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Behavioral Predictors of Outpatient Mental Health Service Utilization within 6 Months after Traumatic Brain Injury in Adolescents

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Abstract

Objective—To characterize utilization of mental health services and determine the ability of a behavior problem and clinical functioning assessment to predict utilization of such services within the first 6 months after moderate and severe traumatic brain injury (TBI) in a large cohort of adolescents.

Design—Multicenter cross-sectional study.

Setting—Outpatient setting of four tertiary pediatric hospitals, two tertiary general medical centers, and one specialized children's hospital.

Participants—Adolescents age 12-17 years (N=132), 1 to 6 months after moderate to severe TBI.

Methods—Logistic regression was used to determine the association of mental health service utilization with clinical functioning as assessed by the Child and Adolescent Functional Assessment Scale (CAFAS) and behavior problems assessed by the Child Behavioral Checklist (CBCL).

Main Outcome Measure—Mental health service utilization measured by the Service Assessment for Children and Adolescents (SACA).

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Results—Behavioral or functional impairment occurred in 37 to 56%. Of the total study population, 24.2% reported receiving outpatient mental health services, 8.3% reported receiving school services, and 28.8% reported receiving any type of mental health service. Use of any (school or outpatient) mental health service was associated with borderline to impaired total CAFAS (OR [CI] = 3.50 [1.46, 8.40], $p < 0.01$) and CBCL total competence (OR [CI] = 5.08 (2.02, 12.76), $p < 0.01$).

Conclusions—A large proportion of participants had unmet mental health needs. Both the CAFAS and CBCL identified individuals who would likely benefit from mental health services in outpatient or school settings. Future research should focus on methods to ensure early identification by health care providers of adolescents with TBI in need of mental health services.

Keywords

Mental Health; Brain Injuries; Adolescent; Behavior

Introduction

Pediatric traumatic brain injury (TBI) is among the most common causes of acquired morbidity and mortality in children [1]. Behavioral and mental health problems frequently occur after TBI in children and lead to significant morbidity across multiple settings, including the home, school, and community [2]. Management of non-cognitive problems, including behavioral and emotional problems, is critical to the success of children in school and the community [3]. Mental health problems after TBI in children span a large spectrum of psychiatric diagnoses and pre-injury psychological problems place children at elevated risk for developing post-injury disorders [4-6]. Within the first 3 months after TBI in children, novel psychiatric disorders occur in approximately 45-49% and often persist long-term after injury [5-10]. In children with severe TBI, the rate of development of novel psychiatric disorders is reported to exceed 80% in one study [5]. Additionally, a previous study of children with TBI, using the same definitions of severity as applied in this study, revealed that most behavior problems were evident at 6 months post injury in both moderate and severe TBI, though somewhat higher rates of disorders were found at an extended follow-up a mean of 4 years after injury [11]. Despite the high rate of behavioral problems and psychiatric disorders identified after TBI in children, there is a relative underutilization of mental health services. In one study, 29% of children and young adults with severe TBI received mental health services within 20 years after injury [12]. Research with adults also indicates limited access to mental health services after traumatic injuries [13]. Overall, few studies have examined the rate of use of mental health services and the characteristics of children that receive these services after TBI.

Previous studies evaluated the health care needs of children after TBI [14-16]. The most recent was a large phone survey of caregivers of children age 5 -15 years who were admitted to the hospital with TBI [15]. Caregivers reported that 73% and 63% of children had cognitive, physical, or socioemotional needs 3 and 12 months post-injury, respectively [15]. Over 25% of children's needs were unmet or unrecognized [15]. Socioemotional needs were reported by caregivers in 71% of children at 3 months and 62% of children at 12 months post-injury, with 11% at 3 months and 12% at 12 months post injury having unmet or unrecognized socioemotional needs[15]. At 3 and 12 months post-injury, 62% and 39%, respectively, reported receiving at least 1 outpatient health care visit. The most common visit was to a physician (56% at 3 months and 39% at 12 months) or to a physical therapist (27% at 3 months and 14% at 12 months) [15]. Over one-third reported that they did not see a physician during the first 12 months after injury [15]. Unhealthy family functioning and Medicaid (versus commercial) insurance status were factors associated with an unmet health

care need within the first year after injury [15]. Thus, there is at least some support for the recommendation that children and teens be evaluated for unmet or unrecognized health care needs by a provider within the first year post-TBI; however, specific assessment tools or methods to identify behavioral functioning have not been investigated. A better understanding of the association of measures of behavioral function with the utilization of mental health services would allow improved targeting of interventions.

The Child Behavioral Checklist (CBCL) is one of the most commonly used assessments of neurobehavioral function after TBI in children and is recommended as a core common data element [17]. However, its association with the use of mental health services after TBI in children has not been examined. The Child and Adolescent Functional Assessment Scale (CAFAS) has been used to assess impairment in behavior functioning and treatment effects in children with serious emotional disturbances but has not been studied with children post TBI [18-20]. The CBCL assesses behavior and emotional symptoms generally, whereas the CAFAS focuses more on impaired functioning in home, school, and community settings [21]. The two measures thus provide complementary information about behavioral outcomes after TBI. Executive dysfunction after pediatric TBI is associated with behavior impairment as assessed by the CAFAS [21]; however, the association of the CAFAS with the CBCL and with the utilization of mental health resources after TBI in children has not been investigated.

The objectives of this paper are to 1) characterize utilization of mental health services within the first 6 months after moderate and severe TBI in a large cohort of adolescents, and 2) determine the association of these services with findings from the CAFAS and CBCL. An examination of the use of mental health services within 6 months after injury is important because there is a high risk of developing novel behavioral problems and psychiatric disorders during this time [5, 6, 11] and it is a time when children with TBI are commonly transitioning back to home, school, and community activities. Consistent with previous findings, we hypothesized that individuals with clinical elevations on the CBCL and CAFAS would not be receiving mental health services congruent with CBCL and CAFAS scores. We further hypothesized that CAFAS scores would be correlated with ratings of behavior problems on the CBCL, and in agreement with prior work [22, 23], that CAFAS scores would predict utilization of mental health resources better than the CBCL. Findings from this study were intended to better elucidate the unmet needs for mental health services in adolescents with TBI, as well as to examine the utility of the CAFAS in evaluating behavior problems post TBI. Additionally, we aimed to shed light on the ability of the CAFAS and CBCL to predict utilization of mental health resources, in order to better understand the types of behavior problems that lead to increased utilization of mental health resources within 6 months after TBI in adolescents.

Methods

Participants

Children 12-17 years of age who required at least an overnight admission to the hospital with a moderate or severe TBI 1-6 months prior to study enrollment were eligible for the study. Scores on the Glasgow Coma Scale (GCS) were used to characterize TBI severity [24]. Moderate TBI was defined as a GCS score of 9-12 or a higher score with evidence of TBI-related neuroimaging abnormalities on clinical computed tomography (CT) or magnetic resonance imaging (MRI) scans. Severe TBI was defined as a GCS score below 9. Exclusion criteria included non-blunt trauma (e.g. penetrating head injury), primary language other than English, severe marital conflict (defined by > 2 S.D. above the mean on the Dyadic Adjustment Scale), participant or parent hospitalization for psychiatric reasons during the previous year, child abuse as documented in the medical record or reported by parents,

history of participant cognitive impairment prior to injury, and participants who are unable to sufficiently participate verbally in the study. The participants evaluated in this study are part of a larger randomized controlled trial that evaluated the efficacy of a 6-month, web-based, family-centered intervention in improving behavior and family outcomes of TBI [25, 26]. Study sites included 4 tertiary pediatric hospitals, 2 tertiary general medical centers, and 1 specialized children's hospital located across a wide geographical area (Cincinnati, OH, Cleveland OH, Denver CO, Rochester MN). Institutional review board approval was obtained from all participating institutions prior to study initiation. Only baseline data are presented in this study.

Three hundred eight families were initially identified as potential study participants, 52 did not meet inclusion criteria, 52 refused participation, 5 were unable to be contacted, and 67 were unable to be recruited within the first 6 months post injury. The final study population consisted of 132 participants, including 86 males, 26 non-whites, and 51 severe TBIs. The mean age of injury was 14.54 years ($SD = 1.74$) and mean time since injury was 3.56 months ($SD = 1.74$). Age at injury, race, and GCS scores were compared between participants and non-participants. Age at injury was not significantly different between participants [mean age = 14.54 ($SD=1.74$)] and non-participants [mean age = 14.68 ($SD=1.74$)]. Non-participants ($n = 43$ [24.4%]) were significantly more likely than participants ($n = 26$ [19.7%]) to be non-white. Injury severity also differed significantly between participants [mean GCS score = 10.03 (4.56)] and non-participants [mean GCS score = 11.94 (3.89)].

Measures

All measures reported in this study were collected by trained research coordinators during baseline visits conducted an average of 3.56 months ($SD = 1.74$) post injury as part of the larger study. Baseline measures were collected prior to treatment group assignment. The CAFAS was used to assess the degree of impaired behavior functioning at the baseline assessment. The CAFAS is a structured clinical interview of adolescent functioning and has been used widely to assess clinical outcomes in children with serious emotional disturbances[18, 23]. The CAFAS generates a total score as well as clinical ratings in eight subscales: school, home, community, behavior toward others, moods/emotions, self-harmful behaviors, substance abuse, and thinking [22]. The total score (range: 0-240) is generated by adding the scores for each of the eight subscales. The rating for the subscale scores is ordinal: 0 - no impairment, 10 - mild impairment, 20 - moderate impairment, and 30 - severe impairment. The CAFAS has excellent inter-rater reliability with correlation coefficients ranging from 0.74-0.99 [23]. CAFAS total scores are typically grouped into five levels of impairment: very minimal (score 0-30), mild (score 40-70), moderate (score 80-100), severe (score 110-130), and very severe (score > 140) [22]. The CAFAS total score was dichotomized into minimal (score 0-30) vs. mild or more severe impairment (scores >30) [22]. The threshold of greater than 30 was chosen because scores in this range indicate that children should be receiving outpatient or more intense mental health or behavioral services [22]. To insure high inter-rater reliability for administration of the CAFAS for this study, a Ph.D. psychologist and Master's level counselor attended a 2-day training session provided by the developer of the CAFAS that certified them as CAFAS trainers [22]. The certified trainers then provided subsequent training to site raters until they were able to pass the necessary tests to achieve 80% inter-rater reliability as recommended by the developer of the CAFAS. Trainers and raters participated in monthly reliability calls throughout the course of the study to discuss recently administered CAFAS interviews, answer questions raised by recent cases, and ensure that each site continued to apply the clinical ratings in a standard manner. Each rater taped 10% of their CAFAS interviews, which were sent off to a certified trainer to be double rated for reliability. Inter-rater reliability was 90% in this study.

The Child Behavior Checklist (CBCL) was used to provide a parent-report of behavior problems for children in this study [27, 28]. The CBCL has been used previously to characterize behavior problems after pediatric TBI [29]. Eight subscales within the CBCL assess various behavioral characteristics: “Anxious Depressed”, “Withdrawn Depressed”, “Somatic Complaints”, “Social Problems”, “Thought Problems”, “Attention Problems”, “Rule Breaking Behavior”, and “Aggressive Behavior”. The subscales are used to derive a Total Problems Score and an Internalizing and Externalizing Problems Score. T-scores between 60 - 63 correspond to the 10th – 16th percentile of a normative sample and are indicative of clinical concern [30]. Scores above 63 correspond to scores obtained by less than 10 percent of a normative sample and are indicative deviant behavior [30]. Scores were dichotomized for the analyses to capture individuals with behavior that is of at least clinical concern (score ≥ 60). The Total Problems Score and the Internalizing and Externalizing Problems Scores were used as the behavioral variables of interest in this study. The CBCL also generates competence scores in Activities, Social, and School domains. A total competence score is the sum of each of the three competence domain scores. T-scores of 31-35 correspond to the 10th – 16th percentile of a normative sample and are indicative of clinical concern and T-scores <31 correspond to scores obtained by less than 10 percent of a normative sample and are indicative deviant behavior on the Activities, Social, and School domain scores [30]. On the total competence scale, T-scores of 37-40 correspond to the 10th – 16th percentile of a normative sample and are indicative of clinical concern and a T-scores <37 correspond to scores obtained by less than 10 percent of a normative sample and are indicative deviant behavior [30]. Both the competence domain scores and total competence score were dichotomized for the analysis, with scores ≥ 35 for the competence domain scores and scores ≥ 40 for the total competence score indicating at least clinical concern.

The Service Assessment for Children and Adolescents (SACA) was used to assess the use of mental health services in the outpatient and school setting. The SACA has demonstrated excellent reliability and validity in assessing the use of mental health services [31]. The test-retest reliability for parent ratings of mental health utilization range from 0.75 to 0.94 for mental health service use over a lifetime and within the last 6 months [32]. The SACA was administered by trained research personnel and consists of 51 questions that assess the types of mental health services children receive, the settings (inpatient, outpatient or school) where they receive services, the reasons for service use, the frequency and duration of services, and the quality of services. Parents were asked to rate the use of mental health services since their child's brain injury on the SACA. Data was extracted from the SACA to describe the setting and type of mental health service used after injury.

Analysis

Data analysis was performed using SAS enterprise guide version 5.1 (SAS Institute, Inc., Cary, NC). Descriptive statistics were used to describe the distribution of demographics and outcome measures in the study population. Independent t-tests or Chi square analysis was used to compare demographic and outcome measures between moderate and severe groups. Spearman correlations were used to determine the association between the CAFAS and the CBCL. The primary correlation of interest was the association of the Total CAFAS score with the CBCL Total Behavior Problem and Total Competence scales. Correction for multiple comparison was performed and a p-value threshold for significance of .025 (.05/2) was used. Secondary analyses were performed to describe the association of CAFAS domain scores with the subscales of the CBCL Behavior Problem and Competence scales. Correction for multiple comparisons was performed for the secondary analyses and a p-value threshold for significance of .0008 (0.05/61) was used. Logistic regression was used to determine the association of the dichotomized CAFAS and CBCL scores with the presence or absence of mental health service utilization assessed on the SACA. Covariates included

race (white versus non-white), gender, injury severity (severe versus moderate TBI), and socioeconomic status as defined by averaging z-scores for estimated family income using the census tract median income for the zip code of the participant's primary residency and primary caregiver education (Z-combined). The primary logistic regression analysis examined associations of mental health service utilization assessed by SACA with the Total CAFAS, CBCL Total behavioral problems, and CBCL Total competence scores. Because three separate models for these primary predictors of interest were used, we used a corrected p-value of .017 (.05/3) as the threshold for significance in the primary analysis. Secondary analyses investigated potential associations of mental health services with domain scores on the CAFAS, CBCL internalizing and externalizing behavioral problems, and CBCL competence domain scores.

Results

Distribution of Outpatient and School Services Received by the Study Population

In the study population, 24.2% reported receiving outpatient services, 8.3% reported receiving school services for behavior problems after injury, and 28.8% reported receiving any (outpatient or school) type of mental health service. The three most common outpatient services reported were visits to: professional offices of psychologists, psychiatrists, social workers, or family counselors (12.1%); community mental health centers or outpatient mental health clinics (6.1%); and pediatricians, family doctors, or nurse practitioners (6.1%). The most common school service reported was school counseling or therapy related to problems with drugs or alcohol, behavior problems, or feelings (5.3%). Only one parent reported that the child was receiving special help in the regular classroom for problems with behaviors or feelings. Two parents reported that their child was placed in a special school for students with problems with behaviors or feelings.

Demographics and Distribution of CAFAS and CBCL Scores in the Study Population

Table 1 shows the demographics and distribution of the measures in the total population, moderate group, and severe group. There were no differences in demographics or measures between the moderate and severe groups.

Participants with any impairment on the CAFAS domains were as follows: 43.2% (n=57) School, 68.9% (n=91) Home, 9.1% (n=12) Community, 43.2% (n=57) Behavior towards others, 59.1% (n = 78) Moods and emotions, 3.8% (n=5) Self-harm, 6.1% (n=8) Substance use, and 60.6% (n=80) Thinking. 56.1% (n=74) had a total CAFAS score > 30, indicating that these children should be receiving outpatient or more intense mental health or behavioral services

Participants scoring in the borderline to impaired range on CBCL behavior problem composite ratings were as follows: 31.8% (n=41) Internalizing problems, 26.4% (n=34), Externalizing problems, and 37.2% (n=48) Behavior Problem Total. Participants scoring in the borderline to impaired range on the CBCL competence scales were as follows: 13.2% (n=17) Activity, 7.0% (n=9) Social, 16.4% (n=21) School, and 32.5% (n=37) Total.

Correlation of CBCL and CAFAS

Table 2 shows the correlation of the CAFAS with the CBCL behavior and competence domains. The Total CAFAS score was correlated with the Total CBCL Behavior and Total Competence domains. Several other significant correlations were noted between the CAFAS and CBCL domains as shown in table 2.

Predictors of Utilization of Mental Health Services (Primary Analysis)—Logistic regression models that controlled for race, socioeconomic status, gender, and injury severity demonstrated a trend for an association between increased use of school services and borderline to impaired scores on the total CAFAS, CBCL Total Behavior Problem scale, and CBCL Total Competence Scale (Table 3).

Logistic regression models that controlled for race, socioeconomic status, gender, and injury severity demonstrated that any (outpatient or school) mental health service was associated with borderline or impaired Total CAFAS scores and CBCL Total Competence Scale scores (Table 3). There was a trend for an association between increased mental health service use and borderline or impaired CBCL Total Behavioral Problems Scale scores.

CAFAS domain and CBCL subscales as predictors of mental health services (Secondary Analyses)

For the CAFAS subscales, logistic regression models that controlled for race, socioeconomic status, gender, and injury severity suggested an association between any impairment on the Behavior Towards Others domain and increased use of school services, odds ratio (95% confidence interval) [OR (CI)] = 4.65 (1.12, 19.37), $p=0.035$, and any (outpatient or school) mental health service use, OR (CI) = 3.19 (1.41, 1.19), $p=0.005$. The other CAFAS domain scores were not associated with mental health service use.

On the CBCL, borderline or impaired Internalizing and Externalizing behavior problem scores were not associated with mental health service use. There is a suggested association between borderline or impaired Activity, OR (CI) = 3.04 (1.05, 8.82), $p=0.04$, and School competence scores on the CBCL, OR (CI) = 5.97 (2.02, 17.68), $p=0.001$, with increased use of any (outpatient or school) mental health service, but not school services. Social competence scores on the CBCL were not associated with mental health service use.

Discussion

In our study about a quarter of adolescents received some type of mental health service for behavior problems, with only 8.3% receiving school mental health services within in the first 6 months after moderate or severe TBI. The CAFAS Total score was only moderately correlated with the CBCL Total Behavior Problem and Total Competence scales, suggesting that the measures may assess different aspects of behavior. This study also demonstrates that the CAFAS Total score and CBCL Total Competence score both predict utilization of mental health services. Our secondary analyses also suggest an association between the Behavior towards others domain on the CAFAS and the Activity and School Competence domains on the CBCL with mental health service use. Overall, these findings suggest that the CAFAS and CBCL are useful in identifying children with TBI who should be receiving services for behavior problems.

This study is one of the few to examine associations of behavior problems and impaired behavior functioning with utilization of mental health services in children with TBI. In examining these associations, we controlled for other factors with potential associations with service utilization, including socioeconomic status[33], race[34, 35], gender[36-38], and injury severity [12]. The findings also suggest that a relatively large proportion of adolescents are not receiving adequate services after their injuries. Approximately 16% of our participants with TBI scored in the borderline to impaired range on the CBCL School competence domain and 43% had at least mild school impairment on the CAFAS school domain, but few of these children were receiving school services. Additionally, more than half of the study population was identified as having behavior problems or impairment in functional behavior, yet less than a third of the sample was receiving any type of mental

health services. Future studies will need to better elucidate the discrepancy between need for service and receipt of services in the school and community.

In a phone survey follow-up study of children admitted overnight to the hospital with a TBI [15], 71% and 62% of the families reported a socioemotional need at 3 and 12 months, respectively, after injury. This is in contrast to our results that showed approximately 37% had borderline or impaired behavior assessed on the CBCL; however, it is similar to the 56% of children with identified behavior problems assessed by the CAFAS total score. Differences between these studies may be explained by the properties of the evaluation tools used. The phone survey was based on parent or family opinion while the CBCL and CAFAS have been validated in several populations to identify behavioral impairment. Compared to the phone survey follow-up, criteria for impaired behavior problems are likely more strict on the CBCL and CAFAS. Additionally, both the CAFAS and CBCL focus on behavior problems, but not on social needs which may also help to explain the relatively lower reported problems in this study. Overall, both this study and the Slomine et al. study [15] indicate that behavioral and socioemotional difficulties are common after TBI and that there is likely unmet needs for the patient and family.

Our findings suggest that the CBCL and CAFAS are useful in identifying children post TBI who are at risk and who may benefit from targeted academic and mental health services. Since the CBCL is based on a parent questionnaire, it may be easier to administer than the CAFAS, which is a structured interview that requires training. However, the CAFAS and CBCL may measure different aspects of behavior: the CBCL is a measure of problem severity whereas the CAFAS is measure of impaired behavior functioning in specific settings. Interestingly, the CAFAS Behavior Towards Others domain is highly correlated with CBCL domains, which may indicate this is a group at higher risk for behavioral problems in social settings. Additionally, the CAFAS Self-Harm domain did not correlate with the CBCL domains, which may indicate an at risk group for self-harm that would not be identified using CBCL behavioral ratings. Studies to better understand ways to identify these at risk groups will be important in the future. Overall, our study suggests that the CAFAS Total problems and CBCL Total Competence scale may be better predictors of the need for mental health services than the CBCL Total Behavior Problem scale. Future studies should better determine how these assessment tools can be used to identify individuals at risk for behavior and emotional problems and guide recommendations of mental health services across various settings.

Limitations

One of the primary limitations of this study is the lack of a control group. A control group of adolescents without TBI would have clarified the extent to which rates of service utilization are higher in adolescents with TBI. Inclusion of controls would also have allowed us to determine if associations of the behavior problems and impaired behavior functioning to service utilization are similar in children with TBI versus without. However, the CBCL is well-validated in normative samples and CAFAS is well validated in a sample of children with severe emotional and behavioral problems, thus comparison with these standards provides an estimate of heightened risk for behavior problems in this sample of adolescents with TBI. Regardless of the origin of their behavior problems, the CAFAS and CBCL proved useful in identifying individuals participating in mental health services. Another limitation is our focus on a cross-sectional evaluation, as examining the use of mental health services over time post injury would provide a more comprehensive evaluation of utilization patterns in relation to the injury. It is possible, for example, that needs may be highest soon after injury but that services are not engaged until later or that some adolescents with TBI discontinue services despite persistent behavior impairments. Behavioral and emotional problems and psychiatric disorders attributable to TBI can be identified for several years

post injury. Additional studies are thus needed to investigate service utilization in children with disorders that persist or emerge across longer post-injury intervals. Future reports will provide data on utilization over 18-24 months post injury. Another potential limitation is reporting bias. For example, families may not have reported other medical visits where behavioral problems were indirectly addressed. We also attempted to quantify the number of days and duration of certain services; however, this was inconsistently reported by caregivers and thus we report only on the presence or absence of a particular service. Additionally, this study does not directly assess potential reasons for decreased access to mental health services. There may be environmental and other factors that limit a family's access to services. Future studies need to evaluate potential access barriers to mental health services in this population. Furthermore, we attempted to assess premorbid behavioral and emotional problems; however, this was inconsistently reported, subject to recall bias, and based only on parent report rather than clinical evaluation. Approximately, 14.4% reported their child was diagnosed with ADHD prior to injury and 6.8% reported other emotional and behavioral problems before injury. Additionally, we do not have ratings of pre-injury utilization of mental health services. Pre-injury emotional or behavioral problems and use of mental health services may influence use of services after injury. Patterns of mental health services use in this subset of individuals with pre-injury emotional and behavioral problems should be assessed in future studies. A limitation to clinical application of the findings is that the measurement tools may not be easily incorporated into mainstream pediatric medical settings. Even the CBCL, which as a parent report measure requires little practitioner time or training, requires some expertise to score and interpret. Finally, participants were more likely to be white and to have more severe TBI than the non-participants. Although these differences were small, caution is advised in generalizing findings to the broader population of children with TBI.

Conclusions

Our study demonstrated that the use of mental health services after moderate to severe TBI in children is related to higher ratings of behavior problems and lower ratings of competence on the CBCL and to impaired behavior functioning as assessed by the CAFAS. The findings document the utility of these assessments in identifying individuals who engage in mental health services in the outpatient and school settings following TBI. Identifying children that would benefit from outpatient mental health services is necessary to optimize the use of behavioral interventions. Future research should focus on optimizing application of these and other tools by health care providers so children that need mental health services can be identified as early after their injuries as possible.

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Table 1

	Total Population	Moderate Group	Severe Group
Demographics (Mean (stdv) or percent)			
GCS *	10.03 (4.56)	13.41 (1.85)	4.96 (1.93)
Age at injury	14.54 (1.74)	14.41 (1.74)	14.73 (1.71)
Months since injury	3.56 (1.74)	3.34 (1.74)	3.92 (1.70)
Race (% non-white)	19.7	24.7	11.8
Gender (% male)	65.2	66.7	62.8
Primary caregiver education (% less than high school)	44.7	43.2	47.1
Study Measures (Mean (stdv) or percent)			
Mental Health Service Use (%)	28.8	27.2	31.4
<u>CBCL Scores</u> (Mean (stdv))			
Internalizing Problems	53.78 (11.07)	53.31 (11.10)	54.50 (11.10)
Externalizing Problems	53.43 (10.38)	52.73 (10.54)	54.50 (10.15)
Total Problems	55.03 (10.07)	54.21 (10.37)	56.30 (9.57)
Activity Competence	45.65 (9.10)	46.57 (8.96)	44.20 (9.21)
Social Competence	47.19 (8.58)	47.26 (8.64)	47.08 (8.56)
School Competence	45.40 (8.70)	45.36 (8.52)	45.47 (9.11)
Total Competence	45.53 (10.26)	45.82 (10.57)	45.02 (9.80)
<u>CAFAS Domains</u> (Mean (stdv))			
School	7.12 (9.37)	7.65 (9.65)	6.27 (8.94)
Home	10.68 (9.51)	9.88 (8.73)	11.96 (10.59)
Community	1.36 (4.75)	1.36 (4.94)	1.37 (4.48)
Behavior Towards Others	6.06 (7.89)	5.43 (7.42)	7.06 (8.55)
Moods and Emotions	9.02 (8.81)	8.15 (9.10)	10.39 (8.24)
Self-Harm	.68 (3.54)	.49 (3.12)	.98 (4.13)
Substance Use	.91 (4.00)	.37 (1.90)	1.76 (5.90)
Thinking	9.92 (8.95)	9.01 (9.03)	11.37 (8.72)
Total Score	45.76 (35.02)	42.35 (34.03)	51.18 (36.20)

GCS = Glasgow Coma Score; CBCL = Child Behavior Checklist; CAFAS = Child and Adolescent Functional Assessment Scale

* indicates significant difference at p-value < .05 between moderate and severe groups

Table 2

Spearman correlation of CAFAS domain scores with the CBCL behavior problems and competence domains

	CBCL Behavior Domains			CBCL Competence Domains			
CAFAS Domains	Internalizing	Externalizing	Total	Activity	Social	School	Total
School	.12	.37 ****	.26 ***	-.15	-.25 **	-.44 ****	-.33 ****
Home	.14	.42 ****	.41 ****	-.31 ****	-.26 **	-.31 ***	-.36 ****
Community	.16	.32 ****	.28 **	-.12	-.30 ****	-.22 *	-.19 *
Behavior towards others	.45 ****	.63 ****	.62 ****	-.15	-.37 ****	-.36 ****	-.41 ****
Moods and emotions	.41 ****	.25 **	.41 ****	-.11	-.15	-.18	-.15
Self-harm	.07	.16	.12	-.11	-.01	-.18 *	-.16
Substance use	.17	.33 ****	.25 **	-.24 *	-.23 *	-.20 *	-.31 ***
Thinking	.35 ****	.33 ****	.41 ****	-.18 *	-.16	-.25 *	-.27 **
Total	.41 ****	.60 ****	.61 ****	-.31 ****	-.35 ****	-.46 ****	-.48 ****

P < .0008***
p < .001**
p < .005*
P < .05

Table 3

CAFAS Total score, CBCL Total Behavior Problem Scale, and CBCL Total Competence Scale as predictors of school services (A) or any mental health service utilization (B).

A.			
	OR	95% CI	P-value
Covariates and Independent Variable			
Race	.33	.03, 3.26	.34
Z-combined	.94	.43, 2.09	.88
Gender	.52	.14, 1.96	.33
Injury severity	2.53	.59, 10.73	.21
* CAFAS Total Score	9.60	1.15, 80.21	.04
Race	.38	.04, 3.96	.42
Z-combined	.96	.43, 2.15	.93
Gender	.67	.17, 2.63	.56
Injury severity	2.22	.528, 9.31	.28
* CBCL Total Behavior Problems	4.85	1.10, 21.44	.04
Race	.48	.05, 5.26	.55
Z-combined	.95	.42, 2.17	.91
Gender	.41	.11, 1.59	.20
Injury severity	2.04	.47, 8.84	.34
* CBCL Total Competence	4.45	1.12, 17.70	.03

B.			
	OR	95% CI	P-value
Covariates and Independent Variable			
Race	.41	.13, 1.34	.14
Z-combined	.64	.38, 1.08	.09
Gender	.87	.38, 2.01	.75
Injury severity	.93	.41, 2.13	.86
* CAFAS Total Score	3.50	1.46, 8.40	< 0.01
Race	.54	.16, 1.78	.31
Z-combined	.67	.39, 1.14	.14
Gender	.98	.41, 2.34	.96
Injury severity	.85	.38, 1.93	.70
* CBCL Total Behavior Problem Scale	2.72	1.18, 6.28	.02
Race	.47	.11, 1.97	.30
Z-combined	.67	.36, 1.24	.20
Gender	.43	.17, 1.12	.08
Injury severity	1.10	.42, 2.84	.86

B.			
	OR	95% CI	P-value
* CBCL Total Competence	5.08	2.02, 12.76	< .01

* n = 132, 129, and 114 for CAFAS total score, CBCL total Behavior Problem Scale, and CBCL Total Competence Scale, respectively. Mental health services were measured by the Service Assessment for Children and Adolescents (SACA). Covariates included race (white versus non-white), gender, injury severity (severe versus moderate TBI), and socioeconomic status as defined by a averaging z-scores for estimated family income using the census tract median income for the zip code of the participant's primary residency and primary caregiver education.