



Quality of life and behavioral adjustment after pediatric bone marrow transplantation

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Summary:

The purpose of this study was two-fold: to describe the quality of life and behavioral adjustment of survivors of pediatric bone marrow transplantation (BMT) prior to and 6 months post-BMT; and, to identify correlates of survivors' quality of life and behavioral adjustment. Participants were 26 children and adolescents who underwent BMT, and their mothers. At pre- and 6 months post BMT, mothers completed standardized measures of their children's behavioral adjustment, quality of life, and adaptive functioning. Self-report questionnaires were completed to determine levels of maternal anxiety and depression, and family functioning. Information was also gathered about demographic variables, medical history, and symptom severity. Children's overall quality of life improved 6 months post BMT and was most strongly associated with pre-BMT levels of family cohesion. Children's behavioral adjustment remained within the normal range across time and was associated with pre-BMT levels of family cohesion and child adaptive functioning. Mothers' psychological adjustment improved over time and was associated with quality of life, but unrelated to children's behavioral adjustment. Pre-BMT levels of family cohesion and child adaptive functioning appear to be important in understanding quality of life and behavioral adjustment of pediatric BMT survivors. *Bone Marrow Transplantation* (2000) 26, 427–435.

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already endured years of aggressive treatment for a life-threatening illness. These children and their families face a future that may vary from a cure and normality to chronic graft-versus-host disease, relapse, and/or even death.¹ For children and families over-burdened with a wide range of medical, socio-emotional, and financial stresses related to the illness, BMT may represent a severe additional stressor with profound disruption for the entire family. Thus, BMT places each family member at risk for psychological maladjustment and dramatic decrease in quality of life. The purpose of this study was two-fold: to describe the quality of life and behavioral adjustment of survivors of pediatric BMT prior to and 6 months post BMT; and, to identify correlates of quality of life and behavioral adjustment.

The BMT procedure and its immediate and late medical effects inevitably have a significant impact on the psychological well-being and quality of life of the child and family. Studies with pediatric BMT survivors have typically used a 'psychopathology' framework to examine psychological well-being. In this framework, psychological dysfunction (eg depression, anxiety, severe problem behaviors) is viewed as an indicator of patients' difficulties adjusting to their illness, its treatment, and survival. Psychological well-being is typically evidenced by a reduction of emotional distress (eg anxiety and depression symptoms) and by a return to normality in every-day life.² Within this type of focus, research has indicated that during the period immediately after BMT, children may become withdrawn and passive (eg Ref. 3) or may express difficult behavior and negative moods.^{4,5} Increased levels of symptoms such as anxiety, depression, anger, and hypervigilance are generally seen as peaking during the period of hospitalization and as reflecting reasonable responses to highly aversive situationally-based stressors (eg daily aversive medical procedures, acute toxicity of chemotherapy, prolonged hospitalization and social isolation). Symptoms of psychological distress have been reported to gradually dissipate over time in many children as they recover and family life regains normality.^{6–9} These findings suggest that overall, this population as a group seems to adjust reasonably well after BMT, without serious short-term or long-term psychopathology (for example, see Refs 4, 10). However, a small subgroup of children and adolescents has been found to exhibit decline in social competence and self-concept,¹⁰ or to experience social isolation¹¹ and other emotional difficulties that may require psychological intervention post BMT.^{7,8} Are these children different? Do their medical symptoms persist longer, or are they of a more severe nature? These questions remain to be answered.

Bone marrow transplantation (BMT) is an aggressive medical procedure associated with high mortality and morbidity rates. For children and adolescents with some life-threatening pediatric cancers, blood diseases, and metabolic disorders, BMT may represent the best or the only viable treatment option after disease relapse and failure of more conventional treatments. Although the medical efficacy of BMT has been established for certain populations, research on the quality of life and psychosocial effects of this procedure lags behind. Many children undergoing BMT have

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Although the majority of research has used this psychopathology framework when investigating psychological adjustment to BMT, some investigators have started to examine children's quality of life using a 'health-related' perspective. This perspective focuses on the psychological well-being of patients as defined by the World Health Organization.¹² Within the health-related perspective, some researchers have investigated the degree of emotional distress and impairment of normal functioning specific to the treatment of patients' medical illness during the acute stage of hospitalization following the BMT.⁴ However, the subtle and sometimes chronic late-effect changes in health-related quality of life of BMT survivors will need to be documented prospectively throughout the recovery period.

Part of the problem in assessing health-related quality of life of survivors of pediatric BMT is the limited availability of adequate instruments that capture relevant physical and psychological late effects. In this study, the Pediatric Oncology Quality of Life Scale¹³ was used to assess the quality of life of children undergoing BMT. This measure was specifically developed for children with cancer and it assesses physical well-being, role restriction, and emotional well-being. It is argued here that using quality of life as an outcome indicator will increase sensitivity to the more subtle changes in health and psychological late effects of a major health crisis, such as a BMT.

Family functioning is defined by Kantor and Lehr¹⁴ as the actions and interactions of the family members within the family system and across its boundaries. Taking a family systems perspective, under normal circumstances relationships among family members can be difficult because they require that each individual adjusts to the dynamics of the entire family. When contemplating a pediatric BMT as a treatment option for a very ill child, parents simultaneously hope for their child's survival and fear for the uncertainty of the outcome. These difficult circumstances place additional strain on parents' psychological adjustment and on family relationships.

Parent psychological adjustment and family functioning have emerged in the literature as factors potentially involved in differentiating between children who adjust well after BMT *vs* those who do not. Thus, children's behavioral adjustment has been associated with their parents' own emotional distress, high levels of marital conflict, low levels of family cohesiveness and expressiveness, and infrequent external social supports available to the family.^{6,7,10}

The current prospective study makes a first step toward a health-related research perspective by including quality of life as a longer-term outcome indicator, along with a more traditional behavioral adjustment outcome. The study presents correlates of adjustment to BMT to be used as potential predictors in the development of a multivariate statistical model in future studies with larger sample size. This study is part of a larger prospective and longitudinal project which examines the psychological adjustment and quality of life of children undergoing BMT, and their families. As such, this study may be vulnerable to many of the limitations common to investigations of this nature. Its statistical power may be compromised by the small sample size, and its data base may be incomplete due to the

inherent difficulties in longitudinal investigations with severely ill populations, such as a high attrition rate due to mortality. Finally, this study presents data based only on parents' reports. Despite these limitations, the results should shed some light on factors associated with quality of life and behavioral adjustment of BMT survivors up to 6 months post BMT. Specifically, the current study first compared the pre- and 6 months post BMT quality of life, behavioral adjustment, and severity of medical symptoms of pediatric BMT patients, as well as maternal psychological adjustment and family functioning. It then investigated which of these pre-BMT variables (as well as pre-BMT adaptive functioning and demographic variables) were correlates of children's quality of life and behavioral adjustment 6 months post BMT. Given the results of the research in the literature to date, we hypothesized that behavioral adjustment and quality of life at 6 months post BMT would be related to the following pre-BMT variables: the child's own resources, maternal psychological adjustment, and family functioning.

Materials and methods

Participants

Potential participants were all children (and their parents) who were eligible for a BMT, except those with severe combined immune deficiency (since its period of isolation is markedly different than for other diagnoses). Due to limited research resources and scheduling difficulties, only about 70% of those eligible were invited to participate. Of the 65 families approached, 62 agreed to participate for a recruitment success rate of approximately 95%. The current study reports on a subset of the original cohort – 26 children and their mothers on whom complete information for most of the variables of interest had been collected to date (ie at both pre-BMT and 6 months post BMT). Of the 62 participants in the larger study, 38% died before the 6-month assessment and 10% withdrew due to feelings of 'too much on their plate'. The remaining participants (11%) had not yet reached the 6-month point; thus, their data were not available for the current study.

Table 1 presents the demographic and relevant medical variables of the sample. Children's age at BMT ranged from 10 months to 17.5 years, with a mean age of 8.5 years (s.d. = 5.73). There were 12 females and 14 males. The majority of children undergoing BMT had a malignancy (54% had leukemia, 19% had other malignancies). In this group, 18 children had an allogeneic transplant (10 related, eight unrelated) and eight an autologous transplant. Mothers' mean age was 34.8 years (s.d. = 6.26) and 81% were part of a two-parent family. Thirty-five percent of the mothers had some university, college, or trade school education.

Procedure

A letter was sent to all potential participants briefly describing the study. The project coordinator contacted them nearer the time of their BMT information consultation in

Table 1 Demographics and medical variables

| | Mean | s.d. | Range |
|-------------------------------|---------|-------|-------------|
| <i>Children (n = 26)</i> | | | |
| Age (years) | 8.5 | 5.7 | 0.8–18 |
| Time since diagnosis (months) | 0.81 | 0.77 | 0.20–3.63 |
| Symptom severity (pre-BMT) | 19.26 | 12.92 | 2–53 |
| Sex | 12 | 14 | |
| | females | males | |
| <i>Diagnosis</i> | | | |
| Leukemias | 54% | | |
| Other malignancies | 19% | | |
| Anemias | 8% | | |
| Genetic/Metabolic | 19% | | |
| <i>Mothers (n = 26)</i> | | | |
| Age (years) | 34.86 | 6.26 | 21.65–46.87 |
| <i>Marital status</i> | | | |
| Two-parent family | 81% | | |
| One-parent family | 19% | | |
| <i>Level of education</i> | | | |
| <i>High school</i> | | | |
| some | 11% | | |
| completed | 27% | | |
| <i>University/College</i> | | | |
| some | 35% | | |
| completed | 27% | | |

order to elaborate further on the study and to invite them to participate. Initial contact with candidates varied depending upon the schedule for admission, ranging from pre-admission consultation visits to the day of hospital admission for BMT. (Correlational analyses revealed that this range in time prior to BMT had no association with any of the variables.) Informed consent was obtained from those who agreed to participate. The coordinator reviewed with the parents the questionnaires they were to complete about themselves and their child (although both parents were invited to participate in two-parent families, only the data from mothers are used in the current study). A mutually convenient time was scheduled to conduct the interview with one parent (usually the mother), to administer the Vineland Adaptive Behavior Scales (VABS¹⁵), and to assess the child. The parents completed a smaller number of questionnaires at 2 weeks post BMT (not reported for this study). All of the measures, except the Vineland, were completed at 6 months post BMT. The full battery was completed again at 12 and 24 months post BMT. For the current study, we present data from some measures completed during the pre- and 6-month post BMT assessments.

Child measures

Children's adaptive functioning levels were assessed using the VABS, a semi-structured interview administered to parents of children from birth to 18 years of age. It assesses the performance of children in three domains: communication, daily living, socialization. For children less than 6 years of age, it also assesses motor skills. Scores on these domains yield an overall Adaptive Behavior score. The total and subscale scores have good internal consistency ($r = 0.69$ to 0.84), 4-week test-retest reliability ($r = 0.78$ to 0.92), and

inter-interview reliability ($r = 0.62$ to 0.78). Adequate validity has also been demonstrated.¹⁵

The two forms of the Child Behavior Checklist (for ages 2 and 3, and for 4 to 18) were used (CBCL¹⁶). The CBCL is a parent-completed questionnaire consisting of 112 items used to assess the child's emotional and behavioral problems as perceived by parents. Behavior ratings are grouped into eight behavioral subscales that in turn yield an Internalizing summary score (representing perceptions of emotional behaviors), an Externalizing summary score (representing perceptions of 'acting out' behaviors), and a Total summary score. These summary scores have good test-retest reliability at 1 week ($r = 0.82$ to 0.92) and 6 months ($r = 0.62$ to 0.74), and have adequate validity.¹⁷ The Pediatric Oncology Quality of Life Scale (POQOLS¹³) is a 21-item parent-completed measure designed for assessing quality of life of children with cancer. It provides a Total score and three factor scores (Role Restriction, Emotional Distress and Physical Discomfort). Good internal consistency was reported for the total and each of the factors (coefficients between 0.67 and 0.87). Inter-rater reliability was adequate ($r = 0.89$).

Medical and demographic data were obtained from the charts and from a brief interview with the mother. These variables include: (1) diagnosis, (2) time since diagnosis, (3) age at BMT, (4) type of transplant, and (5) symptom severity. This information is presented in Table 1. Symptom severity was determined at pre- and at 6 months post BMT by summing the frequency ratings reported by the parent for a list of possible symptoms (eg nausea, mouth sores, fever). Frequency ratings were scored as: none = 0, below average = 1, average = 2, above average = 3.

Family measures

Maternal psychological adjustment was measured using two standardized instruments. The Beck Depression Inventory (BDI¹⁸) measured depression and the State-Trait Anxiety Inventory (STAI¹⁹) measured anxiety. The BDI is a self-administered 21-item questionnaire that has been found to be highly sensitive in measuring change in depressive symptoms and severity.²⁰ Stability of the BDI for non-psychiatry patients was high ($r = 0.60$ to 0.83) and concurrent validity with most other self-report measures of depression has been consistently high.²⁰

The STAI consists of the State and the Trait anxiety scales which are two separate self-report scales of 20 items each. Only the State scale was used in this study because the two scales have been found to be highly correlated in previous work with parents of children with cancer (for example, see Ref. 21). The State scale measures how a person feels right now and has been found to be highly sensitive to 'changes in transitory anxiety' experienced by individuals in unavoidable, real-life stressful situations. The validity of the STAI has been found to be adequate in comparison to other anxiety measures.¹⁹

Family functioning was measured using the Family Adaptability and Cohesion Evaluation Scale (FACES III²²), a 20-item scale based on the Circumflex Model of family functioning. The FACES III measures two dimensions of family relations: cohesion (the degree of family

connectedness) and adaptability (the degree to which the family system is able to change). The test-retest reliability coefficients over a 4- to 5-week period was 0.83 for cohesion and 0.80 for adaptability. Face, content, and discriminative validity are also reported to be high.²² Rating scores on the dimensions of both cohesion and adaptability display a curvilinear relationship to healthy functioning. Families who score in the extreme range on either dimension (ie <35 and >45 for cohesion, and <20 and >28 for adaptability) tend to have more difficulties coping with situational stress. Families that display more moderate scores (ie in the normal range) on these dimensions are expected to cope better.

Results

Pre- and post BMT changes

Table 2 presents means, standard deviations, and significance levels (using paired *t*-tests) of pre- and post-BMT differences on child, family, and medical treatment variables. The Total, Internalizing, and Externalizing behavioral summary scores on the CBCL at the post-BMT assessment did not differ significantly from those reported prior to BMT. Furthermore, these behavior scores remained within the normal range.

Keeping in mind that a decrease in scores on the POQOLS represents an increase (or improvement) in quality of life, results indicated a significant improvement in children's quality of life at 6 months post BMT. Changes in scores on both the POQOLS Total ($t = 2.22, P < 0.05$) and the Physical Discomfort factor ($t = 2.78, P < 0.05$) demonstrated improvement over time. While improvement

represented by the difference between the pre- and post-BMT Role Restriction scores approached significance, the Emotional Distress factor scores remained constant across assessment periods.

Maternal ratings of depressive symptoms on the BDI did not differ significantly between pre- and post BMT and revealed an overall minimal level of depressive symptoms. The percentage of mothers who reported depressive symptoms within the clinical range at pre-BMT and post BMT remained constant at approximately 8% indicating no maternal pathology with regard to depression. In contrast, maternal anxiety ratings measured by the STAI were significantly higher at pre-BMT than at 6 months post BMT ($t = 3.83, P < 0.001$). As a group, mothers' mean anxiety levels did not reach the clinical cut-off (ie a *t*-score of 60); however, 50% of mothers reported anxiety levels within this clinical range at pre-BMT. This is a significantly higher level than expected from the population norms of 15%, $\chi^2(1, N = 26) = 23.9, P < 0.0001$. In comparison, only 20% of mothers reported anxiety levels within the clinical range at the post-BMT assessment.

Finally, pre- and post-BMT mean scores on the family Adaptability and Cohesion scales of the FACES III were within the range expected for normally functioning families at both times. The level of family cohesion, or connectedness, remained constant across testings. There was, however, a significant reduction in family adaptability scores ($t = 2.36, P < 0.05$) suggesting less flexibility post BMT.

Correlates of child's behavioral adjustment and quality of life

Bivariate correlations were used to explore relationships between pre- and post-BMT independent variables (child

Table 2 Pre- and post-BMT comparisons (paired *t*-tests)

| | Pre-BMT | | | Post BMT | |
|-------------------------------------|---------|-------|----------------------|----------|-------|
| | Mean | s.d. | | Mean | s.d. |
| <i>Child variables</i> | | | | | |
| CBCL Internalizing | 51.09 | 9.44 | | 47.70 | 8.96 |
| CBCL Externalizing | 48.96 | 9.52 | | 49.30 | 8.04 |
| CBCL Total | 50.43 | 10.88 | | 48.47 | 10.16 |
| POQOL ^a Role Restriction | 35.84 | 12.78 | | 28.72 | 12.24 |
| POQOL Emotional Distress | 19.18 | 6.45 | | 19.47 | 6.62 |
| POQOL Phys. Discomfort* | 20.28 | 6.67 | | 14.37 | 5.93 |
| POQOL Total* | 75.31 | 18.64 | | 62.57 | 20.27 |
| <i>Parent variables</i> | | | | | |
| Mother's Beck Depression | 8.56 | 5.99 | | 7.60 | 8.03 |
| Mother's State Anxiety*** | 57.92 | 12.56 | | 47.96 | 12.21 |
| <i>Family variables</i> | | | | | |
| FACES III Cohesion | 41.00 | 4.71 | (35–45) ^b | 40.52 | 7.04 |
| FACES III Adaptability* | 23.25 | 5.17 | (20–28) ^c | 20.80 | 5.41 |
| <i>Medical variable</i> | | | | | |
| Symptom Severity | 19.26 | 12.92 | | 18.13 | 9.44 |

CBCL = Child Behavior Checklist; POQOL = Pediatric Oncology Quality of Life; FACES III = Family Adaptability and Cohesion Evaluation Scale.

^aHigher scores represent poorer quality of life.

^bNormal range for Cohesion.

^cNormal range for Adaptability.

* $P < 0.05$; *** $P < 0.001$.

adaptive functioning, maternal depression and anxiety, family functioning, age at BMT, time since diagnosis, and symptom severity) and the two dependent variables (children's behavioral adjustment and quality of life). Two sets of analyses were calculated for all correlational analyses involving the FACES III measure of family functioning: one with, and one without the few scores at the extremes of each dimension of Cohesion and Adaptability. This was done to account for the curvilinear relationship of the dimension scores to healthy functioning. These analyses yielded very similar results with virtually no difference in the number or strength of significant relationships. Thus, analyses with the full sample are presented here.

Table 3 presents correlations between pre-BMT independent and dependent variables. Family Cohesion was strongly related to children's Internalizing ($r = 0.54, P < 0.01$), Externalizing ($r = 0.56, P < 0.01$), and Total problem behavior scores of the CBCL ($r = 0.63, P < 0.001$). These findings suggest that increased levels of family connectedness are associated with maternal reports of greater behavioral adjustment difficulties in children at pre-BMT. Pre-BMT symptom severity, child adaptive functioning as measured by the Vineland, and maternal psychological adjustment (ie depression and anxiety levels) were not significantly correlated with either behavioral adjustment or quality of life.

Table 4 depicts cross-lagged bivariate correlations between pre-BMT independent variables and post-BMT dependent variables. Only pre-BMT child adaptive functioning and family cohesion were significantly related to any of the children's behavioral adjustment and quality of life scores at 6 months post BMT. Specifically, children at a higher level of adaptive functioning at pre-BMT exhibited fewer Total problem behaviors on the CBCL ($r = -0.54, P < 0.01$), and lower Emotional Distress scores on the POQOLS ($r = -0.43, P < 0.05$) 6 months post BMT. Family cohesiveness had mixed relationships (ie both positive and negative) with the dependent variables. Children in

more normally cohesive families at pre-BMT were rated by mothers as displaying both more Externalizing and Total problem behaviors by 6 months post BMT ($r = 0.41, P < 0.05$, and $r = 0.50, P < 0.05$, respectively). On the other hand, children from more normally cohesive families at pre-BMT were reported to have lower scores, and therefore improved quality of life, on all three POQOLS factors ($r = -0.47, P < 0.05$, $r = -0.40$, and $r = -0.67, P < 0.001$) and the POQOLS Total score ($r = -0.61, P < 0.001$). Pre-BMT symptom severity, age at BMT, and time since diagnosis, as well as maternal psychological adjustment (ie depression and anxiety) were not significantly related to children's post-BMT behavioral adjustment or quality of life.

Finally, bivariate correlational analyses were used to explore relationships between post-BMT independent variables (ie family functioning, maternal psychological adjustment, and severity of medical symptoms) and post-BMT child dependent variables. Table 5 presents the results of these analyses. Post-BMT maternal depression and anxiety levels were strongly related to children's quality of life but not to behavioral adjustment. Increases in maternal depression were associated with a decrease in children's quality of life represented by the Total POQOLS score ($r = 0.50, P < 0.01$) and all factor scores ($r = 0.51, P < 0.01$ for Emotional Distress, and $r = 0.46, P < 0.05$ for Physical Discomfort) except Role Restriction. Maternal anxiety was associated with decreased quality of life represented by the Total POQOLS score ($r = 0.60, P < 0.01$), and all three factor scores ($r = 0.41, P < 0.05$ for Role Restriction, $r = 0.52, P < 0.01$ for Emotional Distress, and $r = 0.65, P < 0.001$ for Physical Discomfort). There was also a significant relationship between post-BMT symptom severity and children's quality of life; children who experienced more severe medical symptoms 6 months post BMT were reported to have reduced quality of life as represented by scores on the Total ($r = 0.55, P < 0.01$) and on the three factors of the POQOLS ($r = 0.40, P < 0.05$ for Role Restriction, r

Table 3 Pre-BMT bivariate correlations (pre-BMT child, parent, family and medical variables with pre-BMT behavior and quality of life)

| | Child | | | Parent | | Family | | Medical symptoms |
|--------------------|---------------|-------------------|---------------|---------------|---------------|---------------|---------------|------------------|
| | Age | Time ^a | Vineland | BDI | Anxiety | Cohn | Adap | |
| CBCL | <i>n</i> = 24 | <i>n</i> = 23 | <i>n</i> = 24 | <i>n</i> = 24 | <i>n</i> = 24 | <i>n</i> = 24 | <i>n</i> = 24 | <i>n</i> = 21 |
| Internalizing | -0.08 | -0.00 | -0.32 | -0.02 | -0.16 | 0.54** | -0.16 | 0.29 |
| Externalizing | -0.11 | 0.02 | 0.10 | 0.14 | -0.09 | 0.56** | -0.21 | 0.38 |
| Total | -0.15 | 0.07 | -0.23 | 0.03 | -0.14 | 0.63*** | -0.21 | 0.39 |
| POQOL ^b | <i>n</i> = 19 | <i>n</i> = 18 | <i>n</i> = 19 | <i>n</i> = 19 | <i>n</i> = 19 | <i>n</i> = 19 | <i>n</i> = 19 | <i>n</i> = 18 |
| Role restriction | 0.24 | -0.04 | -0.17 | -0.21 | -0.15 | 0.13 | 0.34 | 0.02 |
| Emotion | 0.32 | 0.01 | -0.04 | -0.03 | -0.39 | 0.21 | -0.11 | 0.23 |
| Phys Discomfort | -0.01 | -0.05 | -0.20 | -0.30 | -0.22 | 0.19 | 0.41 | 0.09 |
| Total | 0.27 | -0.04 | -0.20 | -0.26 | -0.31 | 0.23 | 0.34 | 0.13 |

CBCL = Child Behavior Checklist; POQOL = Pediatric Oncology Quality of Life; Child Variables: Age = age at BMT; Time = time (number of months) since diagnosis; Vineland = Vineland Adaptive Behavior Scales. Parent Variables: BDI = Beck Depression Inventory; Anxiety = State subscale of State-Trait Anxiety Inventory. Family Variables: Cohn = Cohesion, and Adap = Adaptability subscales of Family Adaptability and Cohesion Evaluation Scale (FACES-III). Medical Variable: Symptoms = symptom severity.

^aFor this category, one outlier was dropped from analyses involving this variable.

^bHigher scores represent poorer quality of life.

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Table 4 Cross-lagged bivariate correlations (pre-BMT child, parent, family and medical variables with post-BMT behavior and quality of life)

| | Child | | | Parent | | Family | | Medical Symptoms |
|--------------------|---------------|-------------------|---------------|---------------|---------------|---------------|---------------|------------------|
| | Age | Time ^a | Vineland | BDI | Anxiety | Cohn | Adap | |
| CBCL | <i>n</i> = 23 | <i>n</i> = 22 | <i>n</i> = 23 | <i>n</i> = 23 | <i>n</i> = 23 | <i>n</i> = 23 | <i>n</i> = 23 | <i>n</i> = 20 |
| Internalizing | -0.09 | 0.16 | -0.31 | 0.22 | 0.11 | 0.39 | 0.05 | 0.19 |
| Externalizing | -0.32 | 0.02 | -0.41 | 0.01 | -0.18 | 0.41* | 0.00 | 0.41 |
| Total | -0.28 | 0.11 | -0.54** | 0.02 | -0.14 | 0.50* | 0.05 | 0.24 |
| POQOL ^b | <i>n</i> = 26 | <i>n</i> = 25 | <i>n</i> = 26 | <i>n</i> = 26 | <i>n</i> = 26 | <i>n</i> = 26 | <i>n</i> = 26 | <i>n</i> = 23 |
| Role Restriction | 0.21 | -0.01 | -0.11 | 0.01 | 0.20 | -0.47* | 0.14 | -0.10 |
| Emotion Distress | 0.07 | -0.07 | -0.43* | 0.33 | 0.33 | -0.40* | 0.24 | 0.10 |
| Phys Discomfort | 0.35 | -0.10 | -0.15 | 0.26 | 0.26 | -0.67*** | 0.18 | -0.04 |
| Total | 0.25 | -0.06 | -0.04 | 0.20 | 0.31 | -0.61*** | 0.22 | -0.04 |

CBCL = Child Behavior Checklist; POQOL = Pediatric Oncology Quality of Life; Child Variables: Age = age at BMT; Time = time (number of months) since diagnosis; Vineland = Vineland Adaptive Behavior Scales. Parent Variables: BDI = Beck Depression Inventory; Anxiety = State subscale of State-Trait Anxiety Inventory. Family Variables: Cohn = Cohesion, and Adap = Adaptability subscales of Family Adaptability and Cohesion Evaluation Scale (FACES-III). Medical Variable: Symptoms = symptom severity.

^aFor this category, one outlier was dropped from analyses involving this variable.

^bHigher scores represent poorer quality of life.

P* < 0.05; *P* < 0.01; ****P* < 0.001.

Table 5 Post-BMT bivariate correlations (post-BMT parent, family and medical variables with post-BMT behavior and quality of life)

| | Parent | | Family | | Medical Symptoms |
|--------------------|---------------|---------------|---------------|---------------|------------------|
| | BDI | Anxiety | Cohn | Adap | |
| CBCL | <i>n</i> = 23 | <i>n</i> = 22 | <i>n</i> = 23 | <i>n</i> = 23 | <i>n</i> = 23 |
| Internalizing | 0.22 | -0.09 | 0.07 | -0.05 | 0.05 |
| Externalizing | 0.18 | -0.19 | -0.09 | -0.20 | 0.16 |
| Total | 0.15 | -0.22 | -0.01 | -0.16 | 0.05 |
| POQOL ^a | <i>n</i> = 25 | <i>n</i> = 24 | <i>n</i> = 25 | <i>n</i> = 25 | <i>n</i> = 26 |
| Role Restriction | 0.33 | 0.41* | -0.11 | -0.01 | 0.40* |
| Emotion Distress | 0.51** | 0.52** | -0.19 | 0.38 | 0.42* |
| Phys Discomfort | 0.46* | 0.65*** | -0.26 | 0.37 | 0.58** |
| Total | 0.50** | 0.60** | -0.21 | 0.23 | 0.55** |

CBCL = Child Behavior Checklist; POQOL = Pediatric Oncology Quality of Life; Parent Variables: BDI = Beck Depression Inventory; Anxiety = State subscale of State-Trait Anxiety Inventory. Family Variables: Cohn = Cohesion, and Adap = Adaptability subscales of Family Adaptability and Cohesion Evaluation Scale (FACES-III). Medical Variable: Symptoms = symptom severity.

^aHigher scores represent poorer quality of life.

P* < 0.05; *P* < 0.01; ****P* < 0.001.

= 0.42, *P* < 0.05 for Emotional Distress, and *r* = 0.58, *P* < 0.01 for Physical Discomfort).

Discussion

This study examined children’s quality of life and behavioral adjustment pre-BMT and 6 months post BMT, as well as the medical, child, and family factors that may be associated with these outcomes. As a group, children undergoing BMT showed improvement in their overall quality of life at 6 months post BMT and did not present with symptoms of serious psychological maladjustment at either pre- or 6 months post BMT as measured by CBCL behavioral scores.

Children were reported by their mothers to experience enhanced overall quality of life by 6 months post BMT, as

well as specific reduction in levels of physical discomfort and role restriction as measured by the POQOLS. Although normative data for this measure do not exist, pre-BMT scores on Role Restriction and Physical Discomfort factors in the current study were somewhat elevated compared to the scores of pediatric oncology patients (not undergoing BMT) on whom the measure was developed.¹³ Levels of emotional distress, however, were consistent with levels reported for the pediatric oncology patients. The lack of children’s emotional distress at either pre- or post BMT may be accounted for by a number of explanations. One may involve the subjective nature of this construct and the possibility that mothers’ ratings of their children’s emotional well-being may have been inaccurate, since emotions can often be covert. Alternatively, mothers’ pre-occupation with their children’s medical health and survival may have contributed to an underestimation of emotional

distress. Finally, healthy family functioning and an absence of maternal depressive symptoms may have served as protective factors for children's psychological adjustment during this highly intrusive procedure. These interpretations need to be tested by further investigations utilizing children's self-reports in addition to parental reports of child psychological well-being.

The absence of reported serious behavioral problems is consistent with results reported by Phipps and Mulhern¹⁰ who also found behavior scores to fall within the normative range at 6 months post BMT. Although our study did not demonstrate a significant improvement in Total behavioral scores post BMT, the trend was in the same direction as reported by Phipps and Mulhern.¹⁰ One possible explanation for the lack of significant behavioral improvement in our study may be that due to the small sample size, there was insufficient statistical power to detect a small effect size. Alternatively, the pre-BMT CBCL mean score in our study was at the mean expected for a normative sample of the same gender making it somewhat difficult to improve by 6 months post BMT. Possible declines in scores on the Social Competence scale (such as reported by Phipps and Mulhern) were not examined in the current study due to the low number of children who were old enough (ie >6 years) to have Competence scores computed.

Only a small percentage of mothers (ie 8%) fell within the clinical range for depressive symptomatology at the two assessment periods. This finding is consistent with the clinical rate of depressive symptoms found in the population of mothers of children newly diagnosed with cancer.²¹ It is also consistent with the rate of depression in the general population²³ suggesting that the group of mothers in our study is free of this form of debilitating psychopathology. With regard to anxiety symptoms, prior to BMT, 50% of mothers manifested elevated anxiety levels to within the clinical range. In comparison, anxiety levels reached the clinical cutoff in only 33% of mothers of children newly diagnosed with cancer.²¹ These findings suggest that mothers find contemplating a BMT to be more anxiety provoking than the experience of having a child newly diagnosed with cancer. By 6 months post BMT, anxiety levels had returned to within the normal range for the majority of anxious mothers in our study. This finding reaffirms that although these mothers tended to initially experience a temporary elevation in levels of anxiety related to their children's medical condition, they remained free of longer-term serious psychopathology.

Contrary to our hypothesis and to previous studies with BMT survivors^{6,10} or with children with malignancies not treated with BMT,²⁴ neither pre- nor post BMT maternal anxiety or depression in our study was related to longer-term behavioral adjustment of survivors of pediatric BMT. The lack of relationship between maternal affective state and children's behavioral adjustment is puzzling. It may reflect mothers' overall good mental health, as well as a narrowed focus on their children's physical health to the exclusion of any behavioral concerns. However, since children's behavioral adjustment was assessed via parent report only, evaluation of the anxiety and depression aspects of behavior using children's self-reports is needed to validate current findings. Furthermore, given that the measure of

behavioral adjustment (ie the CBCL) used was not designed for use with a medical population, it may not be an appropriate measure for assessing emotional and behavioral change induced by chronic and/or acute medical illness.

Maternal pre-BMT anxiety and depression levels were also not significantly correlated with children's quality of life as assessed at pre- and post BMT. This lack of relationship may reflect limited predictive value of maternal psychological measures when there is absence of pathology. However, maternal post-BMT anxiety and depression scores were strongly correlated with children's quality of life, as well as with symptom severity at 6 months post BMT. This latter finding was surprising, particularly since the group means for the children's and mothers' measures were all within the normal range. These correlations may indicate that maternal affective disturbance post BMT may be a result of their children's ongoing poor medical status and subsequent reduced quality of life. As well, these associations suggest high sensitivity of the quality of life measure to detect differences in children with varied medical status. These interpretations need to be tested in future studies.

Of all the child, parent, family, and medical variables assessed at pre-BMT, only family cohesion and child adaptive functioning were significantly related to children's quality of life and behavioral adjustment 6 months post BMT. Higher levels of family cohesion were associated with enhanced quality of life in survivors. Thus, family connectedness pre-BMT appeared to be a protective factor against the stresses encountered during the post-BMT period. This finding is consistent with that of another study which found family cohesiveness and adaptability to moderate, or buffer, the potential detrimental effects of caring for children with sickle cell syndrome.²⁵

Results of the current study were contrary to Phipps and Mulhern's¹⁰ results regarding family cohesion and behavioral adjustment. In our study, higher pre-BMT levels of family cohesion were associated with reports of more behavior problems at 6 months post BMT (as well as at pre-BMT). Before attempting to explain this apparently contradictory finding, we need to draw attention to two important points. First, both the family cohesion and child behavioral mean scores in our study were well within the normal range at both pre-BMT and post BMT. Second, correlational results were the same when a second set of analyses was performed removing the few extreme upper-end cohesion scores in order to account for the curvilinear relationship of cohesion with healthy family functioning. Bearing in mind that our finding of an association of increased pre-BMT family cohesion with increased pre- and post-BMT behavioral problems describes measures with mean scores in the normal range, we suspect that increased family cohesion at pre-BMT may have facilitated healthy/normal 'acting out' in this sample population that was still evident at 6 months post BMT. In other words, higher levels of family connectedness, possibly triggered by the seriousness of the children's illness at pre-BMT, may have enabled a degree of acting out by children that promoted continuing adjustment to their medical condition. A related finding that family adaptability mean scores significantly decreased at 6 months post BMT (but still within

the normal range) supports the suggestion of a return to family routines. That is, during the period leading up to BMT, families usually have very little control over the events in which they are involved; thus, an increase in adaptability is a logical adaptive response. Once the immediate crisis is over, families gradually regain more control over their lives, implying a return to family routines and a reduced need for previous levels of flexibility.

In addition to family cohesiveness, our study identified BMT survivors' pre-transplant levels of adaptive functioning (communication, daily living and socialization skills) as an important personal resource playing a role in their ability to adjust psychologically after BMT.

It was surprising to see the relatively lesser relationship between survivors' psychological adjustment and symptom severity. At 6 months post BMT, there was a significant correlation between symptom severity and quality of life but there was no association between this variable and behavioral adjustment. This finding points to the need to continue to explore which specific medical factors are most strongly associated with post pediatric BMT overall psychological adjustment. Moreover, this finding supports the utilization in research of a health-related perspective using measures specifically designed to assess social, emotional, and behavioral functioning in medical populations. Increasingly, the literature suggests the inappropriateness of applying a psychopathology framework to the understanding of individuals' psychological adjustment to aversive medical conditions and procedures. Our findings lend further support to the view that traditional measures of psychological maladjustment may be ineffective and/or insufficiently sensitive in the assessment of emotional and behavioral changes related to medical conditions.

Having the two dependent variables of children's behavioral adjustment and quality of life assessed via only parent report limit the findings of this study. Clearly, the addition of converging evidence through assessment of anxiety and depression using children's own reports is needed to support the current results. This may prove to be a challenge since many children are too young to complete self-report questionnaires. Those children who are older, may not feel well enough to complete questionnaires during the pre-BMT period. In spite of its limitations, however, this study shows a clear pattern of improvement of quality of life for 6-month survivors of pediatric BMT. Furthermore, this study suggests that pre-BMT family cohesion and, to a lesser degree, children's adaptive functioning are highly associated with, and may be predictive of, quality of life and behavioral adjustment of pediatric survivors of BMT. As well, these variables may buffer the potential detrimental effects of experiencing traumatic treatment procedures such as BMT. This information can help to formulate educational intervention strategies that may aid children's adjustment to the various treatments they may encounter.

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