Parent Psychological Functioning and Communication Predict Externalizing Behavior Problems After Pediatric Traumatic Brain Injury

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Objective Adolescents sustaining traumatic brain injury (TBI) show increased prevalence of behavior problems. This study investigated the associations of parent mental health, family functioning, and parent–adolescent interaction with adolescent externalizing behavior problems in the initial months after TBI, and examined whether injury severity moderated these associations.

Methods 117 parent–adolescent dyads completed measures of family functioning, adolescent behavior, and parent mental health an average of 108 days post-TBI. Dyads also engaged in a 10-min video-recorded problem-solving activity coded for parent behavior and tone of interaction.

Results Overall, higher ratings of effective parent communication were associated with fewer externalizing behavior problems, whereas poorer caregiver psychological functioning was associated with greater adolescent externalizing behaviors. Results failed to reveal moderating effects of TBI severity on the relationship between socio-environmental factors and behavior problems.

Conclusions Interventions targeting parent communication and/or improving caregiver psychological health may ameliorate potential externalizing behavior problems after adolescent TBI.

Key words externalizing behavior problems; parent–adolescent interaction; protective factors; traumatic brain injury.

Introduction

Pediatric traumatic brain injury (TBI) is a leading cause of acquired disability in childhood (Langlois, Rutland-Brown, & Thomas, 2004). Changes in behavior following pediatric TBI are particularly common, with close to 40% of children with severe TBI and up to 20% of those with moderate TBI developing significant behavior problems (Schwartz et al., 2003). Almost 60% of children with TBI develop psychiatric disorders after injury, with greater levels of TBI severity associated with higher rates of novel (i.e., not present before injury) psychiatric diagnoses, including externalizing behavior disorders such as attention-deficit hyperactivity disorder and oppositional defiant disorder (Bloom et al., 2001; Max et al., 1997).
Increased prevalence of externalizing behavior problems among adolescent TBI samples (Schwartz et al., 2003) is of particular concern, given the potential ramifications of these behaviors (e.g., detention/expulsion from school, problems with the law). Indeed, adolescents with TBI are over-represented in juvenile justice settings (Perron & Howard, 2008). Given that one of the two peaks of TBI incidence occurs during adolescence (Faul, Xu, Wald, & Coronado, 2010), examining the impact of TBI on subsequent externalizing behavior problems during this life stage is important. In addition, despite consistent evidence of a higher prevalence of externalizing behavior problems after TBI (Schwartz et al., 2003), few studies have looked at factors that influence development of externalizing behaviors in the initial months after TBI among adolescents, although there are a number of studies with younger samples. For example, Anderson, Catroppa, Haritou, Morse, and Rosenfeld (2005b) found that age at injury, pre-injury child adaptive behavior, and family stress post-injury were associated with behavior problems 30 months after injury among a sample of children aged 3 through 12 years. In another sample of young children (aged 6–12 years at injury), more severe TBI and lower family socioeconomic status predicted presence of significant behavior problems 4 years after injury (Schwartz et al., 2003).

In general adolescent samples, factors associated with externalizing behavior problems include low family income and functioning, high stress and conflict in the home, parent mental health problems, poor peer relationships, and poor parent–child interaction (Deater-Deckard, Dodge, Bates, & Pettit, 1998). Although these factors are independently associated with behavior problems, their cumulative effect is a stronger predictor than any single factor (Deater-Deckard et al., 1998). While characteristics associated with adolescent externalizing behavior problems in general samples have been identified, risk and protective factors associated with development of behavior problems in adolescents sustaining TBI have yet to be elucidated. Moreover, existing research suggests that neurological insult such as TBI may exacerbate the effects of social-environmental influences on emerging behavioral problems (Wade et al., 2011), highlighting the need for research with this sample.

A number of factors associated with externalizing behavior problems in general adolescent samples are particularly salient to adolescent TBI samples. For example, parents of children with TBI report more family problems, poorer psychological functioning, and greater levels of stress than parents of noninjured children (Hawley, Ward, Magnay, & Long, 2003; Wade, Taylor, Drotar, Stancin, & Yeates, 1998). These factors, coupled with increased financial burden (Hawley et al., 2003) likely impact general family functioning, such as the emotional climate in the home, family conflict, and the family’s ability to manage additional crises. Aside from family functioning, parent–child interaction has also been shown to deteriorate after TBI. In one study, for example, parents of young children (aged 3–7 years) with moderate TBI showed less warm responses to their child compared with parents of children with orthopedic injuries, and this lower level of warmth was associated with higher rates of externalizing behavior problems (Wade et al., 2008).

Adolescence represents a period of transition marked by transformations in the parent–adolescent relationship (Collins & Steinberg, 2008). Adolescents striving for autonomy has been hypothesized to precipitate conflict between parents and adolescents. However, although adolescence has been conceptualized as a period of high parent–adolescent conflict, this view has been challenged (Collins & Steinberg, 2008). It is now established that frequent high-intensity parent–adolescent conflict is not typical or normative, although parent–adolescent bickering is common (Collins & Steinberg, 2008). Collins and Laursen (2004) note that qualities of the parent–child relationship likely persist, with warm and close parent–child relationships during childhood leading to similarly warm and close parent–child relationships during adolescence. TBI and associated changes may disrupt the normative pattern of parent–child relationships, and may lead to increased parent–adolescent negativity and conflict, and subsequently increased externalizing behavior problems. Indeed, among adolescents with severe TBI, parent–adolescent conflict has been linked to poorer adolescent and family functioning post-TBI (Wade et al., 2003).

Contemporary researchers have emphasized a bidirectional model of parent–child interaction, whereby child characteristics affect parenting behaviors and vice versa (Petit & Arsiwalla, 2008). The presence of a bidirectional relationship between parent and child functioning is supported in the TBI literature (Taylor et al., 2001). Given the reciprocal nature of parent–adolescent interactions, it is likely that changes in either parent or adolescent factors can lead to changes in the system as a whole. Specifically, if parent characteristics contribute to adolescent externalizing behavior problems after TBI, intervening at the parent level may reduce escalations in adolescent externalizing behavior problems.

Parents play a critical role in adolescent development, and parent–adolescent interaction is an important, although largely unexplored, factor in research addressing child functioning post-TBI. Examination of parent–
adolescent interactions after TBI has been hampered by the lack of reliable and ecologically valid approaches to assessment. Paper–pencil self-report measures such as the Interaction Behavior Questionnaire (Prinz, Foster, Kent, & O’Leary, 1979) have been used to examine parent–child communication in TBI (Wade et al., 2011) and non-TBI samples; however, these measures may be influenced by social desirability biases or confounded by psychological problems such as depression. Observational measures that are coded by experimenters who are unaware of diagnosis or condition, such as the Iowa Family Interaction Rating Scales (IFIRS; Melby et al., 1998), have several advantages over self-report measures including enhanced ecological validity of observations. Unfortunately, few studies have collected observational data of parent–child interactions during the initial months after TBI (see Wade et al., 2008 for an exception).

Given that adolescence is a peak time for sustaining TBI (Faul et al., 2010), greater understanding of factors associated with increased rates of externalizing behavior problems in this sample is needed to guide intervention efforts. In addition, protective factors that are associated with better outcomes after TBI need to be elucidated. Identifying risk and protective factors in the acute phase after injury is important, as these findings may inform interventions that can buffer adolescents from developing or escalating problem behaviors post-TBI. Moreover, considering that parent mental health functioning, family stress, and parent–child interaction often deteriorate after pediatric TBI (Hawley et al., 2003; Wade et al., 1998), these variables are particularly important to examine in relation to adolescent functioning after TBI.

The primary goal of this study was to examine the association between socio-environmental factors (i.e., family income, parent psychological functioning, and general family functioning) and parent–adolescent interaction, with adolescent externalizing behavior problems in the initial months after complicated mild/moderate to severe TBI. We hypothesized that features of parent–adolescent interaction would explain variance in adolescent externalizing behavior problems above and beyond socio-environmental factors such as family income and family functioning. In addition, injury severity (i.e., severe vs. complicated mild/moderate) was examined as a moderator of the association between social-environmental characteristics (e.g., family functioning and parent–teen interactions) and externalizing behavior problems. Given the potential challenges associated with self-report measures of parent–adolescent interaction, the IFIRS (Melby et al., 1998), an observational measure of parent–adolescent interaction was used in this study. Although the IFIRS has been used with both typically developing and clinical samples, this is the first study to examine the utility of this measure in predicting adolescent functioning after TBI.

Method

This study reports on baseline data collected as part of a larger randomized clinical trial comparing the effectiveness of an Internet-based counseling intervention to support adolescents and their families after TBI. For further information on this larger study, see Wade et al. (2012). The data presented in this article were gathered during the initial (baseline) home visit conducted with families before study group assignment. All baseline assessments were carried out between 1 and 7 months after the date of the injury.

Recruitment Criteria

Adolescents aged 12–17 years who were admitted for TBI at three large tertiary children’s hospitals and two general hospitals with Level 1 Trauma Centers (and pediatric commitment) were screened to participate. Inclusion criteria included spending at least one night at the hospital due to TBI and a lowest Glasgow Coma Scale (GCS) score of ≤12, or evidence of brain injury visible on computerized tomography (CT) or magnetic resonance imaging (MRI). Other inclusion criteria were use of English as the main language in the home and residence within a 3-hr drive from the hospital. Exclusion criteria included nonblunt head trauma (e.g., gunshot wound), history of child abuse (documented in adolescents’ medical record or based on parent report), and parent hospitalization for a psychiatric disorder in the previous 12 months. Adolescents with moderate/severe intellectual disability before injury were excluded, as were adolescents who had not recovered sufficiently to verbally participate in the study.

Participants

Three hundred eight adolescents were screened to participate and of this total, 52 did not meet inclusion criteria and 52 declined to participate. A further 72 were ineligible because they were unable to be contacted within the initial 6 months after injury. The 132 remaining adolescents and their primary caregiver (caregivers self-identified their status as primary caregiver) completed informed consent and participated in the baseline assessment. Due to financial constraints, IFIRS data were only collected on primary caregiver–adolescent dyads. IFIRS data were not available.
for seven of these participants (due to video-recording problems) and a further eight participants did not complete self-report measures, resulting in a final sample of 117 parent–adolescent dyads. Participants in the final sample did not differ from those who were excluded (i.e., those who consented but did not complete required measures or had unusable IFIRS data) with regard to sociodemographic variables (i.e., family median income, child race) and injury severity (i.e., GCS score).

Study participants were aged between 12 and 17 years ($M = 14.47$, $SD = 1.72$), and 67% were male. GCS scores were available for 110 of the 117 participants, and consistent with other research (Fletcher, Ewing-Cobbs, Miner, Levin, & Eisenberg, 1990; Wade et al., 2008), TBI severity was assessed based on cutoff scores on the GCS. GCS scores of $\leq 8$ at any point post-injury were classified as severe TBI, GCS scores between 9 and 12 were classified as moderate TBI, and GCS scores between 13 and 15 with evidence of brain insult on CT or MRI scans were classified as complicated mild TBI. Based on these criteria, 45 adolescents (41%) were classified as having sustained severe TBI, 17 (15%) were considered to have sustained moderate TBI, and 48 (44%) were classified as having complicated mild TBI. A clinical neuropsychologist reviewed medical records of the seven participants who were not given a GCS score and assigned an injury severity classification based on descriptions in the medical record of eye opening, motor response, and verbalization. In this subset, adolescents with record of verbal unresponsiveness and lack of spontaneous eye movement or purposeful movement were assigned to the severe TBI group ($n = 1$). Adolescents with record of impaired consciousness or brain insult visible on CT or MRI scans who did not meet criteria for severe TBI were assigned to the moderate TBI group ($n = 6$). Consistent with previous research supporting their comparability (Williams, Levin, Harvey, & Eisenberg, 1990), the moderate and complicated mild groups were combined, thereby enabling us to retain participants with missing GCS scores. The final sample consisted of 46 adolescents (40%) in the severe TBI group and 71 (60%) in the complicated mild/moderate TBI group. Table I presents injury severity and demographic characteristics of the 117 adolescents who completed the baseline assessment.

Procedure

This study is based on data gathered during the initial assessment that was conducted an average of 108 days post-TBI ($SD = 53.39$). Before the home visit, the paper–pencil measures were mailed to families, and these forms were collected at the visit. The assessment was completed in one session lasting 75–90 min in the family home and was facilitated by two researchers. After the caregiver interview and adolescent testing were completed, caregiver–adolescent dyads completed the IFIRS measure (protocol is detailed in the Measures section).

Measures

Injury Severity

Information regarding injury severity, including GCS scores and findings from CT or MRI, was obtained from participants’ medical records.

Demographic Information

The primary caregiver of each adolescent completed a questionnaire providing information on age, marital status, race, level of education, and employment status. Most primary caregivers (henceforth referred to as parent) were mothers or stepmothers ($n = 100, 86$%), and some were fathers ($n = 13, 11$%) and grandmothers ($n = 4, 3$%). Household census track income for families was determined based on home address. See Table I for a summary of demographic characteristics.

General Family Functioning

Family functioning was assessed using the Global Functioning Scale of the McMaster Family Assessment Device (FAD-GF; Epstein, Baldwin, & Bishop, 1983), a paper–pencil self-report measure of family functioning with established reliability and validity (Miller, Epstein, Bishop, & Keitner, 1985). The FAD-GF “assesses overall health/pathology of the family” (Epstein et al., 1983, p. 173). Parents and adolescents rated their level of agreement (from strongly agree to strongly disagree) to statements reflecting their family’s functioning, such as we don’t get along well together, we confide in each other, and we have trouble meeting our financial obligations. Scores on the FAD-GF range from 1 to 4, with higher scores indicating poorer family functioning.

Adolescent Behavioral Functioning

Adolescent externalizing behavior problems were measured using the externalizing behavior problems index of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). The CBCL is a paper–pencil parent-report measure of child/adolescent emotional and behavioral functioning. The externalizing behavior scale score is a composite index of externalizing behavior problems endorsed by parents. Scores are reported as $T$ values, with higher scores indicating greater behavior problem severity (Achenbach & Rescorla, 2001).
Parent Mental Health Functioning

Parent mental health functioning was assessed using two self-report measures, the Symptom Checklist-90-R (SCL-90-R; Derogatis & Lazarus, 1994) and the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). The Global Severity Index (GSI) of the SCL-90-R was used as a measure of global parent psychological functioning, and the CES-D was used as the measure of depression. Scores on the GSI are reported as T values, with higher scores suggesting greater distress. Scores on the CES-D range from 0 to 60, with higher scores reflecting higher levels of depression (Radloff, 1977). Although GSI and CES-D scores were highly correlated ($r = .68$, $p < .01$), they represent different theoretical constructs and scores for each were entered separately in the analyses.

Parent–Adolescent Interaction

The IFIRS (Melby et al., 1998) was used to assess interaction between the self-identified primary caregiver and adolescent. The IFIRS measures quality of dyadic interaction as well as behavioral characteristics of the individuals involved. In this study, naïve coders rated quality, tone, and behavior of parents during a 10-min problem-solving task with the adolescent. First, parents and adolescents independently rated how often they disagreed or were upset by 28 common conflict areas between parents and adolescents (e.g., money, alcohol, curfew, breaking rules, discipline, etc.) Next, the researcher instructed parent–adolescent dyads to discuss an upcoming holiday for 10 min; the researcher started the video-recording and left the room. Although not coded, this neutral conversation provided the dyad with an opportunity to become comfortable

### Table I. Summary of Demographic and Study Variables by Injury Severity Group ($N = 117$)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Complicated mild/moderate TBI ($n = 71$)</th>
<th>Severe TBI ($n = 46$)</th>
<th>$T$ ($df = 115$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescent age at injury (in years)</td>
<td>14.25 (1.72)</td>
<td>14.73 (1.72)</td>
<td>−1.49</td>
</tr>
<tr>
<td>Glasgow Coma Scale score ($n = 110$)</td>
<td>13.48 (1.82)</td>
<td>4.91 (1.91)</td>
<td>23.80**</td>
</tr>
<tr>
<td>Adolescent gender (% male)</td>
<td>67.6%</td>
<td>65.2%</td>
<td>−</td>
</tr>
<tr>
<td>Adolescent race (% Caucasian)</td>
<td>77.5%</td>
<td>87.0%</td>
<td>−</td>
</tr>
<tr>
<td>Marital status of primary caregiver</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/Living with someone</td>
<td>60.3%</td>
<td>69.6%</td>
<td>−</td>
</tr>
<tr>
<td>Separated</td>
<td>2.8%</td>
<td>6%</td>
<td>−</td>
</tr>
<tr>
<td>Widowed/Divorced</td>
<td>22.5%</td>
<td>15.2%</td>
<td>−</td>
</tr>
<tr>
<td>Never married</td>
<td>14.1%</td>
<td>8.7%</td>
<td>−</td>
</tr>
<tr>
<td>Education level of primary caregiver</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not complete high school</td>
<td>5.6%</td>
<td>8.7%</td>
<td>−</td>
</tr>
<tr>
<td>High school diploma or GED</td>
<td>38.0%</td>
<td>41.3%</td>
<td>−</td>
</tr>
<tr>
<td>At least 2 years college</td>
<td>33.8%</td>
<td>23.9%</td>
<td>−</td>
</tr>
<tr>
<td>Bachelor’s or advanced degree</td>
<td>22.6%</td>
<td>26.1%</td>
<td>−</td>
</tr>
<tr>
<td>Employment status of primary caregiver</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed full or part time</td>
<td>73.2%</td>
<td>71.7%</td>
<td>−</td>
</tr>
<tr>
<td>Unemployed</td>
<td>26.8%</td>
<td>28.3%</td>
<td>−</td>
</tr>
<tr>
<td>Census tract family income</td>
<td>$67,733 ($30,329)</td>
<td>$73,248 ($23,358)</td>
<td>−1.02</td>
</tr>
<tr>
<td>Child functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBCL externalizing problems (parent report)</td>
<td>52.73 (10.71)</td>
<td>55.22 (10.28)</td>
<td>−1.25</td>
</tr>
<tr>
<td>Parent mental health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CES-D score (parent)</td>
<td>11.07 (8.70)</td>
<td>15.30 (10.34)</td>
<td>−2.39*</td>
</tr>
<tr>
<td>GSI-SCL-90-R (parent)</td>
<td>53.49 (10.64)</td>
<td>58.54 (11.75)</td>
<td>−2.41*</td>
</tr>
<tr>
<td>Family functioning variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAD (parent report)</td>
<td>1.80 (.43)</td>
<td>1.88 (.53)</td>
<td>−.90</td>
</tr>
<tr>
<td>FAD (adolescent report)</td>
<td>2.03 (.37)</td>
<td>1.98 (.52)</td>
<td>.52</td>
</tr>
<tr>
<td>Parent–adolescent interaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFIRS warmth</td>
<td>8.38 (4.70)</td>
<td>8.35 (3.62)</td>
<td>.04</td>
</tr>
<tr>
<td>IFIRS negativity</td>
<td>12.99 (6.23)</td>
<td>14.15 (5.65)</td>
<td>−1.03</td>
</tr>
<tr>
<td>IFIRS effective communication</td>
<td>14.39 (4.62)</td>
<td>14.80 (4.12)</td>
<td>−.49</td>
</tr>
</tbody>
</table>

Note. TBI = traumatic brain injury; CBCL = Child Behavior Checklist; CES-D = Center for Epidemiologic Studies–Depression Scale; GSI-SCL-90 = Global Severity Index of the Symptom Checklist-90; FAD = Family Assessment Device; IFIRS = Iowa Family Interaction Rating Scale.

Numbers in parentheses are standard deviations.

*p < .01, **p < .001.
being videotaped. During this time, the researcher reviewed parent and adolescent responses to the conflict questionnaire and selected three high-conflict issues reported by both parent and adolescent. After 10 min, the researcher instructed parent–adolescent dyads to discuss and find a solution to three high-conflict issues reported by both parents and adolescents for 10 min, and then left the room. The second 10-min recording (i.e., the problem-solving task) was coded by trained coders at the Interaction Rating Laboratory at Iowa State University.

Parent behavior, mood, and tone of interaction were coded and scored on dimensions such as hostility, warmth, assertiveness, prosocial behavior, and sadness. Twenty-nine scales (7 Individual Characteristic Scales and 22 Dyadic Interaction Scales) were scored between 1 and 9 based on frequency and intensity of the behavior during the 10-min interaction. A score of 1 indicated that “the behavior never occurs or occurs just once and is of low intensity,” and a score of 9 indicated that “the behavior occurs frequently of with significant intensity” (Melby et al., 1998, pp. 7–8). Twenty percent of recordings were independently rated by two coders, and intraclass correlations ranged from .43 to .89 (please see Table II for intraclass correlations for each code).

The IFIRS is considered a “well-established” evidence-based measure in pediatric populations (Alderfer et al., 2008). This observational measure has been used in pediatric cancer, cystic fibrosis, and asthma samples (Celano et al., 2008; Delamo, Leyers-Landis, Droter, & Quitmier, 2004; Dunn et al., 2011) but has not, to our knowledge, been administered to assess the effects of pediatric TBI on family interactions. Factor analysis was used to reduce the multiple IFIRS codes to composite measures of distinct types of parent behaviors and interactions salient in this sample. Items from the Individual Characteristics Scales and Dyadic Interaction Scales were analyzed using common factor analysis with an orthogonal rotation (direct oblimin) to group parent items into subsets reflecting underlying construct. Common factor analysis was also used by Williamson, Bradbury, Trail, and Karney (2011) to examine scales of the IFIRS with low-income couples. Before factor analyses, three items with poor distribution (i.e., skewness >3 and kurtosis >8) were removed. The scree plot indicated a three-factor solution, and items with primary factor loadings of ≥ .50 and secondary loadings of ≤ .30 were retained. Items that loaded on more than one factor were excluded, unless their loading on one factor was at least double the value of the loading on the other factor. Items were removed one at a time, with the lowest factor loading item being deleted after each analysis. Repeated factor analyses were conducted until a clean three-factor solution was attained. There were no overlapping items across these scales of the IFIRS with low-income couples. Before factor analyses, three items with poor distribution (i.e., skewness >3 and kurtosis >8) were removed. The scree plot indicated a three-factor solution, and items with primary factor loadings of ≥ .50 and secondary loadings of ≤ .30 were retained. Items that loaded on more than one factor were excluded, unless their loading on one factor was at least double the value of the loading on the other factor. Items were removed one at a time, with the lowest factor loading item being deleted after each analysis. Repeated factor analyses were conducted until a clean three-factor solution was attained. There were no overlapping items across these

<table>
<thead>
<tr>
<th>Code and descriptions (intra-class correlations in brackets)</th>
<th>Factor loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escalate warmth: Building onto one’s own warm/supportive behavior toward another interactor (.89)</td>
<td>.84</td>
</tr>
<tr>
<td>Warmth/Support: Expressions of care, concern, support, or encouragement toward another interactor (.86)</td>
<td>.82</td>
</tr>
<tr>
<td>Positive mood: Expressions of contentment, happiness, and optimism toward self, others, or things in general (.81)</td>
<td>.67</td>
</tr>
<tr>
<td>Endearment: Personalized and unqualified approval of another interactor’s personal characteristics; approval of a global and enduring nature (.63)</td>
<td>.57</td>
</tr>
<tr>
<td>Hostility: Extent to which hostile, angry, critical, disapproving rejecting or contemptuous behavior is directed toward another interactor’s behavior (actions), appearance, or personal characteristics (.67)</td>
<td>.86</td>
</tr>
<tr>
<td>Antisocial: Demonstrations of self-centered, egocentric, acting out, and out-of-control behavior that show defiance, active resistance, insensitivity, or lack of constraint. Reflects immaturity and age-inappropriate behaviors (.61)</td>
<td>.73</td>
</tr>
<tr>
<td>Escalate hostile: Building onto one’s own hostile behaviors toward another interactor (.43)</td>
<td>.72</td>
</tr>
<tr>
<td>Angry coercion: Control attempts that include hostile, contemptuous, threatening, or blaming behavior (.38)</td>
<td>.63</td>
</tr>
<tr>
<td>Contempt: A specific form of hostility characterized by disgust, disdain, or scorn of another interactor (.71)</td>
<td>.57</td>
</tr>
<tr>
<td>Communication: The speaker’s ability to neutrally or positively express his/her point of view, needs, wants, etc., in a clear, appropriate, and reasonable manner, and to demonstrate consideration of a view points of others (.63)</td>
<td>.88</td>
</tr>
<tr>
<td>Assertiveness: The focal’s ability, when speaking, to express self through clear, appropriate, neutral, and/or positive avenues using an open, straightforward, self-confident, nonthreatening, and nondefensive style (.63)</td>
<td>.84</td>
</tr>
<tr>
<td>Listener responsiveness: The focal’s nonverbal and verbal responsiveness as a listener to the verbalizations of the other interactor through behaviors that validate and indicate attentiveness to the speaker (.73)</td>
<td>.81</td>
</tr>
</tbody>
</table>

Note. On the basis of the loadings, factors were assigned the following interpretive labels: Factor 1 = IFIRS warmth (Cronbach’s α = .81), Factor 2 = IFIRS negativity (Cronbach’s α = .86), and Factor 3 = IFIRS effective communication (Cronbach’s α = .90). The source of the brief descriptions is the IFIRS coding manual (Melby et al., 1998).
three factors. Please see Table II for a description of codes in each factor and their loadings.

The first factor, labeled IFIRS Warmth, measured warm/supportive behavior and included the following scales: warmth/support, escalating warmth/support, positive mood, and endearment, and had a Cronbach’s α of .81. The second factor, labeled IFIRS Negativity, measured hostility/anger and included the following behaviors: hostility, escalate hostility, antisocial, angry coercion, and contempt. The reliability of the IFIRS Negativity factor was .86. The third factor, labeled IFIRS Effective Communication, captured effective communication from parent to child and included codes for communication, assertiveness, and listener responsiveness. This factor had a Cronbach’s α of .90.

**Analyses**

Frequencies and univariate statistics were used to examine the distributional properties of all variables as well as summarize results. Bivariate relationships between continuous predictor variables were assessed using Pearson’s correlation coefficient, and independent-samples t-tests were conducted to examine differences between adolescents in the complicated mild/moderate and severe TBI groups on all study variables. Scores on all continuous predictor variables were then centered to facilitate regression analyses.

Multiple regression analyses were conducted to examine injury severity (i.e., severe vs. complicated mild/moderate) as a moderator. In the first block, median family census tract income and injury severity dummy code were entered. To control for main effects, all study variables (i.e., CES-D, GSI, caregiver FAD, adolescent FAD, IFIRS Warmth, IFIRS Negativity, and IFIRS Effective Communication) were entered in the second block. Finally, an interaction term for each study variable by injury severity group was entered in the third block (e.g., CES-D × Severity group, GSI × Severity group, etc.).

Hierarchical multiple regression analyses were then conducted to examine the relationship between sociodemographic factors and parent–adolescent interaction with externalizing behavior problems. To control for possible influences of income and injury severity, median family census tract income and injury severity dummy code were entered in the first block. Next, parent mental health variables (i.e., CES-D and GSI) and family functioning variables (i.e., caregiver FAD and adolescent FAD) were entered in the second block. In the third and final block, IFIRS factor scores (i.e., Warmth, Negativity, and Effective Communication) were entered using stepwise entry (PIN = .05, POUT = .10). Stepwise entry was used in the final block, as the three IFIRS assessed aspects of parent–adolescent interaction and were conceptually similar.

**Results**

**Descriptives and Differences Between Complicated Mild/Moderate and Severe TBI Groups**

Adolescents in the severe group had higher scores on the externalizing behavior problems scale of the CBCL (M = 55.22, SD = 10.28) than the complicated mild/moderate group (M = 52.73, SD = 10.71), although this difference was not statistically significant. FAD ratings by primary caregiver and teen and IFIRS factor scores (i.e., warmth, negativity, and effective communication) did not differ significantly between the severe and moderate/complicated mild groups. Parents of adolescents in the severe TBI group reported higher levels of psychiatric symptoms (GSI scale of the SCL-90, M = 58.54, SD = 11.75 for severe group and M = 53.49, SD = 10.64 for the complicated mild/moderate group, t = −2.41, p < .05) and depression (CES-D, M = 15.30, SD = 10.34 for the severe group and M = 11.07, SD = 8.70 for the complicated mild/moderate group, t = −2.39, p < .05).

Scores of parent, adolescent, and family functioning were comparable with findings in other TBI samples. For example, parent GSI scores were similar to those reported by Stancin, Wade, Nicolay, Yeates, and Taylor (2008) for parents of children aged 3–6 years (mean GSI scores of 56 for severe TBI group and 50 for complicated mild/moderate group). They were also comparable with scores reported by Wade et al. (1998) among parents of children aged 6–12 years (mean GSI scores of 57 for severe TBI group and 56 after complicated mild/moderate TBI). Similarly, parent ratings of family functioning (FAD) were similar to those found by Wade et al. (1998; mean score of 1.77 for both severe and complicated mild/moderate groups).

Defining clinically elevated externalizing behavior problems’ caseness based on a T-score ≥63 (equivalent to <10% prevalence in the norming sample of the CBCL) resulted in an incidence rate of 24% for the severe group and 20% for the complicated mild/moderate group, and were similar to those reported by Schwartz et al. (2003; 23% caseness for severe TBI and 22% for complicated mild/moderate groups 6 months after injury).

**Bivariate Correlations**

Bivariate correlations between study variables and parent report of externalizing behavior problems on the CBCL were as follows (all ps < .05): CES-D (r = .33), GSI (r = .39), FAD (caregiver report, r = .27; teen report,
In the initial model (which controlled for all main effects and included all interaction terms), a significant interaction was found for injury severity and caregiver depression; no other interaction terms were significant. However, trimmed models revealed no significant interaction of injury severity and parent and family variables, or parent-adolescent interaction.

Predictors of Externalizing Behavior Problems
Hierarchical multiple regression analyses were conducted to examine if features of parent-adolescent interaction explained additional variance beyond socio-environmental variables examined. Total $R^2$ for the untrimmed model was .28 ($p < .005$ for total model, and $p < .005$ for step at final step). Of the two control variables, lower income was significantly associated with increased externalizing behavior problems; however, injury severity group was not a significant predictor. In this untrimmed model, only primary caregiver GSI score and IFIRS Effective Communication contributed significant unique variance, and were thus included in the follow-up trimmed regression model. In the trimmed regression model (Table III), the same control variables were entered in the first step (i.e., family income and injury severity) and GSI and IFIRS Effective Communication were entered in Step 2. $R^2$ at Step 1 (with the control variables) was .07 ($p < .05$) and $R^2$ at Step 2 was .27 ($p < .001$). In this trimmed model, GSI ($\beta = .38$, $p < .005$) and IFIRS Effective Communication ($\beta = -.29$, $p < .005$) remained significant predictors; both were uncorrelated, thereby contributing significant and unique variance to the model.

Discussion
Pediatric TBI has well-documented effects on quality of life (Stancin et al., 2002), family functioning (Hawley et al., 2003), and adolescent outcomes (Wade et al., 2003), with severe injuries generally leading to more negative outcomes for the child and family. This study examined factors associated with externalizing behavior problems in the initial months after adolescent TBI. No significant differences between complicated mild/moderate and severe TBI groups were found for primary caregiver report of externalizing behavior problems, adolescent and parent report of family functioning, or on observations of parent-adolescent interactions. Between-group differences were only found for primary caregiver level of depression and parent psychological distress.

Contrary to our hypotheses regarding the possible moderating impact of injury severity, we failed to find evidence that TBI severity moderated the effects of socio-environmental and family characteristics on externalizing behavior problems. There are a number of possible explanations for the lack of evidence for moderation in this study. First and most importantly, this sample did not include a group of adolescents with mild TBI. Inclusion of adolescents with mild TBI or non-neurological injuries may have revealed differences in the magnitude of social-environmental and family influences between those with mild or no TBI versus more severe TBI. In addition, adolescents in this sample were restricted to those who could verbally participate and complete all study procedures.
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Adolescent TBI. Indeed, poor parent psychological functioning may also be attributable to the relatively older age of this sample and the time point at which data were collected. Research findings to date suggest that child outcomes are more adversely impacted when injury is sustained at a younger age (Anderson, Catroppa, Morse, Haritou, & Rosenfeld, 2005a), and although this literature largely focuses on cognitive outcomes, it is possible that behavioral outcomes show a similar pattern. Finally, given that ratings of behavior were made within the initial months after injury (average 3 months), it is possible that differences between those with complicated mild/moderate and severe TBI will emerge with increasing time post-injury.

Although all study variables showed significant bivariate correlations with adolescent externalizing behavior problems, only global parent psychological functioning (GSI of the SCL-90) and effective parent communication (IFIRS effective communication) emerged as significant predictors of externalizing behavior problems. Specifically, higher levels of caregiver psychological distress were associated with higher levels of externalizing behavior problems, whereas higher levels of effective parent communication (i.e., caregivers’ ability to listen and validate adolescents’ views, and the ability to express their point of view in a clear, neutral, and nonthreatening manner) were associated with lower levels of externalizing behavior problems. Parent psychological functioning and effective communication were uncorrelated, suggesting that each is uniquely associated with externalizing behavior problems after TBI.

These findings have important implications for interventions in the acute phase after complicated mild/moderate to severe TBI. First, interventions that encourage effective parent communication skills may reduce the likelihood of adolescents developing post-TBI externalizing behavior problems, or, at the very least, ameliorate potential externalizing behavior problems associated with TBI. Based on theories regarding the bidirectional nature of parent–child interactions (Pettit & Arsiwalla, 2008), poor parent communication may precipitate more challenging adolescent behaviors, which in turn increase communication deficits. Thus, interventions targeting parent–adolescent communication in the acute phase after TBI may help reduce the concomitant escalation of poor parent–adolescent communication and behavioral difficulties that may occur after adolescent TBI.

Second, parent mental health functioning may be an important factor to target in the initial months after pediatric TBI. Indeed, poor parent psychological functioning has been linked with poorer child outcomes after TBI in younger samples (Schwartz et al., 2003; Taylor et al., 2001). The present study provides further evidence for an adverse impact of parent mental health problems on adolescent behavioral outcomes. Professionals working with adolescents who have sustained TBI may be wise to evaluate parent psychological functioning and provide recommendations and referrals for interventions targeting parent well-being.

To our knowledge, this is the first study to use the IFIRS with a pediatric TBI sample. Our findings indicate that this measure is sensitive to differences in parent–adolescent interactions after pediatric TBI. The use of this observational measure of parent interaction minimized potential limitations associated with common paper–pencil measures of parent–child interaction. As this study reports on data from one time point, it is unclear if the IFIRS is sensitive to changes in parent–adolescent interaction over time, or in response to intervention. Future reports from the current study examining the IFIRS before and after family intervention will address this important issue.

Findings from this study need to be taken in consideration of a number of limitations. First, data were collected at one time point in the initial months after TBI, precluding examination of the trajectory of externalizing behavior problems after injury, or the longer-term effects of parent functioning and parent–adolescent interaction on behavior problems after injury. Studies examining long-term trajectories of adolescents sustaining TBI are recommended, as well as studies examining the influence of other factors such as adolescent mood on long-term behavioral outcomes. Second, whereas parent–adolescent interaction was assessed using behavioral observations by observers who were unaware of our participants’ injury status, other variables including externalizing behavior problems were assessed through parent report. Including ratings from additional reporters (e.g., teachers) would have helped to reduce biases associated with relying only on caregiver ratings. Third, given that participants were recruited to participate in an intervention study, there was no non-TBI comparison group. In addition, the sample may have been biased in some respects because participants were consenting to a study offering treatment after TBI.

Most of the primary caregivers in the study were mothers or stepmothers (86%) and the sample only contained 13 (11%) fathers. The subset of fathers was too small to conduct separate analyses, and therefore, although the study conclusions are posited as being directed to caregivers in general, it is possible paternal factors may be different from maternal factors. This is an area suggested
for further exploration. In addition, although the sample was large and representative of the broader population, the sample was predominantly Caucasian and not culturally diverse enough to enable us to explore the impact of race. Finally, because adolescents were recruited after injury, we were unable to assess the extent to which externalizing problems reflected pre-injury status as opposed to the effects of TBI. However, studies with younger child samples have found higher rates of post-injury externalizing behavior problems in TBI samples compared with orthopedic injury samples (even when controlling for pre-injury functioning), indicating an effect of TBI on subsequent behavior problems (Schwartz et al., 2003).

Despite these limitations, this study adds to the limited literature addressing factors associated with negative adolescent outcomes after TBI. Most notably, findings from this study suggest potential avenues for interventions in the acute phase after adolescent TBI. Interventions targeting positive parent communication and/or those designed to improve parent psychological functioning may be effective in reducing the risk and severity of challenging externalizing behavior problems among adolescents with TBI.

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