Through the course of their treatment, children undergoing bone marrow transplantation (BMT) experience stressful procedures typical of other children with cancer (e.g., chemotherapy, bone marrow aspirations, and lumbar punctures). However, BMT may be associated with additional stressors given the often lengthy hospitalization and associated restrictions upon discharge (e.g., limited contact with loved ones and friends). The available literature on the psychological impact of pediatric BMT suggests that these children may be stressed; exhibit poor adherence; have low social competence, self-esteem, and emotional well-being; and have multiple concerns upon discharge (McConville et al., 1990; Phipps et al., 1995; Wiley & House, 1988). In fact, Stuber, Nader, Yasuda, Pynoos, and Cohen (1991) found that five out of six children studied were in the moderate range of posttraumatic stress symptomatology 3 months following BMT.

Researchers have also considered symptoms of stress in BMT family members (Heiney, Neuberg,
Background Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention</th>
<th>Standard Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years; M ± SD)</td>
<td>9.4 ± 4.5</td>
<td>8.0 ± 5.2</td>
</tr>
<tr>
<td>Male</td>
<td>8 (73)</td>
<td>9 (82)</td>
</tr>
<tr>
<td>Female</td>
<td>3 (27)</td>
<td>2 (18)</td>
</tr>
<tr>
<td>Grade in school (M ± SD)</td>
<td>4.5 ± 3.5</td>
<td>3.5 ± 4.2</td>
</tr>
<tr>
<td>Caucasian</td>
<td>9 (82)</td>
<td>9 (82)</td>
</tr>
<tr>
<td>African American or Hispanic</td>
<td>2 (18)</td>
<td>2 (18)</td>
</tr>
<tr>
<td>Illness characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancerous? (yes)</td>
<td>9 (82)</td>
<td>10 (91)</td>
</tr>
<tr>
<td>Length of diagnosis* (months; M ± SD)</td>
<td>11.0 ± 5.7</td>
<td>10.8 ± 8.3</td>
</tr>
<tr>
<td>Type of transplant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allogeneic</td>
<td>5 (45)</td>
<td>3 (27)</td>
</tr>
<tr>
<td>Autologous</td>
<td>2 (18)</td>
<td>4 (36)</td>
</tr>
<tr>
<td>Cord blood</td>
<td>1 (9)</td>
<td>2 (18)</td>
</tr>
<tr>
<td>Stem cell</td>
<td>3 (27)</td>
<td>2 (18)</td>
</tr>
<tr>
<td>Previous hospitalizations*</td>
<td>33.4 ± 35.2</td>
<td>18.2 ± 19.4</td>
</tr>
<tr>
<td>Parent characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years; M ± SD)</td>
<td>37.2 ± 5.2</td>
<td>36.5 ± 8.5</td>
</tr>
<tr>
<td>Education (years; M ± SD)</td>
<td>13.1 ± 3.1</td>
<td>12.9 ± 2.7</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>6 (55)</td>
<td>7 (64)</td>
</tr>
<tr>
<td>Single/separated/divorced/ widowed</td>
<td>5 (45)</td>
<td>4 (36)</td>
</tr>
<tr>
<td>Number of hours from home to hospital</td>
<td>3.1 ± 1.8</td>
<td>2.4 ± .83</td>
</tr>
</tbody>
</table>

*For cancerous disorders only, given that the children with non-cancerous disorders were diagnosed shortly after birth.
*aNumber of hospitalizations ranged from 1–100; median number of hospitalizations was 12.
treatment of choice; no child studied had previously been treated by BMT.

Procedure

Study procedures were approved by the university’s health science center institutional review board. All participants received the Division of Hematology/Oncology’s standard preparation procedure at the time of the child’s comprehensive pretransplant evaluation (i.e., usually 2 to 4 weeks before BMT unit admission). Parents were assessed across six time points. The first assessment served as a baseline measure completed an average of 13 days (range 1–47 days) prior to the child’s BMT unit admission. After baseline assessment, participants were randomly assigned to either the IN or SC condition. All subsequent measures were administered during hospitalization, by a research assistant blind to the participant’s condition. At this institution, the BMT date was scheduled several weeks in advance. The child’s conditioning regimen usually began 7 days before transplant. The second assessment, and the child’s conditioning regimen usually began 7 days before transplant. The second assessment was completed 7 days prior to transplant (day −7), and the remaining assessments were conducted at weekly intervals through three weeks post-transplant (days 0, +7, +14, +21).

Intervention. IN participants were seen by an advanced clinical psychology graduate student for one 90-minute session in the hospital’s psychology clinic. Intervention sessions were scheduled at the convenience of the family and were typically held within 1 week of the child’s admission to the BMT unit (range 0–30 days prior to admission). The intervention followed a stress inoculation model found to be effective for a variety of stressful situations (Jay & Elliott, 1990). A parsimonious one-session treatment format was chosen to simplify scheduling, decrease family burden, and maximize external validity. Included in the intervention were three main components: education, relaxation, and communication. IN participants received handouts illustrating the components of the intervention through concrete examples, as well as a tape-player headset to increase their likelihood of practicing the relaxation training. (Detailed information about the intervention and semi-structured interview is available from Randi Streisand upon request.)

To assure the integrity of the intervention, treatment sessions were videotaped. Trained research assistants who were blind to the study’s hypotheses examined a randomly selected subset of interventions (n = 5) for content comparison to a detailed treatment outline. Results from rater 1 yielded 100% adherence to the intervention outline, and rater 2’s scored treatment integrity was 97.8%.

Measures

Daily Stress Inventory (DSI). The DSI is a 58-item self-report instrument assessing the impact of minor stressful events on a daily basis (Brantley, Waggner, Jones, & Rappaport, 1987). The number of events endorsed as having occurred, and the sum of the impact ratings of those events, comprise the Events and Impact scores. We computed DSI scores for six time points: baseline through day +21. Adequate concurrent and construct validity, as well as good reliability, have been demonstrated (Brantley & Jones, 1993; Brantley et al., 1987). Coefficient alphas for the Event scale in our sample ranged from .94 to .98.

Parenting Stress Index (PSI) We administered the Parent Domain of the PSI, consisting of 53 self-report items that measure the relative magnitude of stress in the parent-child system (Loyd & Abidin, 1985), at baseline and at day +21. The Parent Domain indicates the degree to which stress is related to parental functioning across seven areas. Coefficient alphas for the Parent Domain for our sample were .71 and .81 at preadmission and day +21, respectively.

Semi-structured Interview (SSINT). A semi-structured interview developed for this study assessed the frequency (14 items; 4-point Likert scale) of psychological and physiological symptoms of stress and the degree to which such symptomatology affected participants’ lives; we asked if symptoms were a change (yes/no) from previous functioning and/or considered to be a problem (yes/no). Interviewers cued participants to consider the previous week in giving their responses. Seven additional items (7-point Likert scale) asked parents how stressed they felt during specific times in their child’s medical care (e.g., most recent mouth care treatment, most recent dressing change). Administration of the SSINT therefore yielded four scores: frequency, change, problem, and specific stress. Coefficient alphas for the frequency score ranged from .71 to .85. Participants responded to the SSINT at four time points (pretreatment, day −7, day +14, and day +21) throughout their child’s BMT experience.

Adherence. Participants completed a checklist of the various intervention techniques used during the
previous week, at day −7, day 0, day +7, day +14, and day +21.

Results

Analyses

Planned analyses of variance (ANOВAs) were conducted on demographic information and self-report measures of stress to determine differences between groups at baseline. Repeated measures ANОВAs were computed for each measure of stress. Because of the small sample size and preliminary nature of our research questions, we did not correct for multiple comparison error and instead report ANОВAs and t tests with a p value of <.05 as significant. When appropriate, Welch’s t statistics (Nunnally & Bernstein, 1994) were calculated to compare data from this sample with published normative data.

Time Effects

DSI. There was a main effect for time on both the impact, F(5, 90) = 3.27, p < .02 (see Figure 1), and event, F(5, 85) = 4.5, p < .002, scales of the DSI. In contrast to our hypothesis that stress would be maximized after admission and just prior to transplantation (day −7), post-hoc paired samples t tests indicated that stress was higher preadmission for the DSI impact scale than compared to weeks one, two, and three posttransplant: day +7, t (18) = 2.70; day +14, t (18) = 2.65; day +21, t (18) = 2.49; all ps < .05. Post-hoc comparisons of the event scale yielded similar findings, with more stress reported at baseline as compared to all other data points except for 3 weeks posttransplant: day −7, t (20) = 2.58; day 0, t (20) = 2.89; day +7, t (18) = 3.20; day +14, t (18) = 3.26; all ps < .05.

PSI. There was a significant main effect for time for two of the PSI subscales as well. Mothers reported significantly less stress related to their competence as parents and in terms of role restriction at 3 weeks posttransplant (day +21) compared to preadmission, F(1, 17) = 10.9, p < .005, F(1, 17) = 4.72, p < .05, respectively, further suggesting that preadmission was a particularly stressful time.

SSINT. For the semi-structured interview, the only significant finding was for specific stress, F(3, 60) = 7.83, p < .002. Follow-up comparisons indicated that stresses related to their child’s medical care (e.g., waiting for test results, interacting with nurses, and dressing changes) were more pronounced preadmission for BMT than at 1 week posttransplant (day +7, t [21] = 2.37, p < .03) or 3 weeks posttransplant (day +21, t [10] = 3.69, p < .009). These results corroborate data obtained from both the DSI and PSI, indicating substantial parental stress preadmission.

Group Effects

Table II presents means for both groups at day +21. In contrast to our hypotheses, there were no significant main effects for group on the self-report measures or any of the four scores of the SSINT. As expected, a significant group main effect for use of intervention techniques was found, with IN mothers reporting use of a greater number of intervention techniques than SC mothers, F(1, 18) = 5.78, p < .03.

Examination of Clinical Significance

In order to examine the relative magnitude of stress of the parents in our study, we compared responses on standardized measures of stress to other relevant samples. On both the PSI and DSI, responses of parents in our sample were not in the clinically significant ranges. Participants’ scores on the PSI were compared to a primarily nonclinic-referred normative sample (Abidin, 1995), a sample of 20 parents of preschool age children with diabetes (Wysocki, Huxtable, Linscheid, & Wayne, 1989), and 36 parents of children undergoing an evaluation for transplantation (both solid organ and BMT; Rodrigue et al., 1996). At both preadmission and day +21, mothers in our sample reported significantly less
stress, as indicated by the Parent Domain score, than both the normative sample and the sample of parents of children with diabetes (all \( p < .05 \)). Responses of parents in our sample were not statistically different from those for the sample of parents of children in the evaluation phase of transplantation.

Similar findings emerged when comparing parents’ ratings on the DSI to a normative sample of medical patients \( (N = 223; \text{Brantley} & \text{Jones, 1993}) \). Parents’ impact scores for days +7, +14, and +21 were significantly lower than the normative sample (all \( p < .05 \)). Participants did report a greater number of stressful events at baseline than the normative sample, yet impact ratings for the events did not differ significantly between samples.

**Discussion**

This study is the first to prospectively measure stress in mothers of children undergoing BMT at regular intervals and to pilot a psychological intervention to assist parents in managing their stress. Results indicated three main findings: (1) increased stress preadmission, (2) parents’ ability to learn and put into practice techniques from the intervention, and (3) subclinical distress among parents compared to healthy norms.

The most robust findings were multiple effects over time, with mothers in both groups reporting significantly more stress preadmission than at any other time. Contrary to our hypothesis that stress would be greatest just prior to transplantation (day −7), stress decreased dramatically once the pretransplant conditioning phase began. We believed that stress would be amplified given that the conditioning phase depletes children’s immune functioning, often signaling a “point of no return.” Perhaps knowledge that the long-anticipated treatment had finally begun reduced stress for those parents who had assumed primary caregiving responsibility. These findings are consistent with results from previous BMT investigations, as well as those focusing on solid organ transplantation (Phipps et al., 1995; Rodrigue et al., 1996).

Our second finding, that IN mothers reported significantly more stress preadmission than at any other time. Contrary to our hypothesis that stress would be greatest just prior to transplantation (day −7), stress decreased dramatically once the pretransplant conditioning phase began. We believed that stress would be amplified given that the conditioning phase depletes children’s immune functioning, often signaling a “point of no return.” Perhaps knowledge that the long-anticipated treatment had finally begun reduced stress for those parents who had assumed primary caregiving responsibility. These findings are consistent with results from previous BMT investigations, as well as those focusing on solid organ transplantation (Phipps et al., 1995; Rodrigue et al., 1996).

Our second finding, that IN mothers reported significantly more stress preadmission than at any other time. Contrary to our hypothesis that stress would be greatest just prior to transplantation (day −7), stress decreased dramatically once the pretransplant conditioning phase began. We believed that stress would be amplified given that the conditioning phase depletes children’s immune functioning, often signaling a “point of no return.” Perhaps knowledge that the long-anticipated treatment had finally begun reduced stress for those parents who had assumed primary caregiving responsibility. These findings are consistent with results from previous BMT investigations, as well as those focusing on solid organ transplantation (Phipps et al., 1995; Rodrigue et al., 1996).
used the techniques, further validation of their effectiveness is needed.

The third main finding, that mothers’ level of stress, in general, was not clinically different from that of normative samples, was surprising. There are at least two possible interpretations of this finding. First, the primary burden of care at the time of the child’s BMT hospitalization shifts from mothers to the unit nurses and staff, which may provide a much needed respite and, perhaps paradoxically, stress reduction. Second, it is possible that the types of stressors encountered by mothers were not well detected by our outcome measures, or that floor effects affected our ability to detect such changes, highlighting the need for more specific assessment tools.

In regard to the pilot of our intervention, stress did not differ significantly between the intervention and standard care groups. Results may have been significant with a larger sample or more specific outcome measures. Other investigations with relatively small sample sizes of chronically ill children and their parents have also failed to yield statistically significant differences between intervention and control conditions for a variety of reasons (Hoekstra-Weebers et al., 1998; Kupst & Schulman, 1988; Robinson & Kobayashi, 1991). Methodological challenges in our and others’ treatment outcome studies include randomization to standard care, relevance of nonpediatric assessment tools (La Greca & Lemanek, 1996), and lack of statistical power.

Even though parents’ level of stress was not significantly different from that of normative samples, our finding of changes in stress over time still suggests that, as compared to the hospitalization portion of BMT, the preparation period can be intensive and stressful. For pediatric BMT, this finding further highlights the importance of pretransplant psychological assessments that occur a significant amount of time prior to the BMT admission, as well as the development, implementation, and evaluation of interventions aimed at assisting parents during the time of pretransplantation. Our pilot intervention did not specifically target handling preadmission stressors, such as beliefs about the upcoming transplant. In the future, we recommend that a modified intervention would be most beneficial to the extent that it (1) focuses on parents’ preadmission stress (through use of cognitive-behavioral and family therapy techniques), (2) is administered several weeks preadmission, (3) continues in some capacity (e.g., weekly phone contact) throughout the preadmission process in order to encourage parents to utilize strategies, and (4) includes all possible caretakers (whenever possible), shifting the focus from maternal stress to that of the family. In addition to refining the intervention, designing situation-specific and psychometrically sound measures is an important next step. Continued documentation of parents’ stress as it relates to pediatric BMT is also necessary to enhance our understanding of longer-term issues, such as adjustment to discharge, reintegration of the family and child into school and community settings, and survivorship.

Acknowledgments

This article is based on Randi Streisand’s doctoral dissertation, submitted to the University of Florida. The research was supported in part by awards from the Society of Pediatric Psychology, the Center for Pediatric Psychology and Family Studies at the University of Florida, and the Geoffrey Clark-Ryan Memorial Fund at the University of Florida. Portions of this research were presented at the 106th annual meeting of the American Psychological Association, San Francisco, California, August 1998. We thank Jennifer Blankenship, Teresa Broughton, Shoalay Ji-ang, Steve Judy, and Rachel Rafanan for their assistance with data collection and entry. We also thank Kenneth Tercyak and Anne Kazak for their assistance with earlier drafts of this manuscript.

Received December 1, 1998; accepted August 18, 1999

References

Darke, P. R., & Goldberg, S. (1994). Father-infant interac-


