

Predictors of PTSD in Mothers of Children Undergoing Bone Marrow Transplantation: The Role of Cognitive and Social Processes

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Objective: To investigate the role of cognitive and social processing in posttraumatic stress symptoms and disorder (PTSD) among mothers of children undergoing bone marrow and hematopoietic stem-cell transplantation (BMT/SCT).

Method: Questionnaires assessing emotional distress, BMT-related fears, and negative responses of family and friends were completed by 90 mothers at the time of the BMT infusion and 3 and 6 months post-BMT. PTSD symptoms were measured 6 months post-BMT by both paper-and-pencil and structured interview methods.

Results: Emotional distress, BMT-related fears, and negative responses of family and friends assessed at the time of BMT hospitalization were predictive of later PTSD symptoms. None of these variables prospectively predicted a PTSD diagnosis as measured by the structured interview.

Conclusions: Higher levels of general psychological distress, cognitive interpretations of the threat of the BMT for the child's future functioning, and negative responses of family and friends may place mothers at risk for post-BMT posttraumatic stress symptomatology.

Key words: *posttraumatic stress disorder; pediatric bone marrow transplantation; mothers; psychological distress.*

Bone marrow transplantation (BMT) and hematopoietic stem-cell transplantation (SCT) have become standard therapy for many childhood diseases. Unfortunately, these procedures are risky, and mortality

rates are as high as 50% a year after BMT (Balduzzi et al., 1994). Even if treatment is successful, there is a risk of recurrence, chronic graft-vs.-host disease, and serious late effects (e.g., pulmonary disease and cardiac problems) (Leisner, Leiper, Hann, & Chessells, 1994). BMT/SCT can also have a profound psychological impact on parents. Parents may experience

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anxiety and depressive symptoms (Barrera, Boyd, Pringle, Sumbler, & Saunders, 2000), as well as post-traumatic stress disorder (PTSD). PTSD symptoms include intrusive thoughts or reexperiencing aspects of the traumatic event, avoidance of reminders of the event or a numbing of emotions, and hypervigilance or increased physiological arousal. Studies evaluating PTSD in parents have reported incidence rates between 6% and 39.5% (Butler, Rizzi, & Handwerker, 1996; Kazak et al., 1997; Manne, DuHamel, Galleli, Sorgen, & Redd, 1998; Pelcovitz et al., 1996). However, few studies have evaluated PTSD among parents of children undergoing BMT. Heiney, Neuberg, Myers, and Bergman (1994) studied 20 parents of children undergoing BMT and found that parents described intrusive memories about the BMT and child medical symptoms that prompted fear and anxiety.

Why some parents experience PTSD and others do not is not well understood. Theory and research suggest that cognitive and social processing are involved in PTSD (Lang, 1985; Tait & Silver, 1992). Cognitive processing refers to how the individual comes to understand the implications of the event, in both cognitive and emotional terms, and social processing refers to the way that the experience is talked about and dealt with in the individual's social network.

Cognitive processing theories suggest factors that place some parents at greater risk for PTSD. Creamer and others (Creamer, Burgess, & Pattison, 1992; Lang, 1985) have proposed that a traumatic event results in the formation of a fear network composed of cognitive, affective, and physiological responses and interpretive information about the event (e.g., its meaning). Network size is determined by the perceived threat to the person's life, the intensity of the person's fear reaction, and the appraised potential for personal suffering invoked by the event. The first dimension of the fear network, perceived threat, has been associated with PTSD in studies of individuals who had observed a multiple shooting (Creamer et al., 1992) and studies of parents of pediatric cancer survivors (Kazak et al., 1998). The second dimension of the fear network, the intensity of the person's fear reaction, has also been found to predict PTSD. Immediate emotional reactions have been most frequently studied through analysis of retrospective ratings of the level of fear (Creamer et al., 1992) or anxiety and horror during the event (Cardena, Koopman, Classen, Waelde, & Spiegel, 2000; Maercker, Beauducel, & Schutzwohl, 2000). Unfortunately, research has not addressed the role of the third component of the

fear network, the potential for personal suffering, in the development of PTSD.

A second relevant theory is social processing, which postulates that talking with others can facilitate cognitive and affective processing of traumatic life experiences (e.g., Lepore, Silver, Wortman, & Wayment, 1996; Tait & Silver, 1992). As Tait and Silver suggest, talking with others may facilitate recovery through discharging of emotions, learning to tolerate aversive feelings, and receiving support and encouragement of effective coping. Not being able to talk, either because others act uncomfortable or are overtly critical, may place individuals at higher risk for PTSD, either because they cannot derive the benefits outlined above, or because these responses lead to avoidance. Our cross-sectional research among mothers of childhood cancer survivors has suggested that supportive responses are associated with lower levels of PTSD symptoms, while negative responses are associated with higher levels of symptoms (Manne et al., 2000).

Finally, objective medical aspects of transplantation may play a role in PTSD because they represent greater exposure to aversive aspects of the trauma, which increase perceived potential harm (e.g., March, 1993). Parents of children undergoing BMT/SCT who experience aversive events such as a life-threatening infection may also be more likely to develop PTSD. Although this hypothesis has not been supported in studies of parents of pediatric cancer survivors (Kazak et al., 1998), it should be evaluated because it has been associated with PTSD in other studies (e.g., Kliewer, Lepore, Oskin, & Johnson, 1998).

In this longitudinal, prospective study, three sets of factors were investigated: cognitive processing (e.g., fear network), social processing, and BMT-related medical events and treatment severity factors, in PTSD symptoms and diagnosis. Five study predictions were made. First, we predicted that mothers who had a higher fear network appraisal (perceived threat to the child's life, potential for the child's suffering, and fears for the child's future) during the BMT and at 3 months post-BMT would be more likely to report PTSD 6 months after the BMT. Second, we predicted that mothers experiencing more general distress during and 3 months post-BMT would be more likely to report PTSD. Third, we predicted that unsupportive responses from others and lower levels of social support would be associated with PTSD symptoms. Fourth, we predicted that mothers who were exposed to severe medical events or had children who underwent a poorer prognosis BMT would

be more likely to report PTSD. We focused on mothers who, because of their role as primary caretaker, may carry greater risk for distress reactions during their child's BMT/SCT (Streisand, Rodrigue, Houck, Graham-Pole, & Berlant, 2000).

Method

Participants

Participants were 90 mothers of children undergoing BMT or SCT. This investigation uses data from participants in a multisite longitudinal study of maternal distress and coping after pediatric BMT. Potential participants were recruited from BMT units at six hospitals (Mount Sinai School of Medicine, Memorial Sloan-Kettering Cancer Center [MSKCC], Dana Farber Cancer Institute, Northwestern University Medical Center, Stanford University Medical Center, and Emory University Medical Center). Inclusion criteria were (1) mother can read and write English, (2) mother was the primary caretaker, (3) mother age 18 years or greater, (4) child age 21 years or younger, and (5) mother had a partner. We approached 226 eligible mothers. Seventy-eight mothers (34%) declined participation and 143 (63%) consented. The most common reasons for nonparticipation were being overwhelmed ($n = 15$), lack of interest ($n = 13$), not wanting to leave the child's bedside ($n = 11$), and study burden ($n = 7$). Six of the consenting mothers (4.1%) were unable or unwilling to complete the Time 1 assessment and therefore could not be included. One hundred forty-three mothers completed the Time 1 assessment. Of these, 22 did not complete the Time 2 or 3 assessments (15.3%). Thirty-one children died prior to Time 3 (21.6%). The final sample consisted of 90 mothers (63% of mothers completing Time 1).

The mean age of participants was 37 years, 6 months ($SD = 7.35$, range = 19–56). Most were Caucasian (75.6%). Seventy-seven (85.6%) were married. Median income level was \$50,000 to \$59,999, and 84.4% had had at least some college education. Children ranged in age from 9 months to 20 years, with a mean age of 8.75 years ($SD = 5.51$). Approximately half were males (57.8%). Time since the child's diagnosis ranged from 1.5 months to 10 years, 9 months, with a median of 7 months. The most frequent cancer diagnoses were acute leukemias ($n = 39$) and neuroblastoma ($n = 15$). The most frequent noncancer diagnoses were sickle cell disease ($n = 3$) and juvenile rheumatoid arthritis ($n = 1$). Sixty-six children (73.3%)

were undergoing an allogeneic BMT, and 24 (26.7%) were autologous BMT. Children were hospitalized an average of 27 days posttransplant (range = 7–88 days).

Analyses comparing participants and study refusers were conducted. Demographic categories were collapsed to create the following dichotomous variables: married/nonmarried, Caucasian/non-Caucasian, cancer diagnosis/noncancer diagnosis. In addition, comparisons of hospital site, child gender, type of transplant (autologous/allogeneic), and child age were conducted. Results did not suggest differences between groups with regard to child gender, cancer versus noncancerous condition, ethnicity, or marital status. There were significant differences in the percentage of refusers across study sites ($\chi^2 [n = 242, df = 5] = 12.4, p < .05$). The three study sites that had larger BMT programs had a higher percentage of refusers (Dana Farber, 33%; MSKCC, 32%; Northwestern, 38%) than the smaller study sites (Stanford, 9%; Emory, 12%).

Analyses were also conducted to compare participants with the 22 mothers who did not complete Time 3 (for reasons other than the child's death) on Time 1 variables. Mothers who did not complete Time 3 had more anxiety ($t [104] = 3.5, p < .01$), more depressive symptoms ($t [104] = 2.5, p < .05$), and greater "fear network" ($t [131] = 3.1, p < .01$).

Procedures

Eligible mothers were approached prior to the child's BMT/SCT. After informed consent was obtained, mothers completed paper-and-pencil questionnaires at three time points and one structured interview at the third time point. The first assessment (Time 1) took place after the child was admitted to the hospital for the BMT. The mean date of the Time 1 was the day of the BMT (range = 4 days prior to 10 days post), and 80% were completed by posttransplantation day 3. Time 1 included measures of general distress, fear network, perceived supportive and unsupportive responses. The second assessment (Time 2) was conducted 3 months after the BMT/SCT and included the same measures as Time 1. The mean date for Time 2 was 90 days post-BMT/SCT (range = on time–21 days late), and 85% were completed within 10 days of the 3-month time point. The third assessment (Time 3) was conducted approximately 6 months after the BMT/SCT. Eighty percent of these assessments were completed within 10 days of the 6-month time point (range = on time–1 month late). Time 3 included the same measures as Time 1, with the addition of a paper-and-pencil PTSD symptoms measure and a

PTSD structured interview. The structured interview was administered to a subset of mothers. This strategy was adopted because the time necessary to administer a structured interview would add burden.

Two criteria were used to select the subset of mothers to administer the psychiatric interview (SCID-NP-PTSD; Spitzer et al., 1990). First, a cutoff of 35 on the paper-and-pencil PTSD measure, the PCL-C, was used. This cutoff was selected because cutoff scores between 35 and 40 on the PCL-C have been shown to result in a low rate of false negative diagnoses of PTSD in prior studies (Andrykowski, Cordova, & Studts, 1998; Manne et al., 1998). The good diagnostic utility of the PCL-C in terms of minimizing false negatives suggested that using a cutoff on the PCL-C minimizes the risk of missing a PTSD diagnosis. Second, 20% of the sample was randomly preselected at Time 3 for psychiatric interview. Using these criteria, 44 mothers were identified for SCID-NP administration. Twenty-four mothers were selected because they had scores over 35 on the PCL-C. Twenty-eight mothers were selected because they met random selection criteria. There was an overlap between mothers receiving the SCID-NP by PCL-C cutoff and random selection criteria. Eight mothers met both criteria. Four mothers who met selection criteria did not complete the SCID interview either due to refusal to be audiotaped or experimenter error. In total, 40 mothers were interviewed with the SCID-NP.

Objective medical risk variables were obtained by review of the medical chart at all time points.

Measures

Posttraumatic Stress Disorder. The SCID-NP-PTSD (Spitzer et al., 1990) has four symptom clusters, Criterion A (stressor criterion), Criterion B (reexperiencing cluster), Criterion C (avoidance cluster), and Criterion D (arousal cluster). Symptoms must be present for more than 1 month (Criterion E) and cause clinically significant distress or impairment in social, occupational, or other functioning (Criterion F). All questions were specifically linked to the child's BMT. The entire SCID was given, even if mothers did not meet Criterion A. Interviewers were trained in the SCID-NP-PTSD using the SCID-NP manual, audiotaped sample interviews, and practice interviews. Additional training and supervision was provided during the course of data collection. To establish interrater reliability, a subset of 12 audiotapes was independently reviewed and scored by a second rater, a licensed psychologist with a specialization in the SCID-NP (JD). Ratings were compared using kappa coefficients and percent agreement.

Standard criteria for acceptable kappa levels do not exist. Fleiss (1981) characterizes kappas of .40 to .60 as fair, .60 to .75 as good, and greater than .75 as excellent. Percent agreement for Criteria A, B, C, and D, and for the PTSD diagnosis, were 1.0, 1.0, .92, 1.0, and 1.0, respectively. Under Fleiss's criteria, results indicated that kappas for Criteria A, B, C, and D and PTSD diagnosis were excellent ($\kappa = 1.0$).

Posttraumatic Stress Symptoms. The Posttraumatic Symptom Disorder Checklist–Civilian Version (PCL-C; Weathers, Huska, & Keane, 1991) has 17 items and three subscales that correspond to DSM-IV PTSD Criteria B, C, and D, as well as a total symptoms score. Items were keyed to the child's BMT. The PCL-C can be used to identify individuals who may merit PTSD diagnosis in two ways. The cutoff method suggests a total score of 50 or more as meriting formal diagnosis. The symptom cluster method suggests that individuals may merit PTSD diagnoses if they report having been at least moderately bothered by one or more reexperiencing, three or more avoidance, and two or more arousal symptoms.

Trauma Exposure/Severity. Trauma exposure and severity were assessed by measuring the mother's exposure to aversive medical experiences during the child's BMT (labeled BMT events) and by assessing the medical risk associated with the child's BMT (labeled BMT risk). The BMT events variable was calculated at each time point. Time 1 events included the number of infections during hospitalization, whether or not the child was transferred to the ICU, placed on a ventilator, diagnosed with acute GVHD, or diagnosed with cardiac, bladder, renal, pulmonary, hepatic, CNS, stomatitis, or gastrointestinal toxicities using the Bearman Common Toxicity Rating Scale (Bearman et al., 1988). The 3- and 6-month BMT events variable included the number of hospitalizations and infections since the last assessment and whether the child was diagnosed with chronic GVHD, or the toxicities listed above. The BMT/SCT risk variable was formed by categorizing the BMT/SCT into three risk categories representing increasing levels of risk: autologous BMT/SCT, allogeneic BMT/SCT with a perfect HLA match, allogeneic transplant with an imperfect HLA match. This variable was only calculated once.

Distress. The Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988) and the Beck Depression Inventory (BDI; Beck, Steer, & Garbin, 1988) were used to assess distress at all time points. The BAI is a 21-item self-report instrument used to assess symptoms of anxiety. The BAI focuses on symptoms that are distinct from depressive symptoms (Beck et al., 1988). In this study, internal consistency was ex-

cellent (coefficient $\alpha = .89, .87, .92$ for Times 1, 2, and 3, respectively). The BDI is a widely used 21-item scale used to assess depressive symptomatology. Items represent the presence and intensity of emotional, cognitive, and somatic aspects of depression. In this study, internal consistency was excellent (coefficient $\alpha = .86, .87$, and $.92$ at Times 1, 2, and 3, respectively). Scores on both measures can range from 0 to 63. For purposes of the regression analyses, BAI and BDI scores were summed to create a single indicator of distress. This step was taken for two reasons: First, we did not have separate predictions for anxiety and depression. Second, collinearity diagnostics indicated that multicollinearity was an issue, and a combined scale reduced this risk. The internal consistency for the combined scale was excellent (coefficient $\alpha = .91, .94$, and $.95$ at Times 1, 2, and 3, respectively).

Fear Network. Based on prior research (Foa & Kozak, 1986; Lang, 1985), a measure of fear network was developed. One item assessed the mother's perception of life threat ("How scared are you that your child's treatment will not be successful?") on a 9-point Likert scale. One item assessed the perception of potential for suffering ("How scared are you that you'll never be able to put the cancer experience behind you?") on a 9-point Likert scale. Magnitude of fear was a sum of the intensity and frequency of the mothers' fears. The intensity of fear was assessed by the number of worries she had for her child in the domains of physical health, mental health, social interactions, school activities, family interactions, and future concerns. She was then asked to rate how frequently she had the worry on a 7-point Likert scale. Fear network was a sum of life threat, potential for suffering, number of fears, and the frequency of worries. Coefficient alpha was satisfactory (Time 1 = $.67$, Time 2 = $.68$, Time 3 = $.66$).

Enacted Support. Thirteen items adapted from the Cancer Support Inventory (Manne & Schnoll, 2001) were used. Likert-scale rated items assess emotional support, information guidance, and assistance with adaptive coping. Mothers were asked to make two separate ratings, one for their significant other and one for other family and friends. Scores on each scale can range from 1 to 52. The measure was administered at all time points. The internal consistency for both ratings was excellent (partner, Time 1 = $.85$, Time 2 = $.87$, Time 3 = $.91$; friends/family, Time 1 = $.89$, Time 2 = $.87$, Time 3 = $.87$).

Perceived Negative Behaviors. A 19-item scale adapted from the Cancer Support Inventory (Manne & Scholl, 2001) and Lepore's Social Constraints Measure (1996) was used. Items assessed overtly critical

responses and more subtle avoidance. Mothers were asked to make separate ratings for their significant other and for other family and friends. Potential scores range from 1 to 76. The measure was administered at all time points. The internal consistency was excellent (partner, Time 1 = $.91$, Time 2 = $.93$, Time 3 = $.95$; friends/family, Time 1 = $.91$, Time 2 = $.88$, Time 3 = $.93$).

Overview of Data Analysis

Study analyses were conducted in three steps. The first step was to provide descriptive information for model predictors and outcomes and to evaluate changes in model variables over time. Changes in model variables were evaluated using repeated measures analysis of variance. The second step was to identify a set of variables for inclusion in the multivariable analyses predicting PTSD. This step was taken to reduce the potential number of variables ($n = 16$) entered into the multivariable analyses. Bivariate analyses evaluating the association between the outcome and demographic, medical, and psychological predictor variables were conducted. Demographic variables included child age, child gender, maternal age, education (completed high school vs. did not complete high school), marital status (married vs. not married), ethnicity (Caucasian vs. non-Caucasian), and family income. Medical variables included hospital recruited from (six categories), type of illness (cancer vs. non-malignant condition), HLA compatibility status (perfect match vs. mismatch in one to three antigens), and time from diagnosis to BMT. Psychological variables included distress, enacted support, and negative responses. For the PCL-C symptom total, t tests or analysis of variance were conducted for categorical descriptor variables, and correlations were conducted for continuous variables. For the SCID-PTSD diagnosis, chi-square was used for the categorical descriptor variables and t tests were conducted for continuous variables.

Once a set of predictors was identified, the third step was to use multivariable analyses to evaluate the relative contribution of model variables in predicting PTSD diagnosis and symptoms. For this analysis, separate hierarchical regression analyses were carried out with 6-month PCL-C total scores and SCID-NP-PTSD diagnosis as outcomes. Analyses were conducted separately with model predictor variables from Times 1, 2, and 3. Trauma exposure/severity was entered into every regression equation to control for this factor. Variables were entered into the equations in the following order: trauma exposure/severity,

psychological distress, fear network, and social processing variables. Social processing variables were entered into the equation after cognitive appraisals because we assumed that contextual responses occurred temporally after cognitive appraisals.

Results

Descriptive Data and Changes Over 6 Months

Based on SCID-NP-PTSD responses, seven mothers (7.8 % of all participants and 17.5% of the 40 participants completing the PTSD module) were diagnosed with current PTSD. Partial PTSD, which is defined as meeting the stressor Criterion A and criteria for two of the three PTSD symptom clusters, was present in an additional six mothers (6.6% of all participants and 15% of the 40 mothers completing the PTSD module). Among the 40 mothers administered the SCID-NP, Criterion A was met by 23 mothers (57.5% of mothers completing PTSD module), Criterion B was met by 17 mothers (39.3% of mothers completing the PTSD module), Criterion C was met by 15 mothers (37% of mothers completing the PTSD module), and Criterion D was met by 8 mothers (29.6% of mothers completing the PTSD module). The most frequently endorsed symptoms were “difficulty concentrating” (52%), “difficulty sleeping” (60%), “feelings of detachment” (48%), “irritability or angry outbursts” (44%), “recurrent or distressing recollections of the experience” (43.3%), and “a sense of fore-shortened future” (38%). The least endorsed symp-

toms were “inability to recall important aspects of the trauma” (14.8%), “restricted range of affect” (18.5%), and “acting or feeling as if the event were recurring” (20%). Among the six mothers who met partial PTSD criteria, five mothers met criteria for Criterion B and six mothers met criteria for Criterion D. Only one mother met criteria for Criterion C (avoidance and numbing).

Mothers reported a mean PCL-C score of 27.5 with a standard deviation of 10.08. Using a score of 50 or greater total score on the PCL-C, we found that only three mothers met criteria for PTSD (3.3%). Using the symptom cluster method of determining PTSD, four mothers met criteria. One mother met symptom cluster criteria but did not have a PCLC total score of greater than 50.

Descriptive information for the model predictor variables as well as results of the repeated measures analyses of variance are shown in Table I. BAI and BDI scores are presented as well as the combined distress score. Results of repeated measures analyses of variance revealed that the BDI, BAI, and overall distress evidenced significant reductions over time. The number of BMT events also evidenced a significant reduction over time, as did the amount of perceived family criticism. Enacted support and fear network did not evidence changes over time.

Analysis of Predictors of PTSD

Predictors of PCL-C Symptom Total. Bivariate analyses did not reveal significant associations between demographic or medical variables and PCL-C total

Table I. Descriptive Information for BMT Events, Distress, Fear Network, Partner and Family Support, and Criticism at All Time Points

Variable	Time 1 M (SD)	Time 2 M (SD)	Time 3 M (SD)	F
BMT events	4.52 (3.43)	3.92 (2.97)	2.32 (3.42)	13.67*
BMT risk category				
Autologous	14 (15.5%)			
Allogeneic/perfect HLA	60 (66.6%)			
Allogeneic/imperfect HLA	16 (17.7%)			
BDI	10.56 (6.63)	8.61 (6.71)	7.66 (7.23)	32.98**
BAI	10.78 (8.79)	8.65 (9.38)	7.84 (8.92)	11.80*
Psych. distress	21.39 (14.54)	17.16 (15.18)	15.12 (15.19)	22.86**
Fear network	16.39 (6.50)	16.43 (6.50)	16.52 (6.76)	0.37
Partner support	40.07 (8.23)	39.79 (7.48)	39.46 (8.86)	0.01
Partner criticism	28.22 (10.96)	27.86 (9.52)	27.60 (11.55)	1.99
Family support	38.66 (7.83)	38.13 (7.76)	37.15 (7.43)	1.13
Family criticism	28.64 (8.76)	28.32 (7.45)	26.92 (9.09)	7.22*

BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory.

* $p < .01$.

** $p < .001$.

scores. Thus, other than the trauma exposure/severity variable, these variables were not included in the multivariable regressions. Bivariate correlations between model predictors at all time points and 6-month PCL-C scores are shown in Table II. The bivariate correlations revealed that Time 1, 2, and 3 fear network, psychological distress, and partner and family and friend negative responses had significant correlations with PCL-C total symptoms. Partner and family and friend support did not evidence significant correlations with PCL-C total and were not entered in the multivariable regression equations.

The results of the regression analyses are shown in Table III. For the equation using Time 1 predictors, fear network, distress, and negative responses from friends and family predicted PTSD symptoms. The trauma severity variables were not a significant predictor, accounting for only 1.2% of the variance in PTSD symptoms. Time 1 distress accounted for an additional 14.6% of the variance in PTSD symptoms. Fear network accounted for an additional 25.1% of the variance in PTSD symptoms, and the block that included family criticism (along with partner criticism) predicted an additional 7.5% of the variance.

Table II. Bivariate Correlations Between Model Variables and 6-Month PCLC Total Score

Variable	Predictors		
	Time 1	Time 2	Time 3
Medical events	-.06	.07	.16
Fear network	.52**	.53**	.54**
Psych. distress	.49**	.61**	.71**
Partner support	-.12	-.10	-.08
Partner criticism	.37**	.44**	.38**
Family support	.08	.06	-.02
Family criticism	.34**	.28*	.35**

* $p < .05$.

** $p < .001$.

The set of predictors accounted for 48.4% of the variance in PCL-C scores.

In the equation using Time 2 predictors, only distress accounted for a significant amount of variance in PTSD symptoms (37.8%). In the equation using concurrent predictors (Time 3), psychological distress was a significant correlate of PTSD symptoms, accounting for nearly 61% of the variance in PCLC total score. Trauma severity and critical responses from partner or family members were not associated with PCLC total (although family negative responses evidenced a marginal association), once the other variables were entered into the equation. The set of predictors accounted for slightly more than 64% of the variance in PCL-C scores.

Predictors of SCID-NP-PTSD Diagnosis. For these analyses, we used a dichotomous variable indicating whether the mother received a diagnosis of PTSD. Bivariate analyses using series of chi-squares and t tests indicated that none of the demographic or medical factors was significantly associated with PTSD diagnosis. Among the Time 1 variables, baseline distress ($t [38] = 2.65, p < .05$), fear network ($t [38] = 4.31, p < .001$), partner negative responses ($t [38] = 2.15, p < .05$), and friends and family negative responses ($t [38] = 2.1, p < .05$) were associated with PTSD. Among the Time 2 variables, distress ($t [38] = 3.2, p < .01$) and partner negative responses ($t [38] = 2.7, p < .01$) were significantly associated with PTSD. Among the Time 3 variables, only psychological distress was significantly associated with PTSD ($t [38] = 4.0, p < .001$). Based on these analyses, hierarchical logistic regressions were conducted using each set of predictors.

The results of these analyses are shown in Table IV. None of the Time 1 or 2 predictors was significantly associated with PTSD diagnosis. Time 3 distress remained a significant predictor of PTSD diagnosis after accounting for trauma severity variables.

Table III. Hierarchical Multiple Regression Predicting 6-Month Post-BMT PCL-C Symptomatology

Predictor	Time 1			Time 2			Time 3		
	Beta	p	R^2 change	Beta	p	R^2 change	Beta	p	R^2 change
Trauma exposure/severity			.012			.005			.015
BMT risk	.049	.508		.026	.810		-.038	.651	
BMT events	.034	.346		-.118	.283		.068	.425	
Psych. distress	.354**	.006	.146***	.447**	.001	.378***	.745***	.000	.605***
Fear network	.277*	.021	.251***	.193	.105	.031	.023	.812	.002
Criticism			.075*			.023			.022
Partner criticism	.130	.206		.153	.203		-.055	.568	
Family criticism	.228*	.033		.04	.695		.164	.072	

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table IV. Summary Statistics for Logistic Regressions Predicting 6-Month Post-BMT PTSD Diagnosis

	Beta	SE	Wald	Sig.	Exp (B)
Time 1					
Trauma exposure/severity	.068	1.940	0.00	.97	1.07
Psych. distress	.095	.085	1.26	.26	1.10
Fear network	.255	.192	1.79	.18	1.29
Family criticism	.088	.096	0.85	.36	1.09
Partner criticism	.054	.065	0.70	.40	1.06
Time 2					
Trauma exposure/severity	.726	1.100	0.44	.51	2.06
Psych. distress	.081	.044	3.44	.06	1.08
Partner criticism	.090	.070	1.66	.20	1.09
Time 3					
Trauma exposure/severity	.331	.85	.15	.698	1.39
Psych. distress	.111	.04	7.65	.006*	1.12

* $p < .01$.

Discussion

The results support the role of cognitive and social processing factors assessed at transplantation in PTSD symptoms among mothers of children undergoing BMT. Fear structure, distress, and unsupportive responses by family and friends measured at transplantation were predictive of PTSD symptom severity 6 months after BMT. These data underscore the potential for predicting PTSD symptom severity from maternal fear appraisals, distress, and perceived negative responses from others during the child's BMT. However, these variables were less successful in predicting PTSD symptoms when measured at later time points and in predicting a formal PTSD diagnosis as assessed by the SCID-NP. Only anxiety and depressive symptoms were predictive of PTSD symptom severity, and concurrent psychological distress was the only variable associated with a PTSD diagnosis at 6 months.

Cognitive processing at the time of transplantation played the most important role in later PTSD symptoms. Mother's appraisal of threat to her child's life, potential for her personal suffering, and the number of fears she reported regarding her child's future functioning at the time of the transplantation were the strongest predictors of PTSD symptoms. These results are consistent with our hypotheses and with prior research conducted by Kazak et al. (1998). Emotional distress at the time of BMT was also a key predictor of PTSD symptoms. These results are consistent with research with other populations indicating that distress during or immediately after a traumatic event are associated with PTSD symptoms (Maercker et al., 2000; Roemer, Orsillo, Borkovec, & Litz, 1998).

Family and friend negative responses at BMT were predictive of later PTSD symptoms. The role of negative responses in PTSD has received relatively little attention in the PTSD or pediatric BMT and cancer literature. Our cross-sectional study of mothers of pediatric cancer survivors indicated that social constraints were associated with PTSD symptoms (Manne et al., 2000). Dunmore, Clark, and Ehlers (1999) studied assault victims and found that participants with PTSD were more likely to perceive that others responded negatively to them than participants who did not have PTSD. Maternal perceived family and friend criticism may reflect general overall family functioning. If so, then mothers who had problems managing the stress of the actual BMT may be at greater risk for PTSD symptoms.

Despite the association between cognitive and social processing variables assessed at the time of BMT and later PTSD symptoms, these variables were less predictive when measured 3 and 6 months after BMT. Psychological distress assessed 3 and 6 months post-BMT was associated with PTSD symptoms, but fear network and negative responses from friends and family assessed at these time points were not associated with PTSD symptoms. Moreover, cognitive and social processing variables other than concurrent emotional distress were not able to predict a formal PTSD diagnosis. The lack of prospective associations may indicate that appraisals and reactions at the time of the actual transplantation may be most important in the development of later PTSD symptoms. The findings may also be due to the small sample size of mothers with PTSD and the number of other variables placed into the regression equations in the prospective analyses, and a larger

sample of mothers with PTSD may have yielded different findings. However, our findings also raise the possibility that the nature and distribution of PTSD may differ among individuals who witness a traumatic event and suggest future studies should carefully evaluate differences in the nature of PTSD among witnesses to trauma.

Two variables, social support and exposure to BMT events and medical risk, were not associated with PTSD symptoms. This finding is not consistent with other studies (e.g., Joseph, Andrews, Williams, & Yule, 1992; Manne, DuHamel, & Redd, 2000). One explanation may be that prior research evaluated perceived social support. Studies that have evaluated the role of received social support have reported inconsistent findings, with some studies not finding an association with PTSD (Pickens, Field, Prodromidis, Nogueras, & Hossain, 1995) and some findings reporting a relation between greater received support and lower PTSD (Stretch, 1986). These findings suggest that greater attention should be given to the role of various types of social support, as different dimensions may have different associations with PTSD. The fact that we did not find an association between exposure to aversive BMT events and medical risk of the child's BMT and PTSD symptoms suggests that subjective appraisal may be more important than objective factors. This finding is consistent with research by Creamer et al. (1992) that failed to find a link between exposure and other "severity" factors and PTSD. However, other studies have found an "exposure-response" relationship (e.g., Fontana & Rosenheck, 1993). In addition, other studies of parents of childhood cancer survivors have documented a link between the length of cancer treatment and PTSD (Kazak et al., 1998). There are at least two alternative explanations for our negative finding. First, our measure of stressor severity and exposure may not have been sufficiently comprehensive to capture the objective aspects of BMT that result in PTSD. Second, the link between exposure/severity and PTSD may be mediated by other mechanisms such as appraisal of life threat or treatment intensity (Kazak et al., 1998).

This study has several limitations. First, present PTSD symptoms could reflect preexisting symptoms present prior to the transplantation. A second, related issue is that present PTSD symptoms were actually cued by events prior to the transplantation. Future studies should evaluate symptoms in the several months prior to the child's transplantation. However, even if symptoms prior to the transplantation

were assessed, to some degree the post-BMT assessment would be confounded by pre-BMT experiences. PTSD symptoms can reflect a multiplicity of different cues and stressors, and it is difficult for the participant, as well as the SCID interviewer, to separate cues for PTSD symptoms. Third, mothers who did not complete the 6-month survey may have been more likely to report PTSD symptoms. Mothers with PTSD symptoms may avoid completing a survey and interview that would serve as a reminder of the BMT/SCT. Comparisons of mothers who did not complete the second or third assessments were consistent with this hypothesis: mothers who dropped out, for reasons other than the child's death after the BMT/SCT, were more likely to report anxiety and depressive symptoms and a higher fear network score at Time 1. Attrition may affect estimates of prevalence and severity of PTSD symptoms (e.g., higher participation might result in more mothers with PTSD at 6 months). Biased attrition may also affect relations between our model variables and PTSD. Overall, our findings suggest that mothers at highest risk for developing PTSD may not participate in psychosocial studies. Both clinicians and researchers should be aware that we may know less about those mothers who are most at risk for developing PTSD.

In this study, we identified factors that place mothers at risk for developing PTSD symptoms, but we were less able to identify factors that lead to a formal diagnosis of PTSD. Mothers at risk for later PTSD symptoms have more distress at the time of BMT/SCT, report more negative responses from friends and family, and perceive more life threat to their child, more potential for their own personal suffering, and more fears about the child's future functioning. Our findings also suggest that mothers who drop out of our research might be at higher risk for developing PTSD. This finding suggests that interventions delivered early in transplantation might be able to target and reduce distress among a group of mothers who are less likely to participate in psychosocial studies or interventions later.

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