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ORIGINAL ARTICLE

Prevalence and predictors of posttraumatic stress symptoms in parents of children with ongoing treatment for cancer in South China: a multi-centered cross-sectional study

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Abstract
Purpose Parents of children with ongoing cancer treatment are exposed to risks of developing posttraumatic stress symptoms (PTSS), but little is known about the prevalence and predictors of PTSS among Chinese parents of children with cancer. This study aimed to examine the predictors of PTSS, and explored the correlation of depression, resilience, and family functions with severe PTSS.
Methods This cross-sectional survey was conducted from May 2014 to September 2015 among the parents of cancer children treated in four general hospitals in South China. PTSS in the parents were measured using post-traumatic stress checklist-civilian version (PCL-C). Multiple regression analyses were performed to evaluate the predictive values of depression, resilience, family functioning, and the demographic variables for severe PTSS.
Results A total of 279 parents (192 mothers and 87 fathers) participated in the survey. Severe PTSS, as defined by a PCL-C score ≥50, were reported in 32.97% ($n = 92$) of the total participants, 26.44% (23/87) in the fathers and 35.94% (69/192) in the mothers. The level of PTSS was positively correlated with depression ($r = 0.782$, $P < 0.01$) and a poor general family function ($r = 0.325$, $P < 0.01$) and negatively correlated with resilience ($r = -0.236$, $P < 0.01$). Multivariate analyses indicated that depression, general family function, gender, and education level were significant predictive factors of severe PTSS in the overall parents, accounting for 64.2% of the variance in the prediction of PTSS ($R^2 = 0.642$, $F = 122.602$, $P = 0.000$). For the mothers, depression and family function accounted for 66.5% of the variance in the prediction of PTSS ($R^2 = 0.665$, $F = 187.451$, $P = 0.000$); for the fathers, depression and educational level accounted for 58.8% of the variance in the prediction of PTSS ($R^2 = 0.588$, $F = 59.829$, $P = 0.000$).
Conclusion Parents, especially the mothers, of children with ongoing treatment for cancer are at risk of developing PTSS. Supportive psychological interventions to attenuate the negative emotions of the parents and improve their family functions are important means to promote their natural protective mechanisms to cope with the stressful events.

Keywords Posttraumatic stress · Parents · Pediatric cancer · Cross-sectional study · Prevalence

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Introduction

It is estimated that over 270,000 cases of childhood cancer are diagnosed annually worldwide and its incidence continues to increase [1]. The long and painful therapeutic courses for malignancies not only tremendously affect the children but also cause extremely distressful and traumatic experiences for the

parents with far-reaching psychological aftermath [2–4]. Although many parents adjust well after the cancer diagnosis of their children, some continue to suffer posttraumatic stress symptoms (PTSS) and even posttraumatic stress disorder (PTSD), which severely affects the physical and mental health and quality of life of the parents and profoundly impairs the coping capacity of the family [5–8].

Previous studies have shown that PTSS occur in 28 to 57% of the parents of children with ongoing treatment for cancer [2, 4, 9], an incidence much higher than that in parents of childhood cancer survivors [6, 8, 10–13]. The parents' demographic characteristics (gender, education, economic status, etc.) and psychosocial profiles (depression, social support, etc.) and the medical factors of the children (types of cancer, time since diagnosis/treatment, and relapse, etc.) are all significantly associated with the development of PTSS [4, 14–16]. But the currently available studies reported varying and even conflicting results with regard to the incidences of PTSS and its correlating factors. Currently in China, researchers appear to be more interested in studying the treatment of the disease in the child, while the psychological stresses of the parents, who normally provide the most important family support to the child, often fail to receive due attention. So far, little data have been available on the prevalence of PTSS and the factors contributing to PTSS in the Chinese parents of cancer children.

The development of PTSS in the parents of cancer children is a result of interaction between the array of contributing factors and protective factors. During caring for their children, some parents demonstrate resilience and experience posttraumatic growth, which are deemed as the protective factors against PTSS [17, 18]. Understanding the value of these protective factors against PTSS and interventions to enhance the impact of these factors may help the parents better cope with the psychological stress; this, ideally, may eventually benefit the children with ongoing treatment by providing more positive support from the family.

While there is still debate over how to define resilience, most researchers agree that resilience represents an individual's ability to positively adapt to stresses and adversities following a traumatic and even life-threatening events [19]. Some studies have shown a predictive value of resilience for the development of PTSS in acutely traumatized subjects or in those with a potentially fatal disease [20, 21]. Resilience plays an important role in maintaining the mental health of the parents of childhood cancer survivors or bereaved parents [18, 22], but whether it serves as a predictive factor for the development of PTSS remains to be clarified in parents of children with ongoing cancer treatment.

A good family function is also a protective factor against PTSS in the parents of cancer children. A cancer diagnosis of the child and the ongoing cancer treatment entail a major adaptation of the family function, and a positive adaptation provides a protective environment for the child to ensure the best possible outcome. Studies have shown that ongoing cancer treatment obviously affects the family function, and a poor family function is closely associated with the development of PTSS in parents of childhood cancer [5, 7]. But so far, few reports have been available to describe a comprehensive analysis of the risk factors (such as depression) and protective factors (such as resilience and family function) of PTSS in parents of children with ongoing cancer treatment. Such a comprehensive analysis allows a better understanding of the development of PTSS in these parents for timely and adequate psychological interventions.

In this study, we aimed to investigate the prevalence of severe PTSS and the predictors associated with PTSS among Chinese parents of children with ongoing cancer treatment. We compared the difference in the predictors of PTSS between mothers and fathers, and explored the correlation of depression, resilience, and family functions with severe PTSS in the parents. We believe that hospitalization for treatment represents a critical phase when the parents of children with cancer are acutely exposed to extreme psychological stresses and when the healthcare providers are in close contact with both the children and their parents. Early identification of the psychological stress and timely supportive intervention of the parents may benefit both the children and the parents to cope with the disease and help them better adapt to their future life.

Methods

Study design and participants

This cross-sectional study was conducted in parents of children with ongoing treatment for pediatric cancer. The participants were recruited from the departments of pediatrics at four large general hospitals affiliated to two medical universities (the First Affiliated Hospital of Sun Yat-sen University, Sun Yat-sen University Cancer Center, Nanfang Hospital, and Zhujiang Hospital of Southern Medical University, Guangzhou, China). All these four hospitals are important medical centers for pediatric malignancy in South China. The inclusion criteria of the parents were based on the child patients' characteristics: (1) age of 1 to 18 years; (2) an established diagnosis of cancer at least 1 month prior to the study (including both newly diagnosed cases or cases with relapse); (3) receiving active treatment in an in-hospital setting; and (4) the absence of significant cognitive or sensory deficits. For each child recruited, one of the parents (mother or father) was invited to participate in the study. Parents who reported domestic violence and sexual abuse or had ongoing treatment for depression were excluded.

Approval was obtained from the Nanfang Hospital Medical Ethics Committee of the Southern Medical University prior to data collection. The participating parents were well informed of the purpose and protocol of the study, and informed consent was obtained from all the participants. The parents participated in the study on a voluntary and anonymous basis.

Data collection

Data were collected from May 2014 to November 2015. Prior to the study enrollment, a pilot study was conducted in 30 parents of children with cancer to formulate the study hypotheses and modify the questionnaires. To control the quality of the survey in the formal study, we (1) used standardized questionnaires, and the surveyors (two specially trained nurses from each hospital) provide uniformed guidance for the participants; (2) provided a quiet and private room for the participants to complete the questionnaires at a time of their convenience without affecting the children's treatment; (3) assured the participants that the survey was voluntary, anonymous, and confidential and gave the parents the option to withdraw at any time; and (4) asked the parents to re-check the questionnaire for missing responses before collection of the questionnaires.

Post-traumatic stress checklist-civilian version

PTSS in the parents were measured using the Chinese version of the post-traumatic stress checklist-civilian version (PCL-C). This checklist is a self-report scale consisting of 17 items that cover three symptom clusters of posttraumatic stress disorder (PTSD) according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), including re-experiencing (items 1–5), avoidance/numbing (items 6–12), and increased arousal (items 13–17). The participants were asked to report how much he or she had been bothered by each item in the last month on a 5-point Likert scale (from 1 "not at all" to 5 "extremely bothered"). The total score ranges from 17 to 85, and a higher total score indicates a greater symptom severity. The authors of the PCL recommended a cutoff score of 50 for establishing a diagnosis of severe PTSD [23]. In the present study, the Cronbach's α for the total scale was 0.932; and for the subscales, the α value was 0.839 for re-experiencing, 0.857 for avoidance, and 0.845 for arousal, demonstrating an internal consistency of scale.

Connor-Davidson resilience scale

The Chinese version of Connor-Davidson resilience scale (CD-RISC) [24] was used to assess resilience of the parents. The scale comprises 25 items, each rated on a 5-point Likert scale from 0 (not true at all) to 4 (true all the time) based on how the subject has felt over the past month. The total score ranges from 0 to 100, with higher scores indicating greater resilience.

The Chinese version of CD-RISC assesses a 3-factor structure of resilience (tenacity, strength, and optimism) and had demonstrated good psychometric properties in a sample of general Chinese population [25]. In this study, reliability (Cronbach's α) for the total scale was 0.925, and the subscales also demonstrated a good internal consistency with an α value of 0.879 for tenacity, 0.813 for strength, and 0.622 for optimism.

Patient health questionnaire depression scale

Patient health questionnaire depression scale (PHQ-9) [26] is a simple and effective instrument for screening and diagnosis of depression. It comprises nine items, each rated on a 4-point Likert scale from 0 (not true at all) to 3 (almost every day) based on how the subject has felt over the past week. The total score ranges from 0 to 27, with a higher score indicating a greater severity of depression. The Chinese version had been validated in a sample from Hong Kong Chinese community [27]. In this study, the reliability (Cronbach's α) of the total scale was 0.908.

General functioning sub-scale of McMaster Family Assessment Device

The 12-item general functioning (GF) sub-scale of McMaster Family Assessment Device (FAD) was used to assess the family function. As a simplified version of FAD, this scale measures the overall health status of the family [28] and comprises 12 items, each rated on a 4-point Likert scale ranging from 1 (strongly agree) to 4 (strongly disagree). The parents completed this measurement and rated the extent to which each statement matched the condition of their family. A higher score indicated a poorer family functioning. The Chinese version of the GF sub-scale of FAD has shown good psychometric performance in different Chinese adolescent samples [29]. In this study, the reliability (Cronbach's α) of the total scale was 0.70.

Statistical analysis

Data were analyzed using SPSS for Windows (Ver.19.0 IBM, New York, USA). All the tests were two-tailed, and a P value less than 0.05 were considered to indicate a significant difference. The demographic and medical data of the participants and their children were presented as means with standard deviations (SDs), numbers of cases, or percentages as appropriate. Independent-sample t test or one-way analysis of variance (ANOVA) was used for comparison of the continuous variables. Pearson's Chi-square (χ^2) test was used to compare the categorical variables. Pearson correlations were calculated to measure the correlations among the continuous variables. In addition, stepwise multiple regression analysis was performed to identify the most important independent variables for predicting PTSS. The variables with a P value <0.10 in univariate analyses and three other variables (depression, resilience, and family function) were included as independent variables in the multivariate model, using the PCL-C score as the outcome variable. We adopted a stepwise method for predicting the final risk factors of severe PTSS by gradually adding significant variables and removing the non-significant variables until no more variables could be incorporated in or eliminated from the established equation. Data including the F

value, R^2, variation of R^2 (ΔR^2), standardized regression coefficient (β), and P value in the regression model were reported. The multi-collinearity in the regression analysis was examined by tolerance and variance inflation factor (VIF).

Results

Sample characteristics

Of the 362 children approached who met the inclusion criteria, 294 (81%) agreed to participate in this study. The participants were similar to the nonparticipants with regard to child age, gender, or cancer diagnosis. The main reasons for nonparticipation included limited time, scheduling difficulties, or no interest in the research. None of the total eligible participants asked to withdraw during the survey. Fifteen participants who failed to provide complete data were excluded from the analysis, leaving 279 participants for further evaluation.

The demographic data of the included parents, the children's clinical characteristics, and the PCL-C scores are summarized in Table 1. Of the 279 parents, 192 were mothers (mean age of 34.16 ± 5.28 years) and 87 were fathers (mean age of 36.56 ± 7.00 years). The results of univariate analyses showed that the parents' educational level, residence, status of employment, and monthly household income were all factors significantly associated with PCL-C scores ($P < 0.05$). The other demographic factors were not found to significantly correlate with PTSS.

The average age of the children was 6.69 ± 4.00 years and 182 (65.2%) were boys. Over one-third (36.3%) of the children had a diagnosis of acute lymphoblastic leukemia (ALL), 19.4% had other leukemia, 16.5% had lymphoma, and only 21 children was in disease relapse. None of these demographic or clinical variables of the children (age, diagnosis, or the time since diagnosis) were correlated with the parents' PTSS ($P > 0.05$).

Prevalence of PTSS and descriptive statistics of the main variables

We identified a total of 92 (32.97%) parents who met the diagnostic criteria for severe PTSS as defined by a PCL-C score ≥50, including 23 (26.44%) fathers and 69 (35.94%) mothers (Table 2). The mean PCL-C score of the parents was 43.49 ± 14.48 (range 17 to 80). We compared the three PTSS symptom cluster scores between the mothers and the fathers, and found that the mothers showed a significantly higher score of arousal symptom than the fathers ($t = 2.34$, $P < 0.05$), but the prevalence rates of severe PTSS were similar between them ($\chi^2 = 2.45$, $P > 0.05$). The fathers presented with a better resilience than the mothers ($t = 4.21$, $P < 0.05$). The mean scores of depression and general family function did not differ significantly between the mothers and the fathers.

Correlations among resilience, depression, general family function, and PTSS

Table 3 lists the Pearson's correlation coefficients of resilience, depression, and general family function with PTSD symptoms of the parents. The level of PTSS was positively correlated with depression ($r = 0.782$, $P < 0.01$) and poor general family functioning ($r = 0.325$, $P < 0.01$) and negatively correlated with resilience ($r = -0.236$, $P < 0.01$). Depression was negatively correlated with resilience ($r = -0.220$, $P < 0.01$) and positively with poor general family functioning ($r = 0.264$, $P < 0.01$). We noted a significant negative correlation between resilience of the parents and poor general family functioning ($r = -0.311$, $P < 0.01$).

Multiple regression analysis of predictive factors of PTSS

We chose the variables with a P value <0.10 in univariate analyses (including gender, parents' educational level, residence, status of employment, and monthly household income) and the three other variables (depression, resilience, and general family function) as independent variables in the multivariate model, using the PCL-C score as the outcome variable. The results of stepwise multiple regression analysis showed that depression, general family function, gender, and educational level were all significant predictive factors of PTSS. These four variables together accounted for 64.2% of the variance in the prediction of PTSS ($R^2 = 0.642$, $F = 122.602$, $P = 0.000$). Tolerance (range 0.893–0.95) and VIF (range 1.05–1.12) indicated an acceptable multi-collinearity in the regression model. To assess the potential gender-specific differences in the predictors of PTSS, we conducted regression analyses in the mothers and fathers separately (Table 4). For the mothers, depression and family function were significant predictive factors of PTSS, and the two variables together accounted for 66.5% of the variance in the prediction of PTSS ($R^2 = 0.665$, $F = 187.451$, $P = 0.000$); for the fathers, the significant predictive variables of PTSS were depression and educational level, which accounted for 58.8% of the variance in the prediction of PTSS ($R^2 = 0.588$, $F = 59.829$, $P = 0.000$).

Discussion

In this cross-sectional study, we found a high prevalence of severe PTSS among the parents of children with ongoing treatment for cancer (32.97% in the total parents; 35.94% in mothers and 26.44% in fathers). These rates are higher than those reported in parents of children who survived stem cell transplantation measured using the same scales with the same PCL-C cutoff score of 50 (14% in the total parents; 18% in mothers and 10% in fathers) [30], but comparable with those (28.6%) reported in a sample of parents whose children had been treated for 2 months [31]. Two previous studies [2, 4]

Table 1 Demographic data of the parents, clinical characteristics of the children, and PCL-C scores

Demographic variables	Number	Percentage (%)	PCL-C score mean ± SD	*F/t*	*P*
Parents				1.87	0.06
Father	87	31.2	41.23 ± 12.80		
Mother	192	68.8	44.51 ± 15.10		
Age (year)				1.88	0.15
<35	131	47.0	42.94 ± 13.81		
35–44	126	45.2	44.89 ± 14.87		
≧45	22	7.8	38.73 ± 15.58		
Marital status				0.75	0.457
Married/cohabiting	271	97.1	43.38 ± 14.48		
Single/divorced/separated/widowed	8	2.9	47.25 ± 15.17		
Residence				5.49	0.005
City	74	26.5	40.73 ± 14.75		
Counties and towns	49	17.6	39.71 ± 13.40		
Rural	156	55.9	45.98 ± 14.27		
Educational level				5.61	0.000
Primary school	32	11.5	50.25 ± 15.14		
Junior high school	121	43.4	44.03 ± 14.78		
Senior high school	69	24.7	44.55 ± 14.20		
Junior college	30	10.8	40.37 ± 10.81		
College or higher	27	9.7	33.78 ± 11.51		
On/off job				2.20	0.029
On	67	24.0	40.12 ± 14.84		
Off	212	76.0	44.55 ± 14.24		
Religion				0.18	0.855
No	232	83.15	43.55 ± 15.04		
Yes	47	16.85	43.19 ± 11.45		
Monthly household income (RMB yuan)				3.06	0.011
≤1500	72	25.8	47.74 ± 13.81		
1501–3000	92	33.0	44.00 ± 15.03		
3001–4500	42	15.1	42.24 ± 13.97		
4501–6000	25	9.0	40.36 ± 14.01		
6001–8000	16	5.7	43.06 ± 13.72		
≧8001	32	11.5	36.75 ± 13.43		
Only child				0.69	0.49
Yes	95	34.1	42.65 ± 15.27		
No	184	65.9	43.92 ± 14.08		
Child gender				0.09	0.93
Male	182	65.2	43.43 ± 13.98		
Female	97	34.8	43.60 ± 15.46		
Diagnosis				1.32	0.242
Acute lymphocytic leukemia	102	36.6	41.98 ± 15.01		
Other leukemia	54	19.4	44.13 ± 13.87		
Lymphomas	46	16.5	40.91 ± 14.41		
CNS tumors	8	2.9	39.38 ± 13.04		
Sympathetic nervous system tumors	17	6.1	46.76 ± 10.87		
Malignant bone tumors	17	6.1	46.76 ± 10.87		
Soft-tissue sarcomas	18	6.5	47.06 ± 14.71		
Other solid tumors	23	8.2	49.35 ± 16.75		
Relapse status				0.23	0.818
No	258	92.5	43.43 ± 14.71		
Yes	21	7.5	44.19 ± 11.65		

Table 1 (continued)

Demographic variables	Number	Percentage (%)	PCL-C score mean ± SD	*F/t*	*P*
Time since diagnosis (month)				0.71	0.545
1–5	166	59.5	43.62 ± 14.61		
6–12	62	22.2	41.68 ± 15.40		
13–24	31	11.1	46.29 ± 13.43		
≧25	20	7.2	43.65 ± 12.08		

reported even higher prevalence of severe PTSS among the parents of cancer children during treatment (41 to 68% in mothers and 30 to 57% in fathers). The mean PCL-C score of the parents in our study was 43.49 ± 14.48, significantly higher than the scores previously reported in parents of cancer children at 1 year after treatment [16, 32]. The varying prevalence rates and scores of PTSS across these studies may result from the differences in the sample size, the phase during cancer treatment, psychological instruments used for measurement, and social and cultural background. Overall, the results we obtained are consistent with those of previous studies [2, 4, 8] and further verify that severe PTSS are common in both mothers and fathers of children with ongoing cancer treatment and show PTSS to be more prevalent in this population compared to parents of childhood cancer survivors.

We found that resilience had a significant, but low-level negative correlation with severe PTSS among the parents. In the multivariate model, however, resilience did not significantly predict PTSS. This result is not consistent with previous results obtained from parents of childhood cancer survivors who had completed treatments [18, 22], but this inconsistency does not imply that resilience failed to play a positive role in alleviating psychological trauma of the parents; rather, every individual has great potentials to live through unfortunate life events when he or she is allowed with sufficient time and adequate social and material resources. During the treatment for the children's cancer, the responses of the parents to this tremendous stress are associated with the interactions with other individuals, available social resources, specific cultures and religions, and family environments and society. Providing more social support and improving the family functions and community environments are all important means to promote an individual's natural protective mechanisms to cope with stressful events [19]. What is unclear from this study, however, is when and how these resilience resources develop and change in the cancer care experience. Further longitudinal assessment of PTSS and resilience resources of the parents is warranted to provide evidences for devising adequate interventions to promote the parents' psychological well-being, which may eventually improve the patient outcomes.

Our results of multivariate analysis show that depressive symptoms, general family function, gender, and educational level are all predictors of severe PTSS in the parents of cancer children. Depressive symptoms is one of the factors that most strongly correlated with severe PTSS ($r = 0.782$, $P < 0.01$) and is an important predictor of PTSS, which further demonstrates the co-morbidity of PTSS and depressive symptoms [4, 33]. In DSM-V, persistent negative emotion was listed as an additional (and the fourth) important symptoms for the diagnosis of PTSD [34], suggesting that measures for improving the negative emotions is important in supportive psychological interventions of severe PTSS in the parents of cancer children, especially the highly distressed parents.

General family functioning was identified in the multivariate model as an important factor for predicting PTSS among parents of children with ongoing cancer treatment. A poor general family function was significantly and positively correlated with severe PTSS and depression. This is readily understood as a poor family functioning adds to the stresses of the parents and thus contributes to the development of severe PTSS during cancer treatment for their children, and conversely, the presence of PTSS and

Table 2 Descriptive statistics for PTSS, resilience, depression, and general family function

Variable	Total	Father	Mother	χ^2/t	*P*
Number (%) with total score ≧50	92 (32.97%)	23 (26.44%)	69 (35.94%)	2.45	0.132
PCL-C score (mean ± SD)	43.49 ± 14.48				
Re-experience		13.95 ± 4.00	14.72 ± 5.02	1.36	0.175
Avoidance		15.72 ± 6.03	16.75 ± 6.47	1.25	0.212
Arousal		11.54 ± 4.41	13.00 ± 5.00	2.34	0.020
Resilience (mean ± SD)	58.56 ± 16.37	64.51 ± 16.20	55.86 ± 15.76	4.21	0.000
Depression (mean ± SD)	11.27 ± 6.97	11.30 ± 7.13	11.25 ± 6.92	0.05	0.960
General family function (mean ± SD)	2.19 ± 0.40	2.13 ± 0.35	2.23 ± 0.42	1.87	0.063

Table 3 Correlations among depression, resilience, general family function, and PTSS

Variables	1	2	3
1. PTSS	–		
2. Depression	0.782**	–	
3. Resilience	−0.236**	−0.220**	–
4. General family function	0.325**	0.264**	−0.311**

**Correlation is significant at the 0.01 level (2-tailed)

depressive symptoms can have a negative impact on the family functioning [35, 36]. The typical structure of Chinese families, which are profoundly influenced by the Chinese culture, highlights a parent-child pattern in which the family members are interdependent more strongly than those in the Western families. In the event of family function impairment or loss of family support, therefore, the Chinese families are at greater risks for stress than their Western counterparts. As most of Chinese families are not religious, in contrast to the Western families, the positive effect of religion on stress relief does not apply to the Chinese families with cancer children. In addition, the Chinese parents of cancer children are very often not willing to speak of the medical condition of their children and choose to cope with the stress alone by suppressing their emotions and helplessness. On the part of the medical care providers and social workers, specific interventions of the family with cancer children by providing supportive resources including adequate information concerning the disease, psychological counseling, behavioral training, and health management may prove beneficial to improve the family function and alleviate the psychological trauma of the parents.

The findings in both previous studies [4, 37] and this present study show a correlation between a low educational level and the occurrence of PTSS in parents of cancer children. One of the possible reasons is that the parents' poor education might affect their awareness of the disease diagnosis and treatment process, and potentially causes more uncertainties in treatment-related decision-making. On the other hand, parents with a low educational level often have more limited supportive resources and are less resilient to stressful events [37].

The multivariate model analysis suggested that gender was a predictor of PTSS, indicating that mothers are more vulnerable to severe PTSS than the fathers during cancer treatment for their children [15, 38]. We also noted that the mothers and fathers responded differently to the stresses caused by a cancer diagnosis of their children, and they had different predictive factors of severe PTSS. For the fathers, according to the results of multiple regression analyses, depression and a lower educational level were significant factors associated with severe PTSS; for the mothers, depression and family functioning are the major predictors for PTSS. The explanation for this difference lies not only in the gender-specific differences in the coping strategies against stressful events, psychological states, social roles, and functions [39, 40] but also in the cultural consensus of the Chinese, in which mothers are more often supposed to carry out domestic tasks while the fathers are more active in executing diverse social roles and functions. Poor family functioning and coordination cause chaos among the family members in sharing their responsibilities for taking care of the cancer children, and have an especially greater impact on the mothers, who may have the feeling of increased loneliness and helplessness. In this sense, interventions to improve the family functioning bring more benefits to the mothers to cope with severe PTSS. The understanding of the

Table 4 Stepwise multiple regression analysis of the predictors of PTSS

Variable	R^2	ΔR^2	F	B	Beta (β)
Total sample (n = 279)					
(Constant)				15.227	
Depression	0.611	0.610	435.444***	1.526	0.735
General family function	0.626	0.624	231.255***	4.132	0.115
Gender	0.635	0.631	159.551***	2.841	0.091
Educational level	0.642	0.636	122.602***	−1.059	−0.082
Mothers (n = 192)					
(Constant)				15.19	
Depression	0.649	0.647	351.688***	1.698	0.778
General family function	0.665	0.661	187.451***	4.594	0.128
Fathers (n = 87)					
(Constant)				32.251	
Depression	0.560	0.555	108.107***	1.263	0.704
Educational level	0.588	0.578	59.829***	−1.953	−0.172

***$P < 0.001$

similarities and differences in the mothers' and fathers' psychological responses to their child's illness would potentially contribute to evidence-based psychosocial interventions to minimize the distress of both parents.

The other demographic factors considered in this study were not significantly associated with PCL-C scores in the multivariate analyses. The children's medical factors such as diagnosis of cancer and the time since diagnosis/treatment were not significantly associated with the PTSS of parents, which was consistent with previous reports [16].

Limitations

The current study has several limitations. First, PTSS were assessed through self-report questionnaires only, which may not be as accurate as face-to-face interviews to allow a diagnosis of clinically relevant disorder. Further study is needed to determine the true prevalence of PTSD compared to severe PTSS. Second, the study was conducted following a cross-sectional design without a matching control group. Further investigation by comparing the parents of the cancer children with those of healthy children may produce a more conclusive causality. Third, in this study, we only excluded parents who reported domestic violence and sexual abuse or had ongoing treatment for depression without considering other previous traumatic events of the parents, which may potentially introduce compounding factors in the analysis. Previous traumatic events and their consequences should be analyzed in more detail in future studies. Larger-scale prospective, longitudinal studies and more optimal assessment tools are needed to better describe the predictors and trajectory of PTSS in the parents of children with ongoing cancer treatment and determine the optimal intervention paradigm.

Conclusion

Depressive symptoms, general family function, gender, and educational level are important predictors of PTSS for parents. Gender-specific interventions of PTSS in the parents during their children's treatment may help prevent long-term psychological issues in the parents and promote the family functioning to provide optimal support for the children during cancer treatment.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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