An Online Family Intervention to Reduce Parental Distress Following Pediatric Brain Injury

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This study examined whether an online problem-solving intervention could improve parental adjustment following pediatric traumatic brain injury (TBI). Families of children with moderate-to-severe TBI were recruited from the trauma registry of a large children’s hospital and randomly assigned to receive online family problem solving therapy (FPS; \( n = 20 \)) or Internet resources (IRC; \( n = 20 \)) in addition to usual care. The FPS group reported significantly less global distress, depressive symptoms, and anxiety at follow-up than did the IRC group after controlling for baseline symptoms. The FPS group also reported significant improvements in problem-solving skills, although the groups did not differ significantly at follow-up. Findings suggest that an online, skill-building approach can be effective in facilitating parental adaptation after TBI.

**Keywords:** brain injury, tele-health, problem solving, pediatric, family

Pediatric traumatic brain injury has been shown to contribute to adverse outcomes for both injured children and their families (Fletcher, Ewing-Cobbs, Miner, Levin, & Eisenberg, 1990; Max, Koele, et al., 1998; Rivara et al., 1992; Wade, Taylor, Drotar, Stancin, & Yeates, 1998). Parents of children with moderate to severe injuries report persistent injury-related burden for many years following the injury (Rivara et al., 1996; Wade et al., 2002). Much of this burden is associated with ongoing concerns about the child’s recovery and ability to function autonomously. However, parents also report feeling stressed by the reactions of other family members including one’s spouse (Wade et al., 2002). This issue can be particularly problematic if parents perceive the child’s recovery very differently (e.g., one parent feels that the child is back to normal whereas the other sees residual deficits) or when one parent wants to move on and put the injury behind them whereas the other cannot.

Parents of children with moderate to severe traumatic brain injury (TBI) also report higher levels of psychological distress than do parents of children with mild TBI or orthopedic injuries (Rivara et al., 1992). As many as 40% of parents experience clinically significant levels of anxiety and depression following their child’s injury (Wade et al., 1998). Moreover, evidence indicates that parent and child functioning exert reciprocal influences on one another, suggesting that improvements in parent adaptation should correspond to better child outcomes and vice versa (Kinsella, Ong, Murtough, Prior, & Sawyer, 1999; Max, Castillo, et al., 1998; Taylor et al., 1999).

**Approaches to Intervention Following Pediatric TBI**

Accumulating evidence suggests that TBI has a profound impact on the entire family, underscoring a need for family centered interventions. However, a review of the available literature indicates that only a few investigations to date have evaluated interventions for parents or families following pediatric TBI. Singer and colleagues (1994) compared the efficacy of a stress management program with an informational support group in reducing parental anxiety and depression. They found that parents in the stress management group reported greater reductions in anxiety and depression than those in the informational support group, suggesting that education alone is insufficient to reduce symptoms. However, the study was limited to 9 families, thereby limiting its generalizability. Wade, Michaud, and Brown (2006) tested a family centered problem-solving intervention in a randomized clinical trial (RCT) with 32 families of children with moderate-to-severe TBI. They found significant improvements in internalizing child behavior problems in the treatment group relative to the usual care comparison. However, they did not find corresponding improvements in parental distress. Finally, in a pilot study to the project described here, Wade and colleagues conducted a small trial of an online version of family problem solving (FPS; Wade, Wolfe, & Pestian, 2004). They found high participant satisfaction as well as significant improvements in both parent and child outcomes from pre- to postintervention; however, the sample was small and lacked a control group (Wade, Wolfe, Brown, & Pestian, 2005; Wade, et al., 2005).
Wolfe, Brown, & Pestian, in press). Thus, although cognitive–behavioral interventions show promise with this population, further research is necessary to demonstrate their efficacy.

The lack of established psychological interventions for pediatric TBI may be, in part, attributable to the unique barriers to care faced by most affected families. Injured children receive treatment at centralized pediatric trauma and rehabilitation centers with service areas spanning hundreds of miles. Thus, it may be impossible or unduly time consuming to return to the inpatient rehabilitation facility for ongoing treatment. However, local mental health providers may lack requisite knowledge and expertise. Thus, families must often choose between traveling long distances each week for an extended period to obtain services or forgoing them altogether.

Given these considerations, families of children with TBI may be particularly able to benefit from interventions delivered via computer or the World Wide Web that eliminate common barriers to treatment such as time, distance, and the unavailability of knowledgeable providers. Comparisons of online interventions with traditional face-to-face therapy indicate that online treatment is generally at least as effective as conventional approaches and also possesses several advantages (Griest, 1998; Marks, Susan, & Parkin, 1998; Sturges, 1998). Accessibility is a major advantage, as online services that do not involve a therapist can be accessed from home during nonworking hours, and previous research indicates that many parents of children with TBI actually prefer online therapy to face-to-face therapy (Wade et al., 2004, 2005). Although a number of Web sites currently provide information and referral resources regarding brain injury (i.e., the Brain Injury Association), most of the information is geared toward brain injury in adults. In addition, none of the existing Web sites provide one-to-one, synchronous assistance from a therapist in coping with the challenges of the injury and its sequelae.

Family Problem Solving Therapy

Problem-solving therapy and problem-solving skills training are increasingly being used to address a wide range of diagnoses and issues including depression, anxiety, oppositional defiant disorder, and stress arising from chronic conditions such as cancer (D’Zurilla & Nezu, 1999; Greene et al., 2004; Nezu, Nezu, Felgoise, McClure, & Houts, 2003; Nezu, Nezu, Friedman, Faddis, & Houts, 1998; Robin & Foster, 1989; Sahler et al., 2002, 2005). A problem-solving framework may be particularly useful for identifying problem areas, introducing new approaches to the problem (including learning new skills), and implementing effective strategies in response to injury-related stresses. In the case of TBI, caregivers are confronted with a wide range of new stressors, including changes in their child’s behavior, which may tax existing coping resources or render them ineffective or maladaptive (Max, Castillo, et al., 1998; Max, Koele, et al., 1998). A problem-solving framework may help to ameliorate these difficulties by equipping the individual with a new way of approaching the situation.

Research Objectives and Hypotheses

This investigation examined the efficacy of online family problem solving therapy (FPS) relative to an Internet resources comparison group (IRC) in reducing parental anxiety, depression, and distress following pediatric TBI. We sought to address three main objectives. Our first objective was to determine if FPS resulted in greater improvements in parent psychological outcomes than IRC. We hypothesized that parents in the FPS group would report less anxiety, depression, and psychological distress at follow-up than did parents in the IRC group after controlling for baseline levels of symptoms. Our second objective was to test if changes in parental problem-solving skills mediated improvements in parent psychological outcomes. Because the version of FPS tested here also provided training in skills other than problem solving (such as communication and behavior management), we hypothesized that changes in problem-solving skills would only partially mediate improvements in parent outcomes. Our final objective was to examine demographic and injury characteristics as potential moderators of parental outcomes. With respect to demographic characteristics, we hypothesized that parents of higher socioeconomic status (SES) and those of older children might be more likely to benefit from FPS given their greater familiarity with technology in the former case and the child’s ability to actively participate and benefit from the intervention in the latter. We further hypothesized that parents of children with more severe and more recent injuries would be more likely to benefit from the intervention given the greater burden and distress associated with recent and severe injuries (Wade, Taylor, et al., in press).

Method

The current study involves an RCT comparing usual psychosocial care plus IRC with online FPS. All families received a computer, printer, high-speed Internet access, and a home page linking them to brain injury Web sites and resources in addition to usual psychosocial care. Approval was obtained from the institutional review board prior to study inception.

Participants

Participants were recruited from the trauma registry of an urban children’s hospital. To be eligible, children had to be between the ages of 5 and 16 years, and had to have sustained a moderate-to-severe TBI between 1 and 24 months previously. Consistent with previous studies, severe TBI was defined by a Glasgow Coma Scale (GCS) score of 8 or less. Moderate TBI was defined as a GCS score of 9–12 or a GCS score of 13–15 with evidence of trauma-related abnormalities on imaging. Children with nonblunt trauma (e.g., gunshot wounds) were excluded. We also required that the child reside in the home, speak English, and exhibit no evidence of child abuse.

Figure 1 presents the Consolidated Standards of Reporting Trials Flow Chart (Moher, Schulz, & Altman, 2001) of potentially eligible participants. From the hospital trauma registry, we identified 116 children who met study eligibility criteria. Of these, we were able to contact and screen 87 families (75%). Of the families contacted, 50 (57%) agreed to participate and 46 (53%) completed the baseline and were randomly assigned to the FPS or IRC condition. (One of these children did not meet our criteria for injury severity, with data from this case subsequently excluded from the analyses.) Nearly all participants who declined to participate indicated either that the family was no longer experiencing concerns related to the injury or that they were too busy.

Procedure

Random assignment. After obtaining informed consent from the primary caregiver and verbal assent from the participating child, families were randomly assigned to FPS or IRC using a Web site that provides random-
Therapist and interviewer training. The therapist for the intervention was a clinical psychology doctoral student. She was trained over a 2-month period and received ongoing, weekly supervision. The content of each session was detailed in an extensive treatment manual.1 End-of-session checklists completed by the therapist and family indicated excellent correspondence between actual session content and intervention manual objectives. The interviewers were Bachelor’s and Master’s level research assistants who received extensive training in recruitment, interviewing techniques, and questionnaire administration prior to contacting eligible families. Some families were already receiving psychotherapy, and families in both groups continued to receive any psychosocial treatments that they were previously receiving in addition to the FPS or IRC interventions.

Baseline assessment. After informed consent was obtained, the research assistant went to the family’s house and installed a Dell computer with a 19-inch monitor and an inkjet printer. When available, enrolled families received high-speed Internet access (cable or digital subscriber line). In the current project, we were able to obtain high-speed connections for all but one family (98%). This family, assigned to FPS, was provided with a dial-up connection, printed copies of the Web-site materials, and a speaker phone to complete the synchronous sessions. Families were allowed to keep the computers at treatment completion as an incentive for participation. Families in the FPS group also received a Web camera (see Wade et al., 2004) for the duration of the intervention. During the initial visit, the research assistant completed the baseline assessment and provided family members with training in how to turn on the computer, log onto the home page via Internet Explorer, and navigate within the Web site.

Description of the FPS intervention. At the beginning of treatment, the therapist met once with each FPS family in the family’s home. Parents, the injured child, and school-aged siblings were invited to participate in this and subsequent meetings. During the initial meeting, the therapist conducted a structured interview regarding how the injury had affected the child and family as well as current concerns and goals. The therapist also reviewed the content and structure of the intervention and entered goals identified by individual family members into the Web site. Future meetings with the therapist were scheduled for every 1–2 weeks and were conducted via videoconference. During the week prior to each video conference, the family completed self-guided materials on the Web site.

The FPS homepage featured links to announcements, contact information, resources (other brain injury Web sites), and the session materials. By clicking the Start Sessions button, participants could access the content from current and previous sessions. The therapist assigned new sessions to each family on completion of the previous session. Materials were password protected, encrypted, and available at all times.

We designed the Web site to be used by multiple family members at the same time, analogous to a family therapy session (see Wade et al., 2004 for a complete description). Given the varied age and cognitive abilities of participating children, it was anticipated that parents and children would complete the sessions together, with parents or older siblings providing assistance as needed. The Web site was programmed so that the family could not proceed to the next screen until a response was entered for each question. Each self-guided online Web session included didactic content regarding the skill (i.e., problem solving), video clips showing families modeling the skill, and exercises giving the family an opportunity to practice the skill.

A green check mark appeared next to the session title after the content had been completed. If the family was unable to complete the self-guided content on their own within 2–4 weeks, the therapist completed the session with the family via computer and Web camera. In practice, 15% of the self-guided sessions were completed online with the therapist’s assistance. After completing the self-guided content, the therapist scheduled a synchronous online appointment with the family via video conference. During these sessions, the therapist reviewed the exercises completed by the family and implemented the problem-solving process with a problem or goal identified by the family.

The FPS Web site had 14 separate sessions. Eight “core” sessions provided training in problem solving, communication, and antecedent behavior management skills for all enrolled families, whereas the remaining six sessions addressed content related to stressors or issues that affected some but not all families (see Table 1 for list of core sessions). The first two Web-based sessions addressed the importance of having a positive problem orientation (Nezu et al., 1998) and the steps of problem solving (Aim, Brainstorm, Choose, Do It, and Evaluate; ABCDE). The self-guided Web sessions also provided information and strategies for addressing cognitive and behavioral problems that arise following TBI (Feeney & Ylvisaker, 1995; Ylvisaker & Feeney, 1998). Given the family focus of the intervention, one session provided training in family communication skills (Robin & Foster, 1989). Thus, the FPS intervention can be thought of as standard problem solving plus training in other cognitive–behavioral skills relevant to coping with TBI.

The content of the supplemental sessions included stress management, working with the school, sibling concerns, anger management, pain management, and marital communication. Families that exceeded the clinical

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1 Copies of the FPS manual are available from Shari L. Wade.
Table 1  
Session Content and Description for the Eight Core Sessions

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview, identify goals</td>
<td>Learn about family, FPS overview, identify goals</td>
</tr>
<tr>
<td>2</td>
<td>Positive problem orientation</td>
<td>The importance of attitude in solving problems</td>
</tr>
<tr>
<td>3</td>
<td>Steps of problem solving</td>
<td>Learn steps, complete problem-solving exercises</td>
</tr>
<tr>
<td>4</td>
<td>Cognitive changes</td>
<td>Identify changes, strategies to reduce frustration</td>
</tr>
<tr>
<td>5</td>
<td>Behavior changes</td>
<td>Identify changes, antecedent behavior management</td>
</tr>
<tr>
<td>6</td>
<td>Communication</td>
<td>Listening and positive communication strategies</td>
</tr>
<tr>
<td>7</td>
<td>Crisis management/review</td>
<td>Skills for crises; assess current family strengths</td>
</tr>
<tr>
<td>8</td>
<td>Planning for the future</td>
<td>Reviewing what works and planning for transitions</td>
</tr>
</tbody>
</table>

Note. FPS = family problem-solving therapy.

threshold on any of the Family Burden of Injury Interview subscales (FBII; Burgess et al., 1999) or who identified deficits in problem solving, communication, or behavior management during the self-assessment of skills in Session 7 were targeted to receive up to four individual sessions focusing on the specific area(s) of difficulty identified.

Internet resources comparison group (IRC). Families in the IRC group continued to receive any psychosocial care they were receiving prior to the intervention. In addition, each family received a computer, printer, and high-speed Internet access. IRC families received access to a home page of brain injury resources and links (identical to those given on the FPS homepage) but were not able to access FPS session content. In this way, we controlled for the nonspecific effects of having access to the resources and information of the Web including chat rooms and online support groups, as well as the specific effects of the brain injury links page. Web-site usage was assessed in both groups via questionnaire at the end of the study.

Measures

Assessment of interim functioning at Session 7. To determine the need for individualized sessions, parents completed the problem-solving and communication subscales from the Family Assessment Device (FAD; Miller, Bishop, Epstein, & Keitner, 1985), a self-report version of the FBII (Burgess et al., 1999), and Likert items pertaining to global family problem solving, communication, and behavior management in the past month. Parents reporting deficient problem solving or communication skills on either the FAD subscales or the Likert items were invited to complete supplemental sessions on these topics.

The FAD is a self-report measure of various dimensions of family functioning including communication and problem solving. “People come right out and say things instead of hinting at them” is an example of an item from the communication subscale of the FAD. Response choices range from strongly agree to strongly disagree. The FAD is widely used and has demonstrated reliability and validity (Miller et al., 1985).

The FBII assesses the unique burdens associated with pediatric TBI. Items ask about potential problems that can arise following a traumatic injury. For each item, the parent is asked to respond (“yes” or “no”) whether that issue is a concern or not. For example, the FBII asks “Do you have concerns about how your child reacts or relates to you or your spouse/partner?” If the parent responds yes, he or she is asked to rate how stressful the concern is on a 5-point scale (ranging from not at all to extremely) and whether the concern is a consequence of the child’s injury. The FBII possesses high internal consistency (Cronbach’s alpha = .90) and has concurrent and predictive validity relative to family and child outcomes (Burgess et al., 1999). Items rated as quite or extremely stressful were identified as areas requiring individualized intervention.

We also asked parents to provide global ratings of their problem-solving, communication, and behavior management skills during the past 2 weeks. The available choices were poor, fair, good, and excellent. Parents who rated their skills in any of these areas as fair or poor were offered additional sessions in that area (e.g., communication).

Problems-solving skills. The 25-item Social Problem-Solving Index (SPSI–short version; D’Zurilla & Nezu, 1990), a multidimensional self-report measure of social problem-solving ability, was used to assess changes in parental problem-solving skills. Items included statements such as “When I have problems, I deal with them as soon as possible.” Response choices ranged from not at all like me to extremely like me. The SPSI generates an overall problem solving score and has good stability and internal consistency. Evidence of concurrent and predictive validity is provided through substantial correlations with other measures of problem solving and predictive relationships with measures of psychological distress, respectively. Scores range from 0 to 100 with higher scores indicating better problem-solving skills.

Parental distress, depression, and anxiety. The Symptom Checklist-90—Revised (SCL-90–R), a 90-item self-report inventory, was used to assess global psychiatric symptoms. Symptoms are rated on a five point scale: not at all, a little bit, moderately, quite a bit, and extremely. The SCL-90–R has well-documented reliability and validity (Derogatis, 1994). We used the Global Severity Index (GSI) as an index of parental psychological distress. The scores are reported as T scores with a mean of 50 and a standard deviation of 10. Higher scores indicate higher distress. Consistent with the recommendations of Derogatis (1994), we used a T score of ≥63 on the GSI or on two other dimensions as an indicator of clinical severity that would warrant clinical diagnosis or treatment. This criterion has demonstrated sensitivity, specificity, and predictive validity across several clinical populations.

We chose the Center for Epidemiologic Studies Depression Scale (CES-D) to measure depression because it is brief, has well-established psychometric properties, and is useful for identifying individuals at risk for developing clinical depression (Radloff, 1977). The CES-D contains 20 items that are rated on a 4-point scale ranging from rarely or none of the time (less than 1 day during the past week) to most or almost all of the time (5–7 days during the past week). Total scores range from 0 to 60, with higher scores corresponding to greater depression. A total score of 16 or greater corresponds to clinically significant levels of depression (Radloff, 1977).

The 10-item Anxiety Inventory (AI) has been widely used in psychological research in which repeated measures are taken and limited time is available (Speilberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Items pertain to the past week and include statements such as “I was jittery.” Response choices range from 0 (not at all) to 3 (very much), and total scores range from 0 to 30. Higher scores indicate greater anxiety.

Online usage questionnaire. We constructed a brief questionnaire to assess time spent on the FPS Web site and other brain injury Web sites. Time spent on other TBI Web sites was used to assess the extent of exposure to TBI information and resources in the IRC group.

Website Evaluation Questionnaire (WEQ). The WEQ was adapted from the Website Evaluation Instrument (Rotondi, Sinkule, & Spring, 2005). The WEQ contains a series of questions regarding the ease of use and helpfulness of the video conferences and the components of the Web site rated on a 5-point Likert scale. Response choices for both the ease of use and helpfulness questions were as follows: 1 = not at all, 2 = a little, 3 = moderately, 4 = very, and 5 = extremely. Higher scores corresponded to a more favorable perception of the Web site and video conferences.

SES. The Hauser–Warren socioeconomic index was used to assess the parent’s occupational status (Hauser & Warren, 1997). The Hauser–Warren index provides a measure of occupational SES derived from the
education and income data from workers in the 1990 census and validated against the occupational prestige ratings from the 1989 General Social Survey. This index is an improvement over previous measures of SES (such as the Duncan) because it is based on more recent data and deals with outliers and unusual occupations in a more sophisticated fashion than previous scales. Higher scores correspond to greater SES. Parents were also asked about their educational attainment with choices ranging from less than 2 years of high school to a graduate degree. To examine the combined effects of utilitarian resources, we constructed a social advantage index combining parent education, Hauser–Warren SES scores, and marital status. Parents were given a point if they were above the mean for education (greater than high school) or above the mean on the Hauser–Warren SES, and they were given an additional point if they were married. Scores on this social advantage index ranged from 0 to 3 ($M = 1.64; SD = 1.22$).

**Results**

**Participants**

Table 2 presents the demographic and injury characteristics of the sample at baseline. Six children (25%) in the FPS group and 7 children (35%) in the IRC group had GCS scores of 8 or less indicating severe TBI. SES and education level varied substantially, with more than half of the parents having a high-school education or less. The sample was nearly one fourth African American, which is somewhat higher than the proportion of African Americans in the Trauma Registry. Nearly two thirds of families (93.3%) attrition was 12% in the FPS group versus 0% in the IRC group; however, this difference was not statistically significant, and dropouts did not differ significantly from remaining participants on any of the baseline measures. Data analyses are based on the primary caregivers, which included 36 mothers and 4 fathers.

**Baseline Comparisons**

Baseline differences between the FPS and IRC groups on demographic and injury characteristics were assessed using $t$ tests for continuous variables and chi-square analyses for dichotomous variables. As reported in Table 2, the groups did not differ significantly on any of these key demographic and injury characteristics. With respect to standard psychosocial care, 3% of the FPS group and 20% of the IRC group received some type of psychotherapy or counseling after the injury ($p = .54$). In addition, 9% of the children in the FPS group and 30% of those in the IRC group were receiving therapy, although this treatment may not have been related to the child’s injury, $\chi^2(1, N = 43) = 3.21, p = .073$. Finally, the groups did not differ on any of the parent outcome measures at baseline. Taken together, these comparisons suggest that the randomization was successful and that the groups were reasonably well matched.

**Web-Site Usage in the FPS and IRC Groups**

Most FPS families reported spending either 0.5–1.0 hr (40%) or 1–2 hr (30%) per week at the FPS Web site. Four families (20%) reported spending less than half an hour, and 2 families (10%) reported spending 2–3 hr per week completing the self-guided sessions. The groups did not differ significantly on any of these key demographic and injury characteristics. As reported in Table 2, the groups did not differ on any of the baseline measures at baseline. Taken together, these comparisons suggest that the randomization was successful and that the groups were reasonably well matched.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Demographic and Injury Characteristics of Participants at Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>FPS</td>
</tr>
<tr>
<td>Child’s age (years)</td>
<td>10.92</td>
</tr>
<tr>
<td>Time since injury (months)</td>
<td>13.48</td>
</tr>
<tr>
<td>Lowest GCS score</td>
<td>12.18</td>
</tr>
<tr>
<td>Hauser-Warren score</td>
<td>33.28</td>
</tr>
<tr>
<td>Child is male</td>
<td>64.0</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>5</td>
</tr>
<tr>
<td>European American</td>
<td>20</td>
</tr>
<tr>
<td>Maternal education</td>
<td></td>
</tr>
<tr>
<td>&lt;2 years HS</td>
<td>1</td>
</tr>
<tr>
<td>2 years HS</td>
<td>2</td>
</tr>
<tr>
<td>HS graduate</td>
<td>7</td>
</tr>
<tr>
<td>2 year college/tech.</td>
<td>8</td>
</tr>
<tr>
<td>4 years college</td>
<td>4</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>1</td>
</tr>
<tr>
<td>Married</td>
<td>13</td>
</tr>
</tbody>
</table>

Note. FPS = family problem-solving therapy; IRC = Internet resource comparison; GCS = Glasgow Coma Scale; HS = high school; tech. = technical school.

* Scores range from 3 to 15, with higher scores indicating less severe injuries.

b $M$s for all occupations = 36.81, range = 7.13–80.53; higher scores indicate higher socioeconomic status.
suggesting that families in the IRC group were accessing brain injury resources on the Web.

**Group Differences in Parent Outcomes**

Group differences in parent outcomes were assessed using analysis of covariance (O’Brien & Kaiser, 1985). Intervention group (FPS vs. IRC) was the independent variable. Scores from the pretest assessment were included as covariates to reduce variance in the outcomes attributable to preexisting individual differences. Effect sizes were based on partial eta², an estimate of the unique variance accounted for by the intervention. In accordance with previous guidelines (Cohen, 1988), effect sizes were labeled as follows: .01–.05 = small, .05–.14 = moderate, and >.14 = large.

As reported in Table 3, the parents in the FPS group reported significantly less depression (CES-D), anxiety (AI), and general psychiatric symptoms (SCL-90) at follow-up than did parents in the IRC group, after controlling for baseline symptom levels. The corresponding effect sizes were moderate to large. Although the FPS group also reported higher problem-solving scores on the SPSI than did the IRC group, this difference did not achieve statistical significance ($p = .10$) because the IRC group reported improvements as well. Intent-to-treat analyses that included the 2 parents who completed only two sessions revealed similar results, with the exception that group differences on the AI were no longer significant ($p = .07$).

**Proportions of Parents Reporting Clinically Significant Symptoms at Follow-Up**

Using established clinical cutoffs on the CES-D and SCL-90, we conducted chi-square analyses to examine the proportion of parents in each group reporting clinically significant symptoms at follow-up. On the CES-D, 6 parents in the FPS group (30%) and 12 parents in the IRC group (60%) reported clinically elevated levels of depressive symptoms at follow-up, $\chi^2(1) = 3.64$, $p = .057$, 95% CI (0.95–12.97). Two (10%) of the FPS parents had clinically significant symptoms on the SCL-90 at follow-up compared with 6 (31.6%) in the IRC group, $\chi^2(1) = 3.18$, $p = .095$, 95% CI (0.04–1.39).

**Sessions Completed and Caregiver Satisfaction**

The total number of video-conference sessions completed ranged from 0 to 12, and all but 2 families completed four or more sessions ($M = 9.5$, $SD = 2.19$). Because all but the initial session were preceded by a self-guided Web session, the total number of sessions completed ranged from 1–24. Families received an average of two supplemental sessions on the basis of identified needs ($SD = 1.4$), with 75% receiving at least one supplemental session.

All parents indicated that they would recommend the program to others; however, 7 parents (33%) indicated that they would prefer to meet with the therapist in person. Table 4 presents ease of use and helpfulness data for the Web site and video conferences. All but 1 participant (94.4%) found the Web site to be moderately easy to use. However, a higher proportion of parents (22%) rated the video conferences as not at all or a little easy to use, suggesting potential drawbacks to the video-conferencing technology for some participants. Ratings of the helpfulness of the Web site were high with all but 1 participant rating all the content areas of the Web site as moderately to extremely helpful. The video conferences were rated as moderately to extremely helpful by all participants, but 22% rated them as not at all or a little helpful compared with face-to-face meetings.

**Changes in Problem-Solving Skills as a Mediator of Treatment Response**

As described by Baron and Kenny (1986) and elaborated by Holmbeck (1997), in order for a variable to be considered a mediator, a number of conditions must be met. First, the predictor (i.e., treatment group) must be significantly associated with the hypothesized mediator (i.e., problem-solving skills). Second, the predictor (group) must be significantly associated with the dependent variable (i.e., parental distress). Third, the mediator (problem solving) must be significantly associated with the dependent measure (distress). Finally, to demonstrate mediation, the association between the predictor and outcome variable must be reduced after controlling for the impact of the mediator on the outcome. We tested these steps in a series of multiple regression analyses. Consistent with the results reported in Table 3, we did not find a

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**Table 3**

*Group Differences in Parental Problem Solving and Psychological Status at Follow-Up Controlling for Baseline Scores*

<table>
<thead>
<tr>
<th>Variable</th>
<th>FPS Baseline</th>
<th>FPS Follow-up</th>
<th>IRC Baseline</th>
<th>IRC Follow-up</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>SPSI total</td>
<td>67.50</td>
<td>15.13</td>
<td>73.45</td>
<td>9.61</td>
<td>66.42</td>
</tr>
<tr>
<td>CES-D</td>
<td>13.60</td>
<td>10.22</td>
<td>9.25</td>
<td>7.09</td>
<td>15.95</td>
</tr>
<tr>
<td>AI</td>
<td>11.25</td>
<td>5.66</td>
<td>9.25</td>
<td>4.99</td>
<td>13.00</td>
</tr>
<tr>
<td>SCL-90-GSI</td>
<td>58.11</td>
<td>15.13</td>
<td>52.33</td>
<td>10.69</td>
<td>58.32</td>
</tr>
</tbody>
</table>

*Note.* Primary caregiver completed more than 50% of the sessions ($n = 20$ group). FPS = family problem-solving therapy; IRC = Internet resource comparison; SPSI = Social Problem-Solving Inventory; CES-D = Center for Epidemiology Scale for Depression; AI = anxiety inventory; SCL-90-GSI = Symptom Checklist-90 Global Severity Index.

* $p < .05.$
significant association between group membership and problem-solving skills (SPSI total) at follow-up, controlling problem-solving skills at baseline, $R^2$ change = .04, $F(1) = 2.78, p > .05$. In addition, we did not find an association between problem solving and parental outcomes (SCL-90 GSI and CES-D total) at follow-up after controlling for baseline levels on these measures, SCL-90 GSI $R^2$ change = .02, $F(1) = 1.19, p > .05$; CES-D $R^2$ change = .00, $F(1) = .26, p > .05$. Thus, we did not find support for the second hypothesis that parental problem-solving skills mediated observed improvements in the treatment group.

**Moderators of Treatment Efficacy**

We conducted a series of hierarchical multiple regression analyses to examine whether baseline demographic or injury characteristics moderated treatment response on the CES-D and SCL-90 GSI. In these analyses, the baseline score on the outcome measure was entered first, followed by group membership, the injury (lowest GCS score, time since injury), or demographic characteristic (child’s age, Hauser–Warren SES score, social advantage index), and the interaction or cross-product term of group and the characteristic of interest (e.g., Group $\times$ Child’s Age). We examined five hypothesized moderators in this fashion: the child’s age, injury severity, time since injury, parental SES, and social advantage. Correlations of these variables with the SCL-90 GSI and CES-D scores at follow-up ranged from .06 to −.45. Only SES and social advantage were significantly correlated with the parent outcome measures at follow-up, with parents of higher SES and/or social advantage reporting fewer symptoms at follow-up. Consistent with studies of parental adaptation, there was also a trend ($r = −.25, p = .06$) for parents of children with more recent injuries to report more distress. In the regression analyses testing for moderation effects, none of the interaction terms were significant (all $ps > .2$). Thus, we found no support for the hypothesis that demographic or injury characteristics moderated treatment response.

**Discussion**

As hypothesized, parents receiving FPS reported significantly less depression, anxiety, and global psychological distress at follow-up than did parents in IRC group, controlling for baseline symptom levels. These findings suggest that the online FPS can be effective in improving parent functioning following pediatric brain injury. Moreover, the IRC group failed to improve or worsened on all three measures of clinical symptoms, suggesting that parental distress does not improve with access to Internet resources alone. The effect sizes were moderate to large, providing evidence that treatment differences were clinically meaningful as well as statistically significant.

This study is unique in several important respects. First, it is one of only a few studies to test interventions to improve parent adaptation following pediatric TBI. Moreover, it is, to our knowledge, the first randomized clinical trial to combine a Web-based intervention and synchronous video conferencing in a family treatment program, thereby addressing issues of treatment accessibility. Finally, by using a comparison group that is receiving access to Internet resources as well as usual psychosocial care, we were able to control for the effects of access to online information and support. Consistent with the previous findings of Singer et al. (1994), access to information and support was not sufficient to reduce parental distress. Moreover, the FPS group reported significant improvements despite the limited nature of the treatment and the somewhat higher proportion of families in the IRC comparison group receiving therapy before or during the intervention phase, thereby potentially reducing our ability to detect group differences associated with FPS. These findings suggest that a time-limited and problem-focused treatment can result in reductions in parental distress following pediatric TBI.

Consistent with previous research, the findings also indicate that individuals with varied education and SES can benefit from an online intervention (Wade et al., 2004; 2005). Nearly half the parents in the FPS group did not have more than a high-school
education, and 35% did not use a computer at home. Nonetheless, all but 1 parent rated the Web site as moderately to extremely easy to use, and all rated it as moderately to extremely helpful, suggesting that perceptions of helpfulness were not influenced by the parent’s level of sophistication in using computers. There was a subgroup of 4 parents who found the video conferences to be relatively difficult and unhelpful, particularly when contrasted with a face-to-face visit. Although these individuals did not benefit less from treatment, it is likely that they would have felt more comfortable in a more traditional therapy format. Thus, future work in this area may benefit from identifying such individuals beforehand and either providing greater training to increase their comfort with the online format or offering a face-to-face treatment option.

Contrary to our hypothesis, the groups did not differ in overall problem-solving skills at treatment completion. Although primary caregivers in the FPS group reported significant increases in problem solving from baseline to follow-up, the IRC group also reported small (and nonsignificant) increases. Exploratory post hoc analyses indicated that greater increases in problem solving were associated with a worsening of depression in the IRC comparison group, but not in the FPS treatment group. These findings are at odds with the substantial literature on the relationship between problem-solving skills and depression (see D’Zurilla & Nezu, 1999). However, these findings are consistent with previous research on the relationship between coping strategies and psychological distress following TBI, which indicated that use of active coping was associated with greater distress in the context of severe TBI but not orthopedic injuries (Wade et al., 2001). Thus, efforts at problem solving in the absence of the education and guidance provided by FPS regarding how to channel those efforts may result in increased frustration and distress in this population.

The problem-solving measure used (the short form of the SPSI) was chosen because it was derived from the model of problem-solving adopted in this study (Nezu et al., 1998). However, it was developed to assess changes in problem solving among individuals, not collaborative family-level problem solving. Therefore, the instrument may not have been entirely successful in capturing treatment-related changes in problem solving. Other investigators (see Sahler et al., 2005) have raised concerns about the utility of the SPSI in assessing actual changes in behavior rather than socially desirable attitudes and have proposed using more behaviorally based measures. In the future, researchers may consider adopting a more broad-based approach to assessing problem-solving skills.

The failure to find group differences in problem-solving skills may also be partially attributable to the broader focus of the intervention, which included training in behavior management and communication skills as well as problem solving. Thus, we may have found evidence of mediation if we had used more sensitive measures of problem solving coupled with measures of other target skills. The fact that problem-solving skills were not associated with parent outcomes provides some support for this notion. However, it is also possible that group differences in parent outcomes were attributable to having a trained therapist help address the family’s problems rather than any specific change in the parent or family skills targeted by the intervention. Subsequent research with a more sensitive measure of problem solving and an attention control will be required to disentangle direct and indirect treatment effects associated with FPS.

Contrary to hypotheses, we also did not find evidence that demographic characteristics or injury factors moderated treatment response. This finding is important because it suggests that parents of lower SES are equally able to benefit from an online skill-building intervention. Although the intervention required that at least 1 family member possessed basic computer skills, it also afforded a good deal of redundancy around key concepts and skills. Families were exposed to the content in several different formats (didactic information, video, and interactive exercises) and then given an opportunity to review these materials with the therapist. The interactive exercises designed for the family to work with as a group (Wade et al., 2004) may have also spurred additional discussions among family members, further solidifying learning from the intervention. This built-in repetition coupled with the multimedia presentation of information may have served to mitigate differences in treatment effectiveness attributable to SES. In addition, the child’s age, injury severity, and time since injury do not appear to impact the effectiveness of treatment for parents, indicating that most families should be able to benefit from this type of intervention.

Several limitations of the current research should be noted. First, the sample size was relatively small and skewed toward less severe injuries. As a result, it is difficult to generalize to a sample of children with predominantly severe injuries. Another limitation, as noted above, was the inability to distinguish the specific and nonspecific effects of the intervention in the current design. It is possible that some of the improvement in the FPS group was attributable to therapist attention and not the specific effects of the intervention. Creation of a control group that received equivalent therapist attention, together with administration of measures of family-level problem solving, communication, and behavior management, would better enable us to determine the pathways through which the intervention resulted in improved parent outcomes.

Reliance on self-report measures and the lack of an extended follow-up pose further limitations. Although all participants received computers and Internet access, parents in the treatment group may have experienced greater pressure to provide socially desirable responses reflecting improved functioning. In addition, without longer-term follow-up, it is not possible to determine if treatment effects persisted beyond the end of treatment or if FPS prevented the emergence of subsequent problems.

Despite these limitations, the current study provides evidence that an online, family problem-solving and skill-building intervention can reduce parental psychological distress, depression, and anxiety following brain injury in children. Evidence of the feasibility and efficacy of an online approach with this population holds the promise of providing access to needed treatment for families who might not otherwise be able to attain it because of distance or unavailability of experienced providers. Future research with larger samples and more sensitive measures of target skills and potential moderators (e.g., utilitarian resources) will be necessary to shed light on the mechanisms of treatment action and to identify characteristics of individuals and families most likely to benefit from this approach.
References


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