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Problem-Solving After Traumatic Brain Injury in Adolescence: Associations With Functional Outcomes

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Abstract

Objective—To examine the association of problem-solving with functioning in youth with traumatic brain injury (TBI).

Design—Cross-sectional evaluation of pretreatment data from a randomized controlled trial.

Setting—Four children's hospitals and 1 general hospital, with level 1 trauma units.

Participants—Youth, ages 11 to 18 years, who sustained moderate or severe TBI in the last 18 months (N=153).

Main Outcome Measures—Problem-solving skills were assessed using the Social Problem-Solving Inventory (SPSI) and the Dodge Social Information Processing Short Stories. Everyday functioning was assessed based on a structured clinical interview using the Child and Adolescent Functional Assessment Scale (CAFAS) and via adolescent ratings on the Youth Self Report

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(YSR). Correlations and multiple regression analyses were used to examine associations among measures.

Results—The TBI group endorsed lower levels of maladaptive problem-solving (negative problem orientation, careless/impulsive responding, and avoidant style) and lower levels of rational problem-solving, resulting in higher total problem-solving scores for the TBI group compared with a normative sample ($P<.001$). Dodge Social Information Processing Short Stories dimensions were correlated ($r=.23-.37$) with SPSI subscales in the anticipated direction. Although both maladaptive ($P<.001$) and adaptive ($P=.006$) problem-solving composites were associated with overall functioning on the CAFAS, only maladaptive problem-solving ($P<.001$) was related to the YSR total when outcomes were continuous. For the both CAFAS and YSR logistic models, maladaptive style was significantly associated with greater risk of impairment ($P=.001$).

Conclusions—Problem-solving after TBI differs from normative samples and is associated with functional impairments. The relation of problem-solving deficits after TBI with global functioning merits further investigation, with consideration of the potential effects of problem-solving interventions on functional outcomes.

Keywords

Brain injuries; Problem solving; Rehabilitation

Social problem-solving requires skills to interpret and respond appropriately in social situations and is often impaired after traumatic brain injury (TBI).¹⁻³ Evidence suggests that children with TBI exhibit social problem-solving deficits relative to healthy peers.^{2,4,5} Specifically, children with TBI generated fewer positive responses to problem scenarios³ and more often proposed passive/avoidant or aggressive solutions¹ than typically developing children. Other investigations suggest that post-TBI problem-solving deficits may be particularly pronounced in the domains of problem definition and evaluation.⁴ These studies support the possibility of deficits throughout the social problem-solving process, leading to poorer social functioning and relations.⁶

Several models of social problem-solving have been proposed.⁷⁻⁹ The Social Problem-Solving Inventory (SPSI) based on the D’Zurilla et al^{9,10} model assesses evaluation of the problem situation (positive problem orientation or negative problem orientation) and style of responding (impulsive/careless, avoidant, or rational). The SPSI was examined in a single study of adult TBI¹¹ and may provide an assessment of adolescent problem-solving skills that can be linked to intervention approaches.

Within the developmental psychopathology literature, social problem-solving has been conceptualized within the context of social information processing (SIP). The Crick and Dodge SIP model of social competence⁷ focuses in part on how interpretation of social cues influences problem-solving and contributes to competent versus aggressive responses. This SIP model involves a series of steps (encoding of social cues, interpretation of cues, clarification of goals, response construction, response decision, and behavioral enactment) that together provide a useful measure of social problem-solving style.¹²⁻¹⁵ The Dodge Social Information Processing Short Stories differs from the SPSI in its use of vignettes to

assess social problem-solving. Warschausky et al,³ found that children with TBI generated fewer assertive solutions than healthy peers. Conversely, Hung et al¹⁶ failed to find differences between children with TBI and children with orthopedic injuries (OIs).

Interpersonal negotiating strategies constitute a further model for understanding social problem-solving.⁸ The interpersonal negotiating strategies model emphasizes the developmental nature of interpersonal problem-solving, from impulsive and unilateral to reciprocal and collaborative. Using the interpersonal negotiating strategies task, Hanten et al⁵ found poorer overall problem-solving in children with TBI than in those with OIs. In a separate study, Janusz et al² found that although children with TBI and OI generated solutions at comparable developmental levels, children with TBI were more likely to select lower-level strategies as the best solution. These studies provide additional evidence of selective problem-solving deficits after pediatric TBI.

Adolescence is associated with increased demands for independent problem-solving.¹⁷ Given the incidence of risky decision-making,¹⁸ problem-solving skills may be particularly salient during this developmental period,⁸ and adolescents with TBI may be at elevated risk for poor problem-solving and its attendant consequences. Therefore, it is important to understand the nature of problem-solving deficits after adolescent TBI and their association with functional outcomes.

We examined problem-solving skills after TBI in adolescence from the perspectives of self-described problem-solving style (SPSI) and the quality of responses to social scenarios (Dodge Social Information Processing Short Stories). The overall objectives were to understand the correlation between these differing measures assessing problem-solving post adolescent TBI and their respective associations with functional outcomes. Four main hypotheses were evaluated: (1) SPSI and Dodge Social Information Processing Short Stories subscale and total scores would be correlated in the anticipated direction; (2) adolescents with severe TBI would report poorer problem-solving on the SPSI and provide less competent responses on the Dodge Social Information Processing Short Stories than adolescents with non-severe TBI; (3) youth with TBI would report poorer problem-solving skills on the SPSI than national normative samples, a question that could not be addressed with the Dodge Social Information Processing Short Stories; and (4) problem-solving on the SPSI and Dodge Social Information Processing Short Stories would be predictive of everyday functioning assessed via structured clinical interview with the primary caregiver and adolescent-reported behavior problems, with better problem-solving corresponding to better functioning.

Methods

Participants were recruited as part of a multicenter randomized controlled trial from 4 tertiary care children's hospitals and 1 general hospital, all with level 1 trauma units. Potential participants were ages 11 to 18 years and had sustained a moderate or severe TBI within the last 18 months. TBI severity was determined using the lowest postresuscitation Glasgow Coma Scale (GCS) score¹⁹ and neuroimaging findings. Severe TBI was defined as a GCS score ≤ 8 . Moderate TBI was defined as a GCS score of 9 to 12, or a higher GCS

score accompanied by significant neuroimaging findings (simple, nondepressed skull fractures were excluded). Exclusionary criteria included the following: (1) residence outside the home; (2) preinjury intellectual disability or psychiatric hospitalization; (3) primary language other than English; and (4) inability to complete assessments. Distance of >3 hours from the hospital or unavailability of high-speed Internet access were also exclusionary criteria.

After obtaining informed consent/assent, trained research coordinators administered questionnaires and interviews. Reading skills were not screened prior to enrollment; however, participants had to be able to verbally participate. When participants had difficulty completing questionnaires independently, coordinators read them aloud. On completion of baseline data collection, participants were randomized in equal numbers to 1 of 3 conditions: (1) online family problem-solving, (2) online problem-solving with the teen alone, or (3) access to Internet resources.

Of 625 individuals identified as potentially eligible, 403 were screened. Of these, 153 consented, 170 declined, and 80 were ineligible. Comparisons of those who consented versus those who declined revealed that participants were older than nonparticipants, but did not differ significantly on other demographic or injury characteristics.

Data from 133 of the 153 participants were included because 20 participants were missing data on the SPSI. Of the 133 participants, 78 sustained a moderate TBI and 55 a severe TBI. Their average age was 14.8 ± 2.0 years. Individuals who failed to complete the SPSI were more likely to have severe TBI (65% vs 41%). Group characteristics are described in table 1.

Measures

The SPSI is a 52-item questionnaire assessing problem-solving style.¹⁰ It yields a total score based on relative difference between adaptive and maladaptive problem-solving characteristics, with higher total scores reflecting more adaptive problem-solving style, and the following subscale scores: (1) positive problem orientation, (2) negative problem orientation, (3) rational problem-solving, (4) impulsive/careless responding, and (5) avoidant style. Higher positive problem orientation and rational problem-solving scores reflect better problem-solving, whereas higher negative problem orientation, impulsive/careless responding, and avoidant style subscale scores reflect poorer problem-solving. The SPSI has norms for adolescence through late adulthood, allowing comparison of the means for the current sample with those of typically developing adolescents. Reliability and convergent and divergent validity in adolescents and young adults have been demonstrated.²⁰ Given high intercorrelations among the SPSI subscales and potential for multicollinearity noted on post hoc correlation analyses, standard scores on avoidant style, impulsivity/careless responding, and negative problem orientation were averaged to create a maladaptive problem-solving composite, whereas standard scores on positive problem orientation and rational problem-solving subscales were averaged to create an adaptive problem-solving composite.

The Dodge Social Information Processing Short Stories^{7,12} assessed the components of social problem-solving (ie, encoding, intent attribution, response generation, response

evaluation) in response to 6 scenarios. Participants read vignettes involving peer interactions with ambiguous intent and responded regarding the situation and the behaviors of others toward the target child. Follow-up questions asked whether the peer's behavior was accidental or hostile and whether the situation would evoke anger or sadness on a 5-point Likert scale (where 1 is yes, definitely and 5 is no definitely not). Aggressive and competent responses were averaged across the 6 scenarios. Scores ranged from 1 to 5, with higher scores indicating greater levels of aggressive (Cronbach $\alpha=.82$) or competent problem-solving (Cronbach $\alpha=.79$).

Functioning in everyday settings was assessed using the Child and Adolescent Functional Assessment Scale (CAFAS).^{21,22} The CAFAS uses information from structured key informant interviews (eg, parents) to generate standardized ratings of functioning. In the current project, interviews were conducted with the primary caregiver, who was most typically the child's mother (86%). The CAFAS generates ratings in 8 domains: school, home, community, behavior toward others, moods/emotions, self-harmful behaviors, substance abuse, and thinking. Functioning in each domain is rated on an ordinal scale ranging from 0 (no impairment) to 30 (severe impairment), in increments of 10. Domain scores are summed to create a total score (range, 0–240), with higher scores reflecting worse functioning. The CAFAS has established validity for school-age children with TBI.²³ Scores 50 indicate clinical impairment. Certified CAFAS trainers trained interviewers to achieve interrater reliability >85%. Ten percent of interviews were taped and jointly rated yielding an overall interrater reliability of 95%.

Impairment from the perspective of the adolescent was assessed using the Youth Self Report (YSR).²⁴ The YSR is a well-validated questionnaire assessing both internalizing and externalizing symptoms in youth ages 11 to 18 years. Youth rate each behavior using a 3-point Likert scale with scores of 0 (not true), 1 (somewhat or sometimes true), and 2 (very true or often true). The total problems T score provided a measure of adolescent-reported impairment.

Analysis

Summary statistics including frequencies (percentages) and means (SDs) were used to describe the sample. Chi-square and *t* tests were calculated to test for within-sample differences as reported in table 1. The *t* tests were used to compare means between the current sample and the SPSI normative samples. Correlation analyses were used to examine associations among study covariates, SPSI subscales, Dodge Social Information Processing Short Stories composites, and CAFAS and YSR total scores. Multiple regression analyses were used to examine associations of dimensions of problem-solving with overall functioning on the CAFAS and total problems on the YSR after controlling for sociodemographic characteristics. Covariates included age, sex, race (dichotomized as white/nonwhite), injury severity (dichotomized as severe/moderate), time since injury, socioeconomic status (defined by averaging sample *z* scores for maternal education and median income for the family's Census tract),²⁵ and intelligence quotient. A variance inflation factor of 2.5 was used to determine multicollinearity. Partial η^2 was used to calculate effect sizes. Logistic regression analysis was used to examine associations of

problem-solving with impaired functioning, defined by a CAFAS score >50 or a YSR T score >65. An α level of $P<.05$ was considered statistically significant. All analyses were conducted using SAS 9.2.^a

Results

With the exception of positive problem orientation, adolescents with TBI differed significantly from those in the normative sample for the SPSI on all dimensions of problem-solving (all P values $<.001$) (table 2). The TBI group endorsed lower levels of rational problem-solving, negative problem orientation, careless/impulsive responding, and avoidant style. The relative difference between adaptive and maladaptive problem-solving style was greater within the TBI group than the normative sample; therefore, the total problem-solving score was higher in the TBI group ($P<.001$) (see table 2).

Adolescents with severe TBI did not differ significantly from those with moderate TBI on the SPSI maladaptive and adaptive composites or the Dodge Social Information Processing Short Stories aggressive or competent responses. Consistent with expectations, the Dodge Social Information Processing Short Stories competent responses were correlated with SPSI adaptive composite ($r=.37$, $P<.001$), and total problem-solving ($r=.27$, $P<.01$), but unrelated to maladaptive problem-solving characteristics (table 3). Aggressive Dodge Social Information Processing Short Stories responses were positively correlated with SPSI maladaptive problem-solving composite ($r=.23$, $P<.01$) and inversely correlated with the adaptive problem-solving composite ($r=-.24$, $P<.01$) and SPSI total score ($r=-.33$, $P<.001$).

In the regression models, both the maladaptive (partial $\eta^2=.16$) and adaptive (partial $\eta^2=.06$) problem-solving composites were associated with overall functioning on the CAFAS, after controlling for covariates. For the YSR total score, only maladaptive coping explained significant variance (partial $\eta^2=.38$) (table 4).

In logistic regression analyses, maladaptive problem-solving style was associated with an increased risk of impaired functioning on both outcomes (CAFAS: adjusted odds ratio, 1.08; 95% confidence interval, 1.03–1.13; YSR: adjusted odds ratio, 1.09; 95% confidence interval, 1.04–1.15) (table 5).

Discussion

Findings suggests that self-reported problem-solving of adolescents with TBI differs from normative samples and that problem-solving style is an important determinant of overall functioning. Youth with TBI reported less adaptive and maladaptive problem-solving strategies on the SPSI than normative samples, indicating less engagement in problem-solving activities in general by youth after TBI. Although youth with TBI reported lower engagement in problem-solving strategies in general, their total problem-solving scores were higher on the SPSI than normative samples. This discrepancy was likely driven by relatively less self-reported maladaptive problem-solving (negative problem orientation, avoidant style,

^aSupplier
SAS 9.2; SAS Institute.

impulsive, and careless responding), even though youth with TBI also reported less adaptive problem-solving strategies, than teens in the normative sample. This finding was contrary to expectations but may reflect a tendency of adolescents with TBI to underestimate or lack awareness of the challenges involved in actual problem-solving situations.²⁶ Given that relatively small numbers of participants received counseling previously, it is unlikely that prior therapy explains the lower rates of endorsement of maladaptive problem-solving styles. Although our sample is comparable with the normative sample with respect to age, we had a higher proportion of boys, which may also translate to differences in self-reported problem-solving.

As hypothesized, teens with TBI reported lower levels of rational problem-solving. The neurocognitive effects of TBI, in particular damage to the prefrontal cortex and neural circuitry supporting executive function skills,^{27–29} may lead to poorer rational problem-solving and broader deficits in SIP, particularly in response to ambiguous or complex scenarios that require rapid processing and decision-making. However, the overall pattern of findings for the SPSI suggests that changes in problem-solving after adolescent TBI are varied and not uniformly negative. Prospective studies examining the neural underpinnings of changes in problem-solving skills after TBI are needed to elucidate current findings.

Correlations between dimensions of the SPSI and problem-solving as assessed by the Dodge Social Information Processing Short Stories suggest that self-reported problem-solving style corresponds to the ability to effectively process social situations after adolescent TBI. Specifically, a negative attitude toward problems and a more impulsive and careless style of responding on the SPSI were correlated with more aggressive responses on the Dodge Social Information Processing Short Stories. Conversely, positive, rational approaches on the SPSI were negatively correlated with Dodge Social Information Processing Short Stories aggressive responses. These associations suggest that maladaptive problem-solving style translates to less competent social responses after TBI.

Several recent models^{6,30} highlight the influence of aspects of SIP, including social problem-solving, on social and functional outcomes after pediatric TBI. Our data, although cross-sectional in nature, are consistent with these models, indicating that both adaptive and maladaptive aspects of social problem-solving style (eg, problem avoidance, lower levels of positive problem orientation) are associated with functional impairments in adolescents with TBI. Maladaptive problem-solving was strongly associated with self-reported impairments on the YSR, likely in part because avoidant or careless/impulsive problem-solving styles correspond to the behavioral symptoms of depression or attention deficit hyperactivity disorder. Additionally, a maladaptive problem-solving style increased the odds of being impaired on the CAFAS and aggressive SIP approached significance. The relation of problem-solving to adolescent functioning is likely reciprocal with psychological distress, contributing to maladaptive problem-solving and maladaptive problem-solving leading to subsequent distress and dysfunction. Problem-solving deficits may mediate the association between neurocognitive impairments and social outcomes after pediatric TBI³¹ and may contribute to depression and functional impairments.⁹ Future research should focus on understanding the developmental trajectory of problem-solving strategies in youth after TBI, with a specific focus on how problem-solving strategies develop thorough adolescents and

young adulthood when individuals are transitioning to independence. Additionally, it is important to understand the influence of TBI-related problems, including neurocognitive and neurobehavioral issues (eg, executive dysfunction, fatigue, attention problems, processing speed deficits), on problem-solving strategies. A comprehensive understanding of problem-solving deficits after adolescent TBI would facilitate intervention tailoring.

The common occurrence of problem-solving deficits and their association with poorer functioning after TBI suggests these deficits may be a viable target for intervention in both children and adults.^{32,33} Previous studies have been limited by small samples and varying approaches to assessing problem-solving. Several randomized trials of family problem-solving therapy for children and adolescents with TBI support its potential efficacy to improve behavioral, social, and functional outcomes^{34–36}; however, less is known regarding the utility of individual problem-solving therapy in this population.

Study limitations

The study has a number of limitations. Participants were enrolled in a clinical trial. Although current data were collected prior to randomization, participants may not be representative of the broader population of adolescents with TBI. Participants were older than nonparticipants. However, participants and nonparticipants did not differ on other demographic or injury characteristics. The lack of a healthy comparison group precluded examination of the extent of problem-solving weaknesses in children with TBI relative to uninjured youth from similar backgrounds, or of how associations between problem-solving and functioning might differ for children with TBI compared with other youth. Categorization of TBI severity was limited by lack of information regarding acute monitoring, duration of unconsciousness, and length of posttraumatic amnesia. It is possible that severity-related differences in problem-solving would have emerged with more fine-grained categorization. Reliance on self-report measures of problem-solving (SPSI) and functioning (YSR) constitutes a further limitation given that deficits in cognition and self-awareness may limit the youth's ability to accurately reflect on problem-solving and behavioral challenges. Strengths include a large sample, multiple measures of social problem-solving, and assessment of functional impairment based on ratings from trained raters unaware of injury severity.

Conclusions

Findings underscore the importance of understanding how TBI alters social problem-solving style and skills. A substantial association between problem-solving and functional outcomes highlights the potential value of targeting problem-solving skills in the management of TBI's behavioral consequence. With the exception of family problem-solving therapy, previous interventions addressing social problem-solving after TBI have demonstrated limited effects on behavioral functioning.³⁷ Interventions to improve social problem-solving skills may benefit from opportunities to practice and implement skills with family and peers.

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List of abbreviations

CAFAS	Child and Adolescent Functional Assessment Scale
GCS	Glasgow Coma Scale
OI	orthopedic injury
SIP	social information processing
SPSI	Social Problem-Solving Inventory
TBI	traumatic brain injury
YSR	Youth Self Report

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Table 1

Study characteristics

Characteristic	Total (N=153)	Missing (n=20)	Completed (n=133)	Test Statistic*	P
Patient characteristics					
Age at baseline, y	14.9±2.0	15.6±2.3	14.8±2	-1.75	.081
Female	45 (29.4)	6 (30.0)	39 (29.3)	<0.01	.951
Hispanic	12 (7.8)	0 (0.0)	12 (9.0)	1.96	.174 [‡]
White	123 (80.4)	17 (85.0)	106 (79.7)	0.31	.218 [‡]
Time since injury [‡]	0.5±0.3	0.6±0.3	0.5±0.3	-0.97	.334
Lowest GCS score	9.1±5.2	5.4±6.8	9.5±5.1	2.22	.028
Normative imaging results	21 (14.0)	2 (10.0)	19 (14.6)	1.73	.79
Depressed skull fracture	24 (16.7)	3 (15.8)	21 (16.9)	.02	.90
IVH present	12 (7.9)	2 (10.0)	10 (7.6)	.40	.83
Lesion, multifocal	46 (31.9)	6 (31.6)	40 (32.0)	.001	.97
Lesion, single	17 (11.8)	1 (5.3)	16 (12.8)	.90	.34
SDH, multifocal	55 (38.5)	11 (57.9)	44 (35.5)	3.50	.06
SDH, single	50 (35.0)	5 (26.3)	45 (36.3)	.72	.40
Diffuse injury	46 (30.5)	8 (40.0)	38 (29.0)	1.01	.60
Severe injury	68 (44.4)	13 (65.0)	55 (41.4)	3.94	.047
WASI IQ	99.1 (14.2)	100.2 (16.3)	99.0 (13.9)	-0.36	.719
Parent characteristics					
Mother is primary caregiver	133 (86.9)	19 (95.0)	114 (85.7)	1.32	.173 [‡]
Primary caregiver has some college education	91 (59.5)	12 (60.0)	79 (59.4)	<0.01	.959
Married	90 (58.8)	11 (55.0)	79 (59.4)	0.14	.709
Census tract income (in thousands)	68.4±29.3	67.0±24.8	68.5±30.0	0.21	.831
Combined socioeconomic status, Z score	0.0±1.0	0.0±1.0	0.0±1.0	<0.01	.998
Assessment instruments					
SPSI standardized scores					
Avoidance style		NA	91.9±13.7	NT	NT
Impulsivity/carelessness style		NA	91.9±16.9	NT	NT
Negative problem orientation		NA	87.4±12.9	NT	NT

Characteristic	Total (N=153)	Missing (n=20)	Completed (n=133)	Test Statistic*	P
Positive problem orientation		NA	98.1±17.4	NT	NT
Rational problem-solving		NA	94.5±17.2	NT	NT
Total		NA	106.9±14.7	NT	NT
SIP-SR					
Aggression composite	2.47±0.54	2.24±0.47	2.50±0.55	2.01	.046
Competent composite	3.59±0.46	3.57±0.42	3.71±0.47	1.17	.243
YSR total problems score	24±16.8	2±14.3	22±17.1	0.07	.290 [‡]
YSR total problems score elevated at 65	52.7 (11.3)	53.4 (9.1)	52.7 (11.5)	-0.22	.829
CAFAS total score	38.3±34.2	38.5±30.0	38.2±34.9	-0.03	.975
CAFAS elevated at 50	53 (35.1)	7 (35.0)	46 (35.1)	<0.01	.992

NOTE. Values are mean ± SD or n (%).

Abbreviations: IVH, intraventricular hemorrhage; NA, not applicable; NT, not tested; SDH, subdural hemorrhage; SIP-SR, Social Information Processing Self-Report Short Stories; WASI IQ, Wechsler Abbreviated Scale of Intelligence Intelligent Quotient.

* Test statistic is chi-square for categorical data or *t* test for continuous data.

[‡] Of the cells, 25% have expected counts <5; therefore, probability is based on Fisher exact test.

[‡] 1.0 = year; 0.5 = 6 months.

Table 2

Comparisons between national normative sample and TBI sample on SPSI total and subscale scores

SPSI Composite and Subscales	Normative Sample (n=708)	TBI Sample (n=133)	<i>t</i> Test	<i>P</i>
Maladaptive				
Avoidance style	12.0 (5.7)	8.9 (5.2)	5.90	<.001
Impulsivity/carelessness style	18.8 (6.4)	13.2 (7.1)	5.76	<.001
Negative problem orientation	17.7 (8.4)	10.5 (7.2)	10.22	<.001
Adaptive				
Positive problem orientation	11.5 (3.8)	11.0 (4.4)	1.08	.284
Rational problem-solving	41.5 (13.0)	36.8 (15.0)	3.38	<.001
Total	11.2 (2.5)	12.4 (2.5)	-5.08	<.001

NOTE. Higher scores indicate greater endorsement of the scale. Values are mean, SD.

Table 3

Correlations

Variable of Interest	SPSI			SIP-SR	
	Maladaptive	Adaptive	Total	Aggression Composite	Competent Composite
SPSI					
Maladaptive	1.00				
Adaptive	0.04	1.00			
Total	-0.79 [*]	0.58 [*]	1.00		
SIP-SR					
Aggression composite	0.23 [†]	-0.24 [†]	-0.33 [*]	1.00	
Competent composite	-0.07	0.37 [*]	0.27 [†]	-0.14	1.00

Abbreviation: SIP-SR, Social Information Processing Self-Report Short Stories.

^{*} $P<.001$.

[†] $P<.01$.

Table 4

Multivariate models for CAFAS and YSR total problems as a continuous measure

Variable of Interest	Partial η^2	Standardized Estimate	Parameter Estimate	SE	t Test	Pr > t	VIF
CAFAS							
Age at baseline	.001	-.02	-.040	1.29	-.31	.754	1.15
Female	.027	-.13	-.9.63	5.40	-1.78	.077	1.05
White	.036	.15	12.80	6.14	2.08	.039	1.10
Severe TBI	.009	.07	5.18	5.09	1.02	.311	1.09
Premorbid ADHD or emotional problems diagnosis	.044	.17	15.23	6.62	2.30	.023	1.17
Received behavioral therapy at baseline	.009	.08	6.86	6.73	1.02	.310	1.17
Time since injury	.048	-.18	-18.06	7.49	-2.41	.018	1.14
ZSES	.051	-.20	-7.01	2.83	-2.48	.015	1.35
WASI IQ	.019	-.12	-.0.29	0.19	-1.51	.135	1.30
SPSI maladaptive	.163	.37	0.96	0.20	4.73	<.001	1.27
SPSI adaptive	.063	-.22	-.0.47	0.17	-2.79	.006	1.37
SIP aggression composite	.005	.06	3.63	4.97	0.73	.467	1.31
SIP competent composite	.004	.05	3.99	5.63	0.71	.480	1.22
Model statistics: $F_{13,129}=7.44$; $P<.0001$; $R^2=.40$							
YSR total problems							
Age at baseline	.010	-.08	0.44	0.42	1.05	.297	1.14
Female	.005	-.05	-1.37	1.75	-0.78	.437	1.04
White	.002	.03	0.98	2.05	0.48	.631	1.10
Severe TBI	.028	-.13	-2.99	1.66	-1.80	.074	1.11
Premorbid ADHD or emotional problems diagnosis	.007	.07	1.89	2.09	0.91	.367	1.18
Received behavioral therapy at baseline	.001	.02	0.52	2.18	0.24	.814	1.17
Time since injury	.002	.03	1.01	2.44	0.41	.680	1.16
ZSES	.003	-.05	-.0.56	0.91	-0.62	.537	1.35
WASI IQ	.024	.13	0.10	0.06	1.66	.100	1.31
SPSI maladaptive	.380	.63	0.54	0.07	8.31	<.001	1.26
SPSI adaptive	.004	-.05	-.0.04	0.06	-0.63	.532	1.41
SIP aggression composite	.023	.13	2.65	1.62	1.64	.105	1.32

Variable of Interest	Partial η^2	Standardized Estimate	Parameter Estimate	SE	t Test	Pr > t	VIF
SIP competent composite							
Model statistics: $F_{13,127}=8.17$; $P<.0001$; $R^2=.43$	<.000	<.00	0.09	1.84	0.05	.961	1.25

Abbreviations: ADHD, attention deficit hyperactivity disorder; PR, probability; VIF, variance inflation factor; WASI IQ, Wechsler Abbreviated Scale of Intelligence Intelligent Quotient; ZSES, socioeconomic status measure defined by averaging sample z scores for maternal education and median income for the family's Census tract.

Table 5

AORs for predictors on elevated CAFAS and elevated YSR total problems

Multivariable Models	AOR (95% CI)	χ^2	Pr > χ^2
CAFAS			
Age at baseline	0.86 (0.68–1.10)	1.39	.239
Female	2.98 (1.09–8.11)	4.54	.033
White	1.56 (0.5–4.87)	0.59	.441
Severe TBI	1.03 (0.41–2.59)	<0.01	.950
Premorbid ADHD or emotional problems diagnosis	2.49 (0.79–7.90)	2.40	.122
Received behavioral therapy at baseline	1.21 (0.38–3.81)	0.10	.749
Time since injury	0.43 (0.10–1.86)	1.27	.259
ZSES	0.63 (0.36–1.10)	2.66	.103
WASI IQ	0.99 (0.96–1.03)	0.19	.665
SPSI maladaptive	1.08 (1.03–1.13)	11.11	.001
SPSI adaptive	0.98 (0.95–1.02)	1.13	.287
SIP aggression composite	2.36 (0.95–5.85)	3.42	.064
SIP competent composite	1.00 (0.36–2.77)	<0.01	.995
Model statistics: $\chi^2_{13,130}=25.35$; $P=.0207$			
YSR			
Age at baseline	1.03 (0.78–1.37)	0.05	.815
Female	1.44 (0.45–4.58)	0.38	.536
White	4.01 (0.75–21.46)	2.63	.105
Severe TBI	1.58 (0.52–4.78)	0.66	.416
Premorbid ADHD or emotional problems diagnosis	1.15 (0.33–4.00)	0.05	.826
Received behavioral therapy at baseline	0.34 (0.08–1.54)	1.96	.162
Time since injury	1.34 (0.24–7.51)	0.11	.739
ZSES	0.77 (0.41–1.44)	0.66	.416
WASI IQ	1.03 (0.98–1.07)	1.32	.250
SPSI maladaptive	1.09 (1.04–1.15)	11.54	.001
SPSI adaptive	0.98 (0.94–1.02)	1.01	.314
SIP aggression composite	1.19 (0.37–3.81)	0.09	.766
SIP competent composite	2.56 (0.67–9.77)	1.89	.170
Model statistics: $\chi^2_{13,127}=16.22$; $P=.238$			

Abbreviations: ADHD, attention deficit hyperactivity disorder; AOR, adjusted odds ratio; CI, confidence interval; PR, probability; WASI IQ, Wechsler Abbreviated Scale of Intelligence Intelligent Quotient; ZSES, socioeconomic status measure defined by averaging sample z scores for maternal education and median income for the family's Census tract.