37$ ), and demographic factors. Higher rating on trait anxiety was found to be a significant factor related to severe PTSS in logistic regression model (Table 4).

## DISCUSSION

The current study examined the prevalence of severe PTSS among long-term childhood cancer survivors and their parents. This study also investigated other factors, including family functioning, for each family member. The results indicate that some survivors and their parents suffered from symptoms of posttraumatic stress after long interval from the completion of treatment. The prevalence of severe PTSS obtained for the survivors (10.9%) was comparable to that reported by Stuber et al. [26] (severe PTSS 12.5%), Erickson and Steiner [8] (current PTSD 10%), and Langeveld et al. [16] (severe PTSS 12.5%), although a higher prevalence of PTSD was reported by Hobbie et al. [9] (20.5%) and Meeske et al. [19] (22%). The prevalence of severe PTSS in the present study for mothers (20.7%) and fathers (22.2%) were somewhat higher than those reported by Barakat et al. [3] (10.1% of mothers and 7.1% of fathers had severe PTSS) and Kazak et al. [12] (10.2% of mothers and 7.1% of fathers had severe PTSS), although they were lower than those reported by Stuber et al. [26] (39.7% of mothers and 33.3% of fathers had severe PTSS). Differences in the prevalence of PTSS among these samples may be affected by differences in sample size, sample age, psychological instruments used, cultural background, and the state of disease among survivors. Generally, the results of the present study are consistent with previous studies, which found that the prevalence of severe PTSS/PTSD among parents was higher than that among patients.

The association of impaired "roles" of family functioning with posttraumatic stress in mothers suggests two important issues. First, when the assignment of responsibilities for

family functions is not appropriately distributed, an excessive burden may fall on a specific family member. Second, as a result of impairment of accountability for the responsibilities that are allocated to each family member, the effectiveness of the job being done would be diminished. This situation may place a specific member of a family at greater risk for poor adaptation to a traumatic stressor, and subsequently to possible psychiatric disorder, including PTSD. These findings are in accord with the findings of Brown et al. [4], who found that mothers' greater self-reported level of support within their families was predictive of fewer or less intense maternal PTSS, although no such association was found among survivors. Kazak et al. [13] reported similar findings that family functioning was associated with anxiety and posttraumatic stress in both mothers and fathers. One possible reason for this discrepancy is that the study of Kazak et al. [13] used the Family Adaptability and Cohesion Evaluation Scales-Version III A, which has only three dimensions, as family system variables. A path analysis was then used, which might be more sensitive to identify an association of PTSS with family functioning.

Preliminary analyses found the moderate correlation of PTSS between mother and father. While speculative, this indicates that mothers and fathers share a similar perception about their child's state of disease. Interestingly, these findings contradict those reported in another paper by Kazak et al. [14] in which the report very low levels of concordance of PTSD within a family. Cultural difference might contribute to these contradiction. Our finding of a correlation between mothers and survivors indicates that survivors' PTSS are resonant with mothers but not fathers. It is not clear why a correlation was not found between survivors and fathers. One possible speculation is that most of the adolescent survivors spend much time attending school, participating in extracurricular activities, or in peer relationships. They may not spend much time with their fathers, who in Japan come home late in the evening because of work. These situations decrease communication with fathers more than with mothers.

The time elapsed since the first diagnosis of cancer was found to be a significant factor for mothers' PTSS. It is commonly reported that trauma-induced psychological symptoms decrease with time. Kessler et al. [15] reported in a general population study that about two-thirds of people with an episode of PTSD recovered over time, even without treatment. The results of our study are consistent with the finding of Phipps et al. [22] that parents of recently diagnosed patients showed higher levels of PTSS than parents of long-term survivors. Kazak et al. [13] reported similar findings that a mother's posttraumatic stress was indirectly related to the interval since the final treatment, as determined by the mother's appraisal of the degree of threat to the life of the child. As regards the fathers of survivors, Kazak et al. [12] reported that the number of months off treatment was negatively related to variables of posttraumatic stress. However, it is not necessarily the case that a time lapse reduces PTSS. The present study did not establish the associations of time lapse with severe PTSS in survivors and their fathers. One possible reason for this discrepancy is that because our sample was families of long-term survivors with a mean follow up period 10.8 years (range 5-19), they might be affected by medical sequelae or other concurrent stressors rather than the past intensive cancer treatment. This pattern may be more appropriate for a diagnosis of adjustment disorder than PTSD, although several participants showed a clinical level of PTSD.

Our study also revealed that trait anxiety was an associated factor for PTSS for survivors and parents. It must be noted that caution is warranted in interpreting anxiety as a predictor for PTSS, since trait anxiety is well known to coexist with PTSD-like symptoms. Moreover, it is important to distinguish symptoms of anxiety from PTSS because they are conceptually overlapping but not identical. PTSS is attributed to re-experiencing and avoidant behavior based on the traumatic memories and is closely related to the general level of anxiety. Thus, clinicians should carefully rule out a primary anxiety disorder from the anxiety related to PTSS.

The existence of medical sequelae was a significant factor related to severe PTSS in survivors. Some of these survivors may have experienced physical symptoms at the time of the study and continued limitations of activities in daily life. Thus, it would not be surprising if they reported experiencing increased anxiety or if they perceived their life as currently threatened. This pattern is consistent with the findings from Langeveld et al. [16] that severe sequelae or health problems were associated with posttraumatic stress. However, these findings are not in accord with reports by Hobbie et al. [9], who did not find any association between medical sequelae and PTSS. Specifically, Hobbie et al. [9] reported that subjective factors related to cancer and its treatment (e.g., beliefs regarding a life threat and/or perceived treatment intensity) are more important than the objective medical data about cancer. While speculative, the reason for this discrepancy may be that the study of Hobbie et al. [9] contains a relatively larger proportion of survivors (about 65%) who had moderate to severe medical sequelae while only 36% of the survivors in our study had medical sequelae, so it was more difficult to identify the relationship between PTSD and medical sequelae.

### Limitations

The current study has several limitations. First, only 62% (89 of 144 families) of the subjects could be included in the analysis, and the prevalence of severe PTSS in survivors was relatively lower than that of parents, so the current study may not have had optimal statistical power. Since the present results suggest that only 10.9% of survivors showed severe PTSS, researchers would have to investigate twice as many families to get more valid results. Second, the result relies on self-reported questionnaires only, that do not allow a proper diagnosis of clinically relevant disorder. Further study is needed to determine the true prevalence of current PTSD compared to “severe PTSS”. Third, the design of the study was cross-sectional, and this investigation lacked a matched control group, so no conclusions

regarding causality can be drawn. It needs further consideration that family functioning from the mother's viewpoint is affected by the phase of adolescence, with ensuing conflicts, role changes and developmental tasks. Comparison to families with healthy adolescents probably would yield further information. Fourth, as this study was conducted at three sites, and the disease distribution differed among these sites, an institutional bias may have influenced the results. Finally, the assessments of the treatment intensity and medical sequelae were conducted by an ad hoc method, and the validity and reliability of these measures was not well established, and they may have resulted in classification errors. Replication of the present study with a large, longitudinally followed sample, and more optimal assessment tools, is needed to provide a better description of factors related to PTSS in childhood cancer survivors and their families.

### Clinical Implications

The present data give rise to several important clinical implications for families with childhood cancer survivors. Even when the treatment was successful, some survivors cannot avoid suffering from medical sequelae, so long-term follow up of physical and psychological functioning after treatment is clearly desirable. The Children's Oncology Group website [5] provides detailed guidelines and information about specific later-onset effects for long-term survivors. Moreover, since the risk factors for severe PTSS vary for each family member, health care professionals in pediatric oncology units should assess each member of families and provide suitable treatment. The regular use of "family conferencing" would enable clinicians to bring the dynamics of the family system into relief and focus on the specific individual issues as well. It is important to specify the family functions, to ascertain whether the family has allocated the responsibilities for these functions appropriately, and whether there are suitable mechanisms built in for accountability. Parents also may benefit from education about their child's and their own symptoms and how to manage them

effectively. At the same time, clinicians should assess and treat the general level of anxiety of each family member. Cognitive-behavioral approach and educational information may provide structure and support when anxiety and avoidance discourage exploration. If the situation becomes complicated, referral to a social worker, psychologist, or consultation-liaison psychiatrist would be a good option. Further research is needed to develop intervention programs that are effective in improving family functioning, and that may reduce PTSS in families with childhood cancer survivors.

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TABLE 1  
Demographic and Medical Characteristics of Survivors  
(n=89)

	No. of Survivors(%)
Male gender	40 (45)
Age at investigation (Mean $\pm$ SD)	16.2 $\pm$ 2.3
Age at diagnosis ( <6 years)	57 (64)
Time since diagnosis ( <10 years)	39 (44)
Relapse 1	12 (14)
<b>Diagnosis</b>	
Acute lymphoblastic leukemia	46 (52)
Other leukemia	14 (16)
Malignant lymphoma	9 (10)
Infant neuroblastoma	11 (12)
Other solid tumor	9 (10)
<b>Treatment Intensity</b>	
I (mild)	11 (12)
II (intermediate)	55 (62)
III (severe)	23 (25)
<b>Medical sequelae</b>	
I (None)	57 (64)
II (Yes)	32 (36)
<b>Socioeconomic Status</b>	
I	2 (2)
II	17 (19)
III	57 (64)
IV	11 (13)
V	2 (2)

TABLE 2. Means(SD) of IES-R Dimensional Score and Correlations of IES-R between Family Members

	Survivors (n=88)	Mothers (n=87)	Fathers (n=72)
	Mean (SD)	Mean (SD)	Mean (SD)
IES-R Total	9.0 (10.4)	15.0 (12.4)	16.0 (14.3)
Intrusion	2.9 (3.9)	5.7 (4.7)	6.0 (5.3)
Avoidance	3.1 (4.8)	6.0 (5.4)	6.8 (6.0)
Hyperarousal	3.0 (3.3)	3.3 (3.8)	3.2 (4.1)
Correlations(IES-R Total)			
1. IES-R Survivors	-		
2. IES-R Mothers	0.377**	-	
3. IES-R Fathers	0.179	0.483**	-

TABLE 3. Comparison of medical factors and psychological variables between survivors and their parents with severe PTSS and those with not severe PTSS

	No. with severity of PTSS (%)		Analysis	
	Severe PTSS	Not severe PTSS	Statistic	<i>P</i>
Survivors (n=88)	n=9	n=79		
Age; mean (SD)	16.1 (1.9)	16.2 (2.3)	t(df=86) 0.16	0.87
Male gender	5 (56)	34 (43)	<sup>2</sup> (1,n=88) 0.5	0.47
Medical sequelae: I (None)	3 (33)	55 (70)	<sup>2</sup> (2,n=88) 8.3	<0.01
Medical sequelae: II (Yes)	6 (66)	24 (30)		
Trait anxiety; mean (SD)	56.2 (8.6)	43.2 (9.9)	112.5 <sup>a</sup>	<0.01
FAD-Roles; mean (SD)	2.3 (0.3)	2.1 (0.4)	193.0 <sup>a</sup>	0.03
FAD-Affective Responsiveness; mean (SD)	2.5 (0.6)	2.1 (0.5)	208.5 <sup>a</sup>	0.04
Mothers (n=87)	n=18	n=69		
Age; mean (SD)	43.4 (5.0)	43.9 (4.8)	t(df=85) 0.44	0.69
Child's age at diagnosis (<6 years)	11 (61)	21 (30)	<sup>2</sup> (1,n=87) 5.8	0.02
Time since disease onset (<10 years)	13 (72)	23 (33)	<sup>2</sup> (1,n=87) 8.9	<0.01
Trait anxiety; mean (SD)	52.2 (10.2)	41.5 (9.9)	280.5 <sup>a</sup>	<0.01
FAD-Roles; mean (SD)	2.2 (0.3)	2.0 (0.4)	383.0 <sup>a</sup>	0.01
FAD-General Functioning; mean (SD)	2.1 (0.4)	1.9 (0.5)	425.0 <sup>a</sup>	0.04
Fathers (n=72)	n=16	n=56		
Age; mean (SD)	47.1 (7.8)	47.4 (5.5)	t(df=70) 0.19	0.85
Trait anxiety; mean (SD)	46.5 (10.5)	39.4 (9.7)	266.5 <sup>a</sup>	0.01

TABLE 4. Factors Related to Severe PTSS in Survivors (n=88), Mothers (n=87), and Fathers (n=72):  
Logistic Regression Analysis of Medical and Psychological Variables

		B	exp(B)
<b>Survivors</b>			
Step 1	Trait anxiety	0.15 *	1.16 (1.03-1.31)
Step 2	Medical sequelae (Yes)	1.77 *	5.85 (1.02-33.72)
Step 3	FAD-Affective Responsiveness	1.00	5.20 (0.73-37.06)
	FAD-Roles	1.19	1.15 (0.11-11.76)
<b>Mothers</b>			
Step 1	Trait anxiety	0.12 **	1.13 (1.04-1.23)
Step 2	Time since disease onset ( <10 years)	1.86 **	6.45 (1.67-24.89)
Step 3	FAD-Roles	2.51 *	12.34 (1.11-136.97)
	FAD-General Functioning	-1.42	0.24 (0.03-1.78)
<b>Fathers</b>			
Step 1	Trait anxiety	0.07 *	1.07 (1.01-1.14)

## FIGURE LEGENDS

### TABLE 1

Socioeconomic status was calculated using Hollingshead and Redlich Two Factor Index of Social position [10].

### TABLE 2

IES-R= Impact of Event Scale-Revised; \*\* $p < .01$

### TABLE 3

PTSS: posttraumatic stress symptoms; SD: standard deviation; FAD: family assessment  
a. Mann-Whitney  $U$  test

### TABLE 4

FAD = Family Assessment Device; \* $p < .05$ ; \*\* $p < .01$

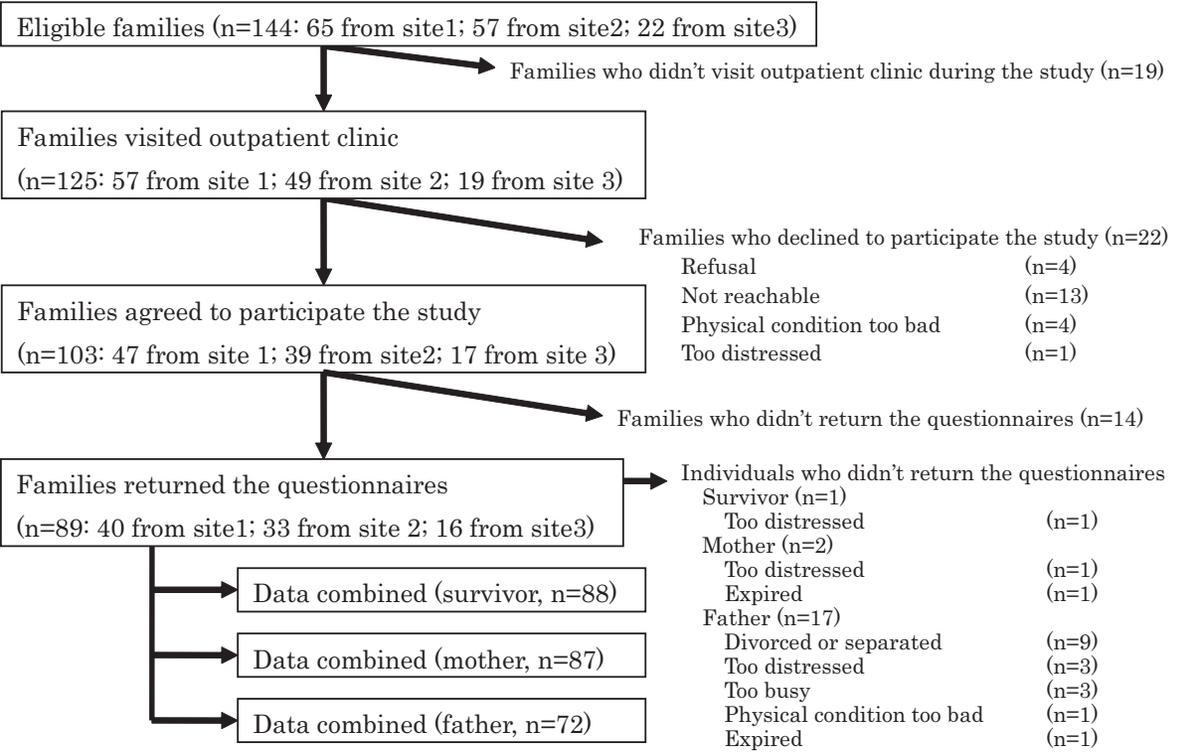


FIGURE 1 . Flow chart showing the study population