PSYCHOSOCIAL SUBTYPES ON THE BEHAVIOR ASSESSMENT SYSTEM FOR CHILDREN, SECOND EDITION FOLLOWING PEDIATRIC TRAUMATIC BRAIN INJURY

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Dean of the Graduate School:

I am submitting herewith a dissertation written by Jonelle Ensign entitled "Psychosocial Subtypes on the Behavior Assessment System for Children, Second Edition Following Pediatric Traumatic Brain Injury." I have examined this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in School Psychology.

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ABSTRACT

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PSYCHOSOCIAL SUBTYPES ON THE
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Increasing numbers of children are surviving traumatic brain injuries (Thurman, Alverson, Dunn, Guerrero, & Sniezek, 1999), and in many cases, the public school system is the primary, if not only, provider of services to these survivors. School psychologists will typically be among the professionals responsible for completing evaluations for children with TBI within the school system; therefore, information regarding the existence and delineation of the characteristics of psychosocial problems in children suffering from TBI would be helpful to these and other clinicians. In the current literature, two studies have described specific psychosocial sequelae of pediatric traumatic brain injury (TBI) by identifying profiles of psychosocial functioning based on scores earned on a general behavior rating scale, specifically the Personality Inventory for Children – Revised (PIC-R; Butler, Rourke, Fuerst, & Fisk, 1997) and Child Behavior Checklist (CBCL; Hayman-Abello, Rourke, & Fuerst, 2003). School psychologists, however, may be more familiar with and more accustomed to using the Behavior Assessment System for Children, Second Edition (BASC-2) in their assessment protocols. Therefore, the purpose of this study was to develop a profile of psychosocial

functioning following pediatric TBI by subjecting BASC-2 clinical scale profiles to cluster analysis. Data was archival and gathered from neuropsychological evaluations completed at an urban pediatric hospital. Those children aged 6 through 21 with BASC-2 PRS scores were considered for inclusion. Using a variety of hierarchical agglomerative clustering techniques, a typology was derived and compared to existing PIC-R, CBCL, and BASC-2 clinical profiles. The most reliable typology that emerged included two subtypes, which were labeled Normal and Pervasive Emotional Difficulties based on scale elevations of the mean BASC-2 profiles. Using further exploratory analyses, other less statistically reliable subtypes were also observed that were thought to have clinical significance. These were labeled Mild Externalizing/Depression, Mild Externalizing/ Attention Problems, Mild Depression, and Mild Anxiety. While some similarities between these subtypes and the PIC-R and CBCL subtypes were noted, the subtypes were found to be quite different from the BASC-2 clinical profiles for the Bipolar Disorder, Depression Disorders, and Emotional/Behavioral Disturbance clinical subgroups. In addition, relationships between psychosocial subtype membership and gender, time elapsed since injury, age at injury, and age at testing were investigated. These analyses revealed time elapsed since injury to be the only variable resulting in a significant difference between subtypes. Limitations of the current investigation as well as suggestions for future studies are also discussed.

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CHAPTER I

INTRODUCTION

Humans are social beings, and social and emotional competence is one of the developmental tasks that must be mastered during childhood. These skills are important to a child's later mental health, as well as social and academic success. During the preschool years, one of the most important developmental tasks to achieve is sustained positive engagement with peers (Eckerman & Stein, 1990). In other words, they must begin to meet the social expectations of people other than their parents. The various components of emotional competence that are foundational to successful social interactions at this age include listening, cooperating, appropriate help-seeking, the ability to join another child or group in play, and negotiating disagreements (Denham, 2007). During the preschool years, children also become more able to delay or inhibit responses (Carlson & Moses, 2001; Diamond & Taylor, 1996; Dowsett & Livesey, 2000; Gerstadt, Hong, & Diamond, 1994; Kochanska, Murray, Jacques, Koenig, & Vendegeest, 1996; Livesey & Morgan, 1991) and jointly understand the theme of the interaction and develop social knowledge of the peer group (Howes, 1988).

During the school-age years, the tasks central to social competence shift. During middle childhood and preadolescence, numerous aspects of social knowledge undergo changes, including knowledge of social outcomes and goals, understanding others' probable intent, information about the causes of social events, and the appropriateness of

social behaviors (Crick & Dodge, 1994). Older children begin to associate with a wider social network, and inclusion by one's peers and the avoidance of rejection or embarrassment are highly important. The goals of social development during this stage include securing social support, self-disclosure, information exchange, empathic involvement in others' emotions, and regulating one's own demonstration of emotion (Denham, 2007). When children enter school with friends, are well liked, are able to make and maintain new friendships, and are able to initiate positive interactions with their teachers, children feel more positively about themselves, participate in school more, and demonstrate higher achievement (Denham). Children who exhibit social-cognitive deficits and unskilled behavior are likely to have negative self-perceptions, are more likely to be rejected and victimized by their peers, and are more likely to experience loneliness and depression. In essence, they are at risk for developing a myriad of subsequent internalizing and externalizing problems (Booth-LaForce & Oxford, 2008).

A large proportion of the brain is involved in social interaction. Collectively, the brain regions involved in social cognition are known as the 'social brain.' Various regions in the social brain undergo structural and functional changes during development. These areas, according to Blakemore (2008), include the medial prefrontal cortex, the anterior cingulate cortex, the inferior frontal gyrus, the superior temporal sulcus, the amygdala, and the anterior insula. Structural MRI studies have enabled researchers to conclude that several cortical regions, particularly parts of the prefrontal cortex, the temporal cortex, and the parietal cortex, as well as a number of the subcortical structures, undergo substantial changes in white and gray matter volume throughout adolescence

(Giedd et al., 1999; Gogtay et al., 2004). This increase in white matter volume and corresponding decrease in gray matter volume has been suggested to reflect axonal myelination, thus fine-tuning the remaining synaptic connections into specialized functional networks (O'Donnell, Noseworthy, Levine, & Dennis, 2005).

It follows logically that any insult to this neurodevelopmental process would result in disruption of both the structural and functional development of the brain. In fact, it is generally posited that children who sustain traumatic brain injuries (TBI) tend to manifest psychosocial and behavioral problems as a result of those injuries. Neurological findings show that, following moderate to severe TBI in childhood, there is a reduction of volume in the whole brain, ventromedial frontal, superior medial frontal, and temporal lobes. In addition, reduced white and gray matter was observed, and a selective vulnerability for frontal temporal tissue loss was found (Wilde et al., 2005). Thus, the entire social brain network is potentially vulnerable to TBI, given the potential for damage in structures that play critical roles in emotional regulation, social cognition, memory, and executive function (Yeates et al., 2007). While the exact nature of the deficits that will be observed may vary according to the specific combination of focal and diffuse damage, injury anywhere in the social brain network will disrupt normal functioning of the system, which will place the child at greater risk for deficits in social information processing (Yeates et al., 2007). In fact, even the milder forms of pediatric brain injury increase the risk for subsequent psychiatric problems (Luis & Mittenberg, 2002).

Personality change due to TBI (PC) is a disorder thought to be related to the direct physiological effects of a TBI (Max et al., 2000). It is manifested as a marked deviation from normal development rather than as a change in a stable personality pattern, and it has been found to be a clinically meaningful and reliable diagnosis following severe TBI in children and adolescents (Max et al., 2000). Five major subtypes of PC have been described and identified in pediatric TBI samples: labile, aggressive, disinhibited, apathetic, and paranoid. Max and colleagues (2005a) have also described secondary attention deficit/hyperactivity disorder (SADHD), which refers to the development of ADHD following brain injury. The inattentive subtype of this disorder seems to predominate, although most subjects also had either threshold or subthreshold hyperactive/impulsive symptoms as well (Max et al., 2005a).

In other research, lifetime psychiatric disorders were observed in 76% of a pediatric TBI sample, while nearly 60% of the sample developed one or more novel psychiatric disorders at some point following their injury (Bloom et al., 2001). Approximately 75% of these disorders were persistent beyond one year post-injury. ADHD and depression were the two most commonly observed lifetime and current disorders. In fact, more than one-third of the sample developed symptoms of one of the subtypes of ADHD or developed symptoms prominent enough to warrant a diagnosis of ADHD Not Otherwise Specified (ADHD-NOS). Depressive disorders, on the other hand, accounted for about 25% of novel diagnoses, with 60% of all mood disorders resolving by one year post-injury.

Obsessive-compulsive symptoms (OCS) are also common following severe TBI (Grados et al., 2008). Compared to a rate of 8.4% in a community sample of adolescents, new-onset OCS following TBI occurred at a rate of 26.4%, with females exhibiting symptoms more often than males in the TBI sample only. Also associated with OCS in the TBI sample were anxiety and affective disorders such as specific phobias, mania, dysthymia, depressive symptoms, and hyperarousal PTSD symptoms.

Children with TBI are also likely to be developmentally behind their same-age peers in their responses to problem solving, and they tend to struggle more with negotiation and collaboration (Hanten et al., 2008). Thus, children with TBI were found to be impaired on social perspective taking and tended to solve problems with strategies that were more impulsive and egocentric than collaborative. These difficulties with problem solving skills have been observed to extend across a time span of at least four years post-injury (Janusz, Kirkwood, Yeates, & Taylor, 2002). At four years post-injury, children with severe TBI were able to define conflictual social situations and generate alternative solutions to those conflicts, but they demonstrated deficits in their ability to choose a particular strategy and evaluate its effectiveness. The TBI sample tended to prefer less developmentally mature strategies and demonstrated less mature reasoning in assessing outcomes.

Self-regulation has also been found to be a deficit area following childhood TBI (Ganesalingam, Sanson, Anderson, & Yeates, 2006, 2007). Specifically, compared to healthy controls, children with TBI were more impulsive, more easily distracted, and less attentive. Parents reported poorer regulation in that they observed their children

displaying less emotional awareness, empathy, situationally appropriate affect, and more poorly regulated negative affect (Ganesalingam et al., 2006).

In addition to these studies, which have identified specific psychosocial sequelae of pediatric TBI, research has also been conducted in an attempt to identify profiles of psychosocial functioning based on scores earned on a general behavior rating scale (Butler, Rourke, Fuerst, & Fisk, 1997; Hayman-Abello, Rourke, & Fuerst, 2003). Hayman-Abello and colleagues used the Child Behavior Checklist (CBCL; Achenbach, 1991a) and identified four subtypes: normal, attention, delinquent, and withdrawn-somatic. While most children fell within the normal subtype, parents of children with TBI observed more behavior problems than parents of nonreferred children. The problems they observed did not, however, represent pathological psychosocial functioning.

Butler and colleagues (1997) used the Personality Inventory for Children – Revised (PIC-R; Wirt, Lachar, Klinedinst, & Seat, 1990) and found most children to fall within the normal subtype. Other subtypes described included cognitive deficit, somatic concern, mild anxiety, internalized psychopathology, antisocial, and social isolation. Regarding relationships to severity of TBI injury, proportionately more severely injured children fell in the social isolation subtype, while more mildly and moderately injured children fell in the cognitive deficit subtype. Also, the normal and antisocial subtypes contained proportionately more moderately injured children, and the somatic concern subtype contained proportionately more moderately and severely injured children. Equal numbers of children comprised the mild anxiety and internalized psychopathology subtypes. The relationships between psychosocial functioning and both age at injury and

time since injury were also examined. Generally, younger children were more likely to be included in the social isolation, cognitive deficit, and mild anxiety subtypes. More specifically, age at injury was greater for the antisocial subtype than the mild anxiety, cognitive deficit, and social isolation subtypes; age at injury was greater for the normal subtype than the cognitive deficit and social isolation subtypes; and age at injury was greater for the somatic concern subtype than the social isolation subtype. Thus, children injured at younger ages were significantly more likely to be assigned to the social isolation, cognitive deficit, and mild anxiety subtypes. For time since injury, children with a longer time since injury were more likely to be assigned to the social isolation subtype than the antisocial and normal subtypes.

Rationale, Purpose, and Significance of the Current Study

To date, these are the only two studies that have attempted to identify profiles of psychosocial functioning of children and adolescents with TBI using widely used, general behavior rating scales. The Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) is another general behavior rating scale that was developed to be used as a clinical assessment tool. When compared to the CBCL, the BASC-2 possesses similar reliabilities; however, the BASC-2 is more closely linked to diagnostic definitions of behavioral disturbances. Further, while the empirical validity research of the BASC-2 is not nearly as extensive of that of the CBCL, the BASC-2 was designed to be used clinically instead of as a research tool.

Research informs us that increasing numbers of children are surviving traumatic brain injuries (Thurman, Alverson, Dunn, Guerrero, & Sniezek, 1999), and in many

cases, the public school system is the primary, if not only, provider of services to these survivors. In addition, given the number of hours per day a child spends in school and the demands placed on children in an educational setting, their neuropsychological deficits, of which the psychosocial deficits are often the most pervasive, enduring, and disruptive, may be most often exhibited in the school setting. Since schools are often serving as primary care providers for these children, school psychologists will typically be among the professionals who will be responsible for completing their evaluations, and they may be most familiar with the BASC-2 rather than the CBCL or PIC-2. Therefore, information regarding the existence and delineation of the characteristics of psychosocial problems in children suffering from TBI based on assessment using the BASC-2 would be helpful to these and other clinicians and, thus, represents research that is yet to be addressed.

Thus, the focus of this project was to provide parallel research to the studies already completed using the CBCL and PIC-R. The purpose of this study was to develop a BASC-2-based psychosocial profile of children with TBI and answer the following proposed research questions:

R1: How do these derived BASC-2 profiles compare to known CBCL and PIC-R profiles? This was accomplished by visually comparing the subtypes derived in these analyses with the subtypes derived in the Butler and colleagues (1997) and Hayman-Abello and colleagues (2003) studies.

R2: How do these derived BASC-2 profiles compare to known BASC-2 clinical profiles? One-sample *t*-tests were used to compare the subtypes derived in these

analyses with the BASC-2 clinical sample profiles, as reported in the BASC-2 manual (Reynolds & Kamphaus, 2004).

R3: What is the relationship between psychosocial outcome and variables such as gender, time elapsed since injury, age at injury, and age at testing? Chi-square analyses were conducted for gender and months elapsed since injury because of their categorical nature, and an analysis of variance was used with age given its continuous nature.

CHAPTER II

REVIEW OF THE LITERATURE

Children walk through the doors of America's schools every day with a myriad of conditions that complicate their ability to learn and interact. Whether those conditions are psychological, emotional, or medical, some are quite unrecognizable to the casual observing eye. One condition whose symptoms can be difficult to categorize is traumatic brain injury (TBI). A task force who performed a systematic search of the literature on mild traumatic brain injury reported they had located consistent and methodologically sound evidence that the prognosis in children following a mild TBI is good. More specifically, they concluded that symptoms typically resolve within two to three months of the initial injury with few residual cognitive, behavioral, or academic deficits (Carroll et al., 2004). However, research has been persuasive in demonstrating that persistent and pervasive neurobehavioral deficits following moderate and severe TBI do affect the child's day-to-day functioning (Fay et al., 1994). For those children suffering from the most severe brain injuries, recovery will typically be observed; however, there will be some lingering, significant impairments (Christensen et al., 2008). Thus, it is important that school psychologists become aware of the symptoms related to TBI and, as will be addressed in this paper, that TBI has the potential to result in psychosocial disturbance in children.

TBI in Children: Incidence, Epidemiology, and Physiology

In 2003, TBI rates were highest among children aged 0-4 years (1188.5 per 100,000). For children aged 5-14, the rate dropped by about half to 520.5 per 100,000 (Rutland-Brown, Langlois, Thomas, & Xi, 2006). The mechanisms of injury also change depending on the developmental stage, with the 0-4 age group suffering most often from falls, and adolescents suffering most often from sports- and motor vehicle-related causes and assaults (Keenan & Bratton, 2006). In children aged 5-18 years, the activities associated with the greatest number of TBI-related emergency department visits included bicycling, football, basketball, playground activities, and soccer (Centers for Disease Control and Prevention [CDCP], 2007).

Fortunately, research tells us that, in the period from 1980 through 1994, TBI-associated rates of mortality and hospitalizations declined by 20%, with most of this decline due to a 38% decrease in transportation-related deaths (Thurman et al., 1999). The authors suspected that the decline in the rate of nonfatal TBI resulting in hospitalization may be a result of improved injury prevention efforts and changes in hospitalization admission practices (i.e., policies that encourage outpatient care for less severe injuries). In addition, research has proven helpful in identifying various risk factors. Results from a Centers for Disease Control and Prevention report revealed race to be one such risk factor (Langlois, Rutland-Brown, & Thomas, 2005). Data collected between 1995 and 2001 showed the combined TBI-related death rate for blacks was 6 per 100,000, compared to 4.3 per 100,000 for whites (Langlois et al.). However, the authors also stated that race itself may not be the risk factor for TBI. Instead, it may be a marker

for other risk factors. For instance, Rivara (1994) stated that for all races, injury death rates are negatively correlated with income level; thus, the differences between racial groups may actually be the result of differences in income level. Rivara went on to speculate the reasons for the increased risk for children of lower socioeconomic status (SES), and suggested factors such as less supervision, decreased access to information regarding preventative measures such as bicycle helmets, and a higher frequency of exposure to dangerous environments such as multi-story apartment buildings and higher volumes of faster moving traffic.

Interestingly, many of these identified risk factors for TBI-related injuries are also factors affecting the child's prognosis. For instance, although there is some discrepancy in the literature regarding the degree of residual disability in children compared to adults (see Christensen et al., 2008), injury-related deaths are fewer for children than for adults (Tepas, DiScala, Ramenofsky, & Barlow, 1990), although, among children, mortality rate has been found to be higher in younger children (Morrison, Arbelaez, Fackler, De Maio, & Paidas, 2004). Regarding gender, the research is mixed. In some studies, gender has not affected outcome. In others, females have been shown to have better outcome, while in still others, males have had lower mortality rate or better functional outcome (see Morrison et al.). Finally, children who have better pre-injury functioning and whose families have more resources experience less stress and can provide more structure and, thus, have better outcome (Yeates et al., 1997).

With such variability in risk factors, mechanisms of injury, levels of severity, and factors affecting prognosis, it is not surprising that TBI is a complex, multi-faceted

condition that results in deficits in numerous areas of functioning. Generally, TBI can be defined as any head injury with evidence of brain involvement, as evidenced by altered level of consciousness or focal neurological signs (Christensen et al., 2008). TBI can be produced when either the head comes into contact with an object or the head is subjected to cranial acceleration or deceleration (Ewing-Cobbs & Bloom, 2004). The former, known as contact forces, results in focal injuries, or injuries at the site of impact, such as indentation, deformations, fractures, and bruising. In addition, contact forces cause injuries distal to the site of impact, also known as the contre-coup phenomenon (Ommaya, Goldsmith, & Thibault, 2002). Cranial acceleration or deceleration, also known as a noncontact force, causes shearing of the tissue. This, in turn, results in diffuse axonal injury and the rupture of the veins located between the brain and membranes (Ommaya et al.). In addition to these primary injuries, secondary brain injury occurs when cells not impacted by contact or noncontact forces are compromised due to other stresses. These stresses include cerebral swelling, increased intracranial pressure, and hypoxic-ischemic injury produced by reduced blood flow and oxygen delivery (Novack, Dillon, & Jackson, 1996). Most frequently, lesions are found to be located in the frontal lobe white matter; however, insults to the orbital and inferior frontal gyri are also often present (Levin et al., 1997). In addition, significant volume loss has been found in deep cortical structures including the hippocampus, amygdala, and globus pallidus (Wilde et al., 2007). Finally, numerous complications can occur as a result of a TBI, including posttraumatic seizures, hydrocephalus, autonomic instability, and sensory deficits (see Christensen et al. for a review).

Severity of a brain injury is most frequently assessed using the Glascow Coma Scale (GCS), which was introduced in 1974 by Teasdale and Jennett in order to provide a practical method for assessing level of consciousness (Chung et al., 2006). The GCS score can range from 3 to 15 and provides a measurement of three components of consciousness: motor response, verbal response, and eye opening (Lustig & Tompkins, 1998). The scale for motor responses evaluates central nervous system (CNS) functioning, and a score from one (showing no response to examiner pinch) to six (obeying simple commands) can be earned. Verbal responses evaluate nervous system integration and are graded on a scale from one to five. A high score of five is earned when the patient demonstrates sufficient time/space orientation, and a low score of one is earned when the patient makes no sounds at all. Finally, eye opening responses are examined in order to assess the amount of preservation of brain stem arousal mechanisms. Eye opening responses are graded one to four, with the highest score obtained when the patient opens his or her eyes spontaneously and the lowest score earned when he or she does not open them in response to either speech or pain (Lustig & Tompkins). Generally, mild TBI is defined by a GCS score within the range of 13 to 15; moderate TBI is defined by scores from 9 to 12; and severe TBI is assumed when scores drop below nine (Ewing-Cobbs & Bloom, 2004).

Teasdale and Jennett (1974) reported many strengths of the GCS method of assessment. First of all, they noted rare disagreement between doctors and nurses in their GCS assessments. In addition, the scale minimized cross-cultural language biases and miscommunications among professionals and provided a method for defining coma

without depending upon knowledge of site of lesion or physiological measures such as pupil reaction or respiration. However, other researchers have reported weaknesses of the scale as well. For example, it has been reported that the GCS may not be sensitive enough so that a valid prognosis can be made (Levin, Eisenberg, Wigg, & Kobayashi, 1982). Therefore, the usefulness of the GCS may be limited to providing a general assessment for initial severity classification (Lustig & Tompkins, 1998). Age at injury is another important characteristic when assessing long-term neurobehavioral effects since injury at a specific developmental stage will affect previously attained cognitive or behavioral skills as well as interfere with the attainment of normal developmental milestones in the future (Lustig & Tompkins). As a result, some researchers recommend setting the critical predictive GCS score at five for pediatric TBI (Chung et al., 2006).

Despite these physical sequelae to brain injury, numerous forms of cognitive, emotional, and behavioral morbidity can result as well. For example, in their review of neuropsychological, psychiatric, and educational issues surrounding TBI, Ewing-Cobbs and Bloom (2004) described reductions in intelligence scores, persistent impairments on measures of psychomotor speed and accuracy and all forms of attention, slower rates of learning, impairments in language used in social contexts, and difficulties in executive functions. In addition, they described a range of psychosocial issues that often arise following a TBI. This paper will focus on the psychosocial sequelae of TBI, as the ability to adjust socially following an injury can be quite debilitating.

Development of Typical and Atypical Psychosocial Functioning

It is apparent that social behavior changes with age, and this is in large part due to the development of various brain regions. It has been found that brain maturation correlates with increases in children's capacities for social information processing and the development of social behavior. Therefore, the neurodevelopmental considerations surrounding competent, age-appropriate social behavior will be discussed. In addition, to provide some contrast, a review of the typical developmental courses of social problems will be outlined.

Neurodevelopment of Social Behavior

In broad, sweeping terms, it is evident that, with increasing age and brain maturation, children's social information-processing abilities develop, and their social behavior becomes more diverse and complex. In their conceptualization of the development of the social brain network, rather than emphasizing a maturational perspective, Johnson and colleagues (2005) concentrated on the concept of interactive specialization. A maturational perspective, they claimed, does not completely explain some aspects of human functional brain development since the emergence of new cognitive functions is dependent upon the maturation of new brain regions. Johnson cites evidence from his own research that some of the slowest developing brain regions actually show activity from shortly after birth. Thus, his interactive specialization perspective assumes that postnatal development of the cerebral cortex involves organization of the patterns of connectivity, changes in the response properties of cortical regions, and sharpening of the functions of brain regions. According to this viewpoint,

Johnson and colleages state that development is more flexible and better able to respond to damage.

Adolphs (2003) outlines three sets of regions that are especially important for the processing of emotions and, consequently, social behavior. First, higher-order sensory cortices are involved in perception of social signals. For example, the fusiform gyrus has been found to be important in processing the structural properties of faces. Second, the amygdala, striatum, and ortitofrontal cortex form a neural system that links these sensory representations of stimuli with social judgments based on motivational value. Lastly, additional cortical regions such as the left prefrontal, right parietal, and anterior and posterior cingulate cortices work to construct an internal model of the social environment. Essentially, perceptual processing of a socially relevant stimulus in the visual cortices feeds to structures such as the amygdala and prefrontal cortex. The response of the prefrontal cortex is modulated by the amygdala's input, which refers to vigilance, threat, and ambiguity regarding the stimulus. The amygdala's response, in turn, may be modulated by the habituating input from the prefrontal cortex (Adolphs, 2001). Thus, Adolphs (2001) summarizes that the structures involved in social cognition include the sensory and association neocortex for social perceptual processing; a system consisting of the amygdala, prefrontal cortex, cingulate cortex, and right somatosensory-related cortices for mediating between perception and other cognitive processing; and the hypothalamus, brainstem nuclei, basal ganglia, and motor cortices for acting out the social behavior.

During the infancy and toddler years, rapid increases in whole brain volume, as well as the volumes of the frontal and temporal lobes have been recorded (Matsuzawa et al., 2001). Social development during the first four years of life includes increases in the ability to inhibit responses (Carlson & Moses, 2001; Diamond & Taylor, 1996; Dowsett & Livesey, 2000; Gerstadt et al., 1994; Kochanska et al., 1996; Livesey & Morgan, 1991). In addition, toddlers begin to imitate peers' play actions, which leads to the emergence of reciprocal imitation and social games (Eckerman & Stein, 1990). False-belief understanding also develops and has been found to be a significant predictor of positive social skills (Watson, Nixon, Wilson, & Capage, 1999). Theory of mind development becomes apparent in early childhood as well, as four-year-olds have been observed to behave in ways that mislead and also understand the impact of these actions (Sodian, Taylor, Harris, & Perner, 1991). Research strongly suggests a close relationship between the development of executive functioning and the development of theory of mind. In addition, developments in inhibitory control facilitate and may in fact be necessary for theory of mind development. Inhibitory control is not sufficient for these improvements, however, as working memory skills may be implicated as well (Carlson & Moses).

Frontal lobe development continues into early childhood, and the sequence in which the cortex matures corresponds with cognitive and functional developmental milestones (Gogtay et al., 2004). While the areas associated with more basic functions, such as sensory processing (frontal and occipital poles) and spatial orientation, speech and language development, and attention (upper and lower parietal lobes), mature earlier,

the frontal lobe, which is associated with more complex functions such as executive function, attention, and motor coordination, matures later (Gogtay et al.).

Frontal lobe developments are evident in the social development of children entering middle childhood and preadolescence. Children in this age group develop increasing knowledge regarding the consequences of behavior, the probable intents of others, the probable causes of events and how others may react to their behaviors, and the appropriateness of social behaviors (Crick & Dodge, 1994). As children mature they also become capable of skepticism. In other words, they become more aware of the potential for error when receiving information from third parties (Kuttler, Parker, & La Greca, 2002). One of the major challenges for children moving into adolescence is the negotiation of more complex and elaborate systems of peer relationships (Brown & Klute, 2003). In adolescence, advances in cognitive development and relationship management skills, especially the negotiation of conflict, result in friendship stability. In fact, those adolescents who maintain high-quality friendships display higher emotional adjustment (Brown & Klute).

Typical Trajectories of Psychosocial Problems

Unfortunately, significant psychosocial problems, such as anxiety, bipolar disorder, social withdrawal, and physical aggression, can occur in children who have not had a traumatic brain injury. Thus, it is important to understand these developmental courses to aid in comparing and contrasting their trajectories with the presentation of these disorders in children with brain injuries. Therefore, the typical developmental courses of various psychosocial problems minus the impact of brain injury will be

discussed here. This section will begin by discussing internalizing disorders, including anxiety, social withdrawal, and bipolar disorder. This will be followed by an examination of the trajectories of externalizing disorders, including aggressive behaviors.

Anxiety disorders are primarily characterized by fearfulness or excessive worries associated with emotional distress or avoidance behaviors and can be accompanied by physiological symptoms. A study using questionnaires completed by mothers and teachers reported four distinct trajectories of anxiety in a sample of children representative of the population of elementary-age children in Quebec (Duchesne, Vitaro, Larose, & Tremblay, 2008). The low group, consisting of 10.2% of the sample, demonstrated a low level of anxiety between kindergarten and grade six. Their level of anxiety decreased at a constant rate over time. Thirty-nine percent of the sample comprised the moderate group. For these children, anxiety levels increased from kindergarten to grade two, then slowly declined until grade six. For the high group, composed of 41% of the sample, anxiety began at a high level but declined steadily until grade six. Despite the decline, however, anxiety remained at a high level. Finally, a chronic group was identified. For these children (9.7% of the sample), anxiety also started at a high level but declined only slightly across the elementary school years. Thus, this research revealed that half of elementary-age children experience some amount of anxiety during the first years of schooling, and differences between children were evident at an early age.

Another study provided further evidence of the effects of anxiety at an early age. Specifically, in kindergarten-age anxious solitary children, peer exclusion was often

apparent (Gazelle & Ladd, 2003). Understanding the combined influence of anxious solitude, or individual vulnerability, and peer exclusion, or interpersonal adversity, provides information regarding the circumstances under which anxious solitary children either improve over time or fare most poorly. Gazelle and Ladd conceptualized their findings using a diathesis-stress framework where anxious solitude combined with peer exclusion resulted in continued anxious solitude over time. In contrast, anxious solitude without peer exclusion resulted in decreased anxious solitude over time. The authors explained that anxious solitary children who do not experience peer exclusion may gradually learn they do not have reason to be fearful since their fears have not been confirmed by their social experiences. The diathesis-stress framework describing the trajectory of anxious solitude was also extended to predict depressive symptoms. In the case of depressive symptomatology, peer exclusion was again the determining factor, in that the experience of peer exclusion predicted elevated depressive symptoms, while a lack of peer exclusion predicted diminished depressive symptoms (Gazelle & Ladd; Gazelle & Rudolph, 2004). Behaviors related to anxious solitude, including shyness, verbal inhibition, and solitary behavior, contribute to the risk for interpersonal adversity because they signal vulnerability and inspire peer dislike (Gazelle & Ladd).

Regarding social withdrawal, three classes of children have been identified (Booth-LaForce & Oxford, 2008; Oh et al., 2008): a large normative group that never exhibited social withdrawal, a decreasing group that had relatively high levels of withdrawal in first grade but gradually decreased by grade six, and an increasing group that began with relatively low levels but increased to much higher levels by grade six. For

the increasing group, peer exclusion and friendship instability were significant predictors of social withdrawal, while the decrease in withdrawal in the decreasing group was predicted by lower levels of peer exclusion (Oh et al.). Socioeconomic status (SES) has also been found to impact social withdrawal and participation (Schneider, Richard, Younger, & Freeman, 2000). SES can be a risk factor for several reasons. Interaction with a smaller network of peers is observed more often in lower SES families and may pose several disadvantages. A small social network provides fewer potential sources of social support during stressful events and may interfere with the acquisition of social abilities. Further, SES differences were evident in the value parents placed on social competence, and these value differences were linked to the number of opportunities provided for children to interact with other peers in non-school settings. Finally, children from lower SES families displayed far more solitary-passive play than their higher-SES counterparts.

A model designed to describe the pathway to social withdrawal (Rubin, Burgess, Kennedy, & Stewart, 2003) begins with individual differences in temperament, and, specifically, behavioral inhibition, or the tendency to be cautious, timid, and wary in unfamiliar situations. These individual temperament differences lay a foundation for parental reactions that can result in an insecure parent-child attachment relationship and, subsequently, a socially wary and withdrawn behavioral style. This socially inhibited and insecure child is proposed to withdrawal from the social world of peers and fail to develop the skills that are derived from peer interaction. As a result, the child becomes increasingly anxious and isolated, and recognition of this social failure in turn elicits

thoughts and feelings of negative self-regard. The combination of social withdrawal, social failure, negative self-regard, and peer rejection can conspire to maintain and predict internalizing problems such as loneliness, depression, and feelings of insecurity.

Mental illness due to bipolar disorder is characterized by substantial morbidity, including early age of onset of mood disturbance, long duration, fluctuating course, high familial association with mood and other psychiatric disorders, and high rates of comorbid disorders (Birmaher et al., 2006). Lifetime prevalence of bipolar disorder is approximately 1% at age 18 and about 2% at age 24, while the lifetime prevalence of subsyndromal bipolar disorder is about 5%. Most bipolar cases are diagnosed with bipolar II disorder and cyclothymia rather than bipolar I disorder (Lewinsohn, Klein, & Seeley, 2000). Incidence rates have been found to peak at age 14 and to then decline sharply by early adulthood to the point that, in one study, no new cases were detected between ages 24 and 30 (Lewinsohn, Seeley, & Klein, 2003). The mean age at which the first affective episode occurs was 11.8 years in a community sample (Lewinsohn et al., 2003). In most cases, the initial episode was characterized by depression rather than mania, and the average duration of the most recent episode was 10.8 months (Lewinsohn et al., 2003). The duration of manic episodes has been calculated to be 79.2 +/- 66.7 consecutive weeks, with time to recovery being 60.2 +/- 47.5 weeks. Time to relapse following recovery was 40.4 +/- 33.4 weeks (Geller, Tillman, Craney, & Bolhofner, 2004).

As mentioned above, bipolar disorder is a chronic-recurrent condition with 27% remitting between the ages of 19 and 23 (Lewinsohn et al., 2000). In addition,

adolescents were found to have 1.5 syndromal recurrences per year, particularly depressive episodes (Birmaher et al., 2006). Regarding conversion to another bipolar disorder, approximately 20% of adolescents with an initial diagnosis of bipolar II converted to bipolar I, and 25% of those diagnosed with bipolar not otherwise specified converted to bipolar I or bipolar II (Birmaher et al.). Interestingly, those adolescents with subsyndromal bipolar disorder rarely developed bipolar disorder in young adulthood and none of them experienced a recurrence of subsyndromal bipolar disorder in young adulthood. This suggests that the experience of having periods of elated mood may be limited to adolescence (Lewinsohn et al., 2000).

Regarding those variables that impact outcome of bipolar disorder, no difference was found between those with and without a history of bipolar disorder in terms of sex, age, race, or parental education (Lewinsohn et al., 2003). Adolescents with bipolar disorder were less likely to have lived with both biological parents, primarily due to parental divorce (Lewinsohn et al., 2000), and relapse to mania or hypomania was predicted by low maternal warmth (Geller et al., 2004). Finally, it was found that adolescents whose illness began early in life or was of longer duration, who came from lower SES, or who experienced psychotic symptoms had worse outcomes (Birmaher et al., 2006).

Finally, the developmental course of externalizing behaviors must be considered. A distinction has been made in the literature between proactive and reactive aggression, with proactive aggression referring to goal-oriented, calculated behavior motivated by external reward and reactive aggression referring to behavior that occurs in response to

another individual's behavior that is perceived as threatening or intentional (Fite, Colder, Lochman, & Wells, 2008). Levels of both types of aggression have been found to increase from fifth to sixth grade, peak in sixth grade, and then decline. While the trajectories of both types of aggression were similar, teachers reported higher levels of reactive than proactive aggression at all grade levels (Fite et al.). In addition, while reactive aggression and delinquency were unrelated, proactive aggression predicted increases in delinquency (Fite et al.).

Various studies have reported anywhere from three to seven distinct trajectory patterns for aggression across different age ranges (Brame, Nagin, & Tremblay, 2001; Campbell, Spieker, Burchinal, & Poe, 2006; Hill, Degnan, Calkins, & Keane, 2006; Kokko, Tremblay, Lacourse, Nagin, & Vitaro, 2006; NICHD Early Child Care Research Network, 2004; Tremblay et al., 2005). The study reporting seven trajectories (Brame et al.) will be described here since the age range used was widest. However, it should be noted that only males were assessed in this longitudinal study and that assessment consisted of teacher ratings of social behavior and self-reported physical aggression. Three groups with low and steadily declining physical aggression were identified. The largest group (about 33% of the sample) reported virtually no physical aggression. A second group, consisting of about 11%, demonstrated a trajectory that began with low physical aggression at age 13, followed by an increase to moderate aggression by ages 16-17. Thus, the probability of those children displaying low physical aggression during childhood going on to exhibit increasing levels of aggression was a low .23. The third

group (about 13%) began with moderate aggression at age 13 but decreased to a near-zero level in the following years.

A two-group cluster with generally moderate but declining levels of aggression was also identified. The first of this cluster was composed of 21% of the sample, and these children reported virtually no physical aggression during adolescence. The second group of about 10% reported relatively high beginning levels that declined during adolescence. Finally, another two-group cluster was identified and consisted of children displaying a consistently high level of physical aggression from ages 6-13. The first group was composed of 3% of the sample and reported higher rates of aggression than any other group at any other age. Their violence rose steadily to a peak at age 15 and then declined. The second group (10%) reported high levels of physical aggression in childhood but a negligible amount later in adolescence. Thus, even among those who display high levels of aggression during childhood, the probability is high (about 0.77) that they will engage in little or no aggression during adolescence. Overall, then, this study demonstrates that boys beginning with higher physical aggression are much more likely to transition to higher-level adolescent aggression than boys with lower childhood aggression. Also, there was little evidence of late-onset high-level physical aggression (also reported in Nagin & Tremblay, 1999). Those with chronic difficulties with aggression displayed problems with physical aggression at least since kindergarten. In fact, other research extended the chronic nature of high levels of physical aggression downward to infancy and toddlerhood (Tremblay et al, 2005).

Factors predicting lower levels of aggression include higher levels of family resources and more sensitive parenting (NICHD Early Child Care Research Network, 2004). In addition, age of mother at the birth of her first child has been found to be a significant predictor of childhood aggression, with younger age predicting higher levels of aggression (Tremblay et al., 2005). Aggressive behaviors may also be the result of difficult temperament, insecure parent-child attachment, authoritarian or laissez-faire parenting, and/or family stress (Rubin, Bukowski, & Parker, 2006). While occasional physical aggression is frequent among preschool-age children, those children falling within the high physical aggression trajectory group were more likely to be boys, come from low income families, and have mothers who had not completed high school and who used more hostile or ineffective parenting strategies (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006). Finally, at age 2, lower SES was a risk factor for boys but not girls and emotional regulation was a risk factor for girls but not boys in the maintenance of higher levels of externalizing behavior. Inattention was a risk factor for both boys and girls (Hill et al., 2006).

Application to Pediatric Traumatic Brain Injury

The social brain network may be especially vulnerable to early insults. In fact, a variety of studies have demonstrated that children with TBI display impairments of psychosocial functions. Therefore, it is important to understand not only the developmental trajectories of psychosocial problems as described above but also how they may be altered by childhood brain injury. This section will describe the brain

regions implicated in deficits in social behavior, as well as the specific effects found on psychosocial functioning as a result of pediatric TBI.

Mechanisms of Injury Resulting in Psychosocial Deficits

In contrast to the adult literature, the neuroimaging studies completed with pediatric samples are limited. Nevertheless, it is known that the orbitofrontal cortex (OFC) and temporal lobe are especially susceptible to injury following trauma (Cassidy, 1994). Vasa and colleagues (2004) studied the OFC and temporal regions in particular since these brain regions are components of a larger network of circuits that mediate anxiety. These researchers used multiple descriptors of brain damage, including the volume and presence or absence of lesions, and controlled for pre-injury anxiety as well as damage to other brain regions. Even after controlling for these factors, results continued to demonstrate that children with more OFC damage were less likely to develop anxiety. Vasa and colleagues explained that the expression of anxiety may be influenced by an imbalance in the connection between the OFC and the amygdala since previous research suggests that networks in the OFC may access information regarding the emotional valence of a situation from the amygdala in order to guide behavior. Diffuse axonal injury lesions in the OFC as a result of TBI may interrupt these circuits that mediate anxiety and, therefore, result in decreased anxiety. The authors provided further proof for their findings by citing similar results from prior human and animal lesion research. In addition, it was found that there was not hemispheric specificity regarding the differentiation of anxiety symptoms, although right OFC damage decreased the risk for anxiety disorders. Regarding temporal lobe lesions, there was no correlation

between injuries in these regions and anxiety outcomes, although temporal lobe lesions did correlate with post-traumatic stress disorder (PTSD) and post-traumatic stress symptoms (PTSS). The lack of significance may, however, have been due to the study's method, since specific temporal lobe structures such as the amygdala, which are implicated in fear and anxiety, were not delineated. Post-injury anxiety was most strongly predicted by pre-injury anxiety. Other important predictors of post-injury anxiety included the volume and number of ORC lesions.

Other brain regions have also been examined, including the cerebellum and projections to and from the cerebellum such as the pons, thalamus, and areas of the prefrontal cortex such as the dorsolateral, ventrolateral, and superior medial areas (Spanos et al., 2007). Frontally mediated problems such as attention difficulties, personality change, impaired regulation of affect, irritability, and disinhibition are common impairments following TBI. The cerebellum may play a role in the networks underlying these problems since recent primate research has discovered pathways between the medial and dorsolateral frontal areas and the cerebellum via the thalamus (Middleton & Strick, 2001). Spanos and colleagues found prominent cerebellar white matter volume loss in every child with TBI when compared to typically developing matched controls, even after those children sustaining focal cerebellar abnormalities had been excluded from analysis. In addition to the white matter volume loss, gray matter volume loss was also observed; however, white matter was disproportionately affected in comparison to gray matter.

Effects of Traumatic Brain Injury on Psychosocial Functioning

One of the devastating effects of TBI is a disruption in psychosocial functioning. Numerous studies exist reporting the behavioral disruptions in children with all degrees of head injury severity. These will be reviewed here, beginning with personality change due to TBI (PC), a disorder thought to be related to the direct physiological effects of a TBI. Next, the development of symptoms of secondary attention deficit hyperactivity disorder (SADHD) will be examined. Finally, studies investigating other behavioral disruptions will be discussed, organized by time since injury.

Personality change due to traumatic brain injury. In 2000, Max and colleagues presented the first of several articles regarding PC, a disorder they examined based on the eligibility criteria set forth in the Diagnostic and Statistical Manual – Fourth Edition (DSM-IV; American Psychiatric Association, 1994). This disorder is characterized by persistent personality disturbance thought to be the result of the direct physiological effects of a TBI. In children, this disorder can be diagnosed with the observance of a marked deviation from normal development lasting at least one year, rather than manifesting as a change in a stable personality pattern. Five subtypes have been identified, including labile, aggressive, disinhibited, apathetic, and paranoid (American Psychiatric Association). Max and colleagues (2000) attempted to assess the occurrence of PC in a sample of hospitalized TBI patients. Neurological assessments; a semi-structured interview; review of family psychiatric history; and assessments of family functioning, adaptive functioning, and intellectual functioning were completed at various intervals following TBI in children and adolescents. The researchers found that

persistence of the disorder occurred in almost 40% of the sample assessed an average of two years after TBI. More specifically, however, persistent PC was not found to occur at all in children suffering mild-moderate TBI, although a more transient form of the disorder, in other words, one in which symptoms resolved over time, was observed in five percent of these children.

In the children for whom PC was diagnosable, each of the five subtypes was identified, although the apathetic subtype was often transient (i.e., followed by remission), and the paranoid type was rare (Max et al., 2000; Max, Robertson, & Lansing, 2001). Among severe TBI patients, the labile subtype was the most commonly occurring subtype, with 49% of patients with PC demonstrating this form. This was followed by the aggressive and disinhibited subtypes (38%) and, finally, the apathetic and paranoid subtypes (14% and 5%, respectively; Max et al., 2001). Most often, subtypes overlapped in their presentation. The labile and aggressive subtypes almost always co-occurred, while the disinhibited subtype typically accompanied either the labile or aggressive subtype (Max et al., 2000; Max et al., 2001). Onset of PC was found to commonly occur within the first three months following TBI (Max et al., 2001). Of note was the finding that persistent PC was not significantly associated with any of the psychosocial variables, including socioeconomic status (SES), family functioning, family psychiatric history, and family stress. Thus, the authors suggested that persistent PC is more likely a behavioral syndrome mediated by brain damage than a disorder with a psychosocial basis (Max et al., 2000).

A later study focused on longer-term outcomes, specifically, from six months to two years post-injury (Max et al., 2006). At six months post-injury, occurrence of PC was found to be 22%; however, this percentage decreased to a relatively stable rate of 12-13% from 6-12 to 12-24 months post-injury. Occurrence of subtype also remained stable, with the affective form most common, followed by the aggressive, disinhibited, apathetic, and paranoid subtypes. Predictors of personality change included injury severity; lesion location; and pre-injury adaptive function, suggesting that, while this disorder is directly affected by brain damage, pre-injury personal characteristics can also influence outcome. Regarding the latter, it was found that lesions within the superior frontal gyrus predicted personality change between six and twelve months post-injury. This relationship was lost, however, at the 24-month assessment, at which point a new relationship with frontal white matter lesions emerged (Max et al., 2006).

Secondary attention-deficit hyperactivity disorder. Max and colleagues have also studied the phenomenology and predictive factors of attention-deficit/hyperactivity disorder (ADHD) following TBI, or secondary ADHD (SADHD). They have found SADHD symptoms to be a clear consequence of closed head injury, with a rate of occurrence of 35%, even after excluding from analysis those individuals with apparent pre-existing disorder (Schachar, Levin, Max, Purvis, & Chen, 2004). In a study using the same sample of hospitalized patients as for the PC studies, an occurrence rate of 16% was determined (Max et al., 2005a), while with another sample, rates of 15% and 21% were found from 6 to 12 months and 12 to 24 months, respectively, post-injury (Max et al., 2005b). A third sample reported SADHD in children without pre-injury ADHD at a rate

of 19.2%. However, in contrast to PC, SADHD was found to not necessarily be a permanent condition, with almost one-third of cases resolving within 18 months following injury (Max et al., 2004).

All subtypes of ADHD have been observed, although the most common subtypes observed between 6 and 24 months post-injury were inattentive or not otherwise specified (NOS) (Levin et al., 2007; Max et al., 2005a, 2005b). Despite the predominance of the inattentive type, pure inattentive SADHD was rare, with most participants exhibiting threshold (i.e., of sufficient severity to count toward diagnosis) or subthreshold (i.e., occasional symptoms occurring more often than normally expected but of insufficient severity to count toward diagnosis) hyperactive/impulsive symptoms (Max et al., 2005a). Another study reported that an increase in inattentive and hyperactive symptoms was observed in children without pre-injury ADHD over the first six months post-injury, whereas a higher and more stable level of symptoms was observed in children with pre-injury ADHD (Levin et al., 2007). In addition, significant comorbidity existed between SADHD and externalizing disorders such as PC and new-onset oppositional defiant disorder (ODD)/conduct disorder (CD)/disruptive behavior disorder (DBD) (Max et al., 2005a, 2005b).

Although there is some discrepancy regarding whether increasing severity of injury is associated with greater risk for SADHD (Schachar et al., 2004; Max et al., 2004; Max et al., 2005a, 2005b), even in the study where there was a clear association, SADHD occurred at a similar rate after mild-moderate TBI and orthopedic injury. This suggests that changes in ADHD symptomatology are not necessarily directly related to brain

injury and may be relatively more influenced by psychosocial factors (Max et al., 2004). More specifically, other research has demonstrated that the risk factors for SADHD actually changed from the initial six months post-injury to the subsequent 18 months (Max et al., 2005b). While orbitofrontal gyrus lesions predicted the development of SADHD in the first six months following TBI (Max et al., 2005a), family psychosocial adversity and pre-injury adaptive function but not lesion variables predicted SADHD at 18 months post-injury. This suggests that the influence of injury variables on psychiatric outcome decreased with time (Max et al., 2005b). Within two years after injury, lower SES was the only reliable predictor of SADHD (Levin et al., 2007). Finally, the absence of a significant relationship with family history of ADHD suggests that this acquired form of ADHD is distinct from the developmental form, which does in fact have a significant familial association (Max et al., 2005a).

Analysis of lesion location failed to distinguish between severe TBI patients with and without SADHD. However, CT scans, which were used in this study, are relatively insensitive to the detection of diffuse injuries, subcortical lesions, and small lesions. Other data, including duration of impaired consciousness and GCS data, however, suggested diffuse axonal injury was linked to SADHD; therefore, a specific correlation between lesion location and symptomatology would not be expected (Max et al., 2004).

Psychosocial disturbances observed immediately post-injury to twelve months following injury. Immediate and persistent deficits in attention were also examined by Bakker and Anderson (1999). Their small sample of 14 children was assessed following mild to severe TBI at the acute stage post-injury (0-3 months) and again at 6 months post-

injury. Assessment consisted of qualitative observations, which were then quantified using a behavioral checklist based on psychological concepts of attention and its various subcomponents. At the acute stage assessment, a trend was revealed for children with severe TBI to display more inattentive behaviors in comparison to those children in the mild TBI group. From initial to follow-up evaluation, children with severe TBI demonstrated improvement in attentional skills, as evidenced by a near significant trend toward improvement on arousal or level of alertness and oppositional behavior. There was no change, however, on focused attention and distractibility, impulsivity, or hyperactivity.

Pre-morbid states, as well as the post-acute behavioral outcomes, of preschool-age children with TBI have also been explored (Goldstrohm & Arffa, 2005). The 29 participants for this study had sustained mild to moderate TBI and were recruited from the pediatric trauma units of two hospitals. Two comparison groups were formed as well, with one composed of 33 children with mild to moderate injuries to other regions of their bodies, and the second composed of 34 non-injured children, who were recruited from the community and local preschools. The study confirmed that children aged three to six suffering from mild to moderate brain injury do in fact have higher rates of pre-existing behavior problems than non-injured children. In fact, pre-morbid behavioral factors accounted for most of the problems observed post-injury. Thus, the authors suggested that neuropsychological effects and the trauma of hospitalization actually had little long-term effect on behavioral sequelae. Nevertheless, there were some group differences between the TBI and orthopedically impaired groups and the non-injured group, and the

differences observed during the acute state continued to be evident at six months post-injury. However, because there was not a worsening of behavior at six months post-injury, the authors suggested that one could not expect that any later development of behavioral disorders would be significantly linked to the brain injury.

Children with pre-existing psychiatric disturbances were excluded from analysis in another study of the interaction between injury and psychosocial factors (Anderson et al., 2001). While children from the mild, moderate, and severe TBI groups all showed mean increases in behavior scores, suggesting greater behavioral disturbance, the behavioral profiles of more than 80% of the children remained within the normal range. A greater percentage of children with mild and moderate TBI (12.6 and 10.7%, respectively) exhibited behavioral problems than did those with severe injuries (5%). The authors speculate that those children suffering severe injuries may be less mobile and independent and, as a result, are less likely to demonstrate behaviors such as hyperactivity, impulsivity, or aggression.

Common symptoms reported by caregivers were described by Hooper and colleagues (2004). The sample was large and included 681 children and adolescents with mild, moderate, or severe TBI. Caregivers of these children were interviewed, with questions pertaining to the presence of neurological symptoms, behavioral symptoms, neurocognitive changes, and school-related functioning. Results revealed that neurological, neurocognitive, and behavioral symptoms were more common at 1, 4, and 10 months post-injury in hospitalized patients compared to those treated exclusively in the emergency department. At ten months post-injury, 47% of hospitalized children

continued to exhibit symptoms, compared to 13% of emergency department treated children. Regarding behavioral symptoms, low frustration tolerance was most often reported at all time points for the hospitalized group.

The research of Bloom and colleagues (2001) was designed to assess lifetime psychiatric disorder following pediatric TBI, the development of novel (postinjury onset) psychiatric disorders following TBI, and the sensitivity of parent ratings of behavioral, social, emotional, and cognitive functioning to lifetime and current psychiatric disorder at least one year post-injury. The researchers described 76% of their sample, which included 46 children and adolescents who had suffered a TBI at least one year prior, as having a lifetime psychiatric disorder. Nearly 60% of the sample developed at least one novel psychiatric disorder at some point following their TBI, and approximately three-fourths of these disorders persisted at least one year post-injury. Prior to TBI, the most common disorders were ADHD and anxiety disorders, whereas ADHD and depressive disorders were the most common novel disorders following TBI, with depressive disorders accounting for approximately 25% of novel diagnoses. Whereas novel ADHD disorders were typically persistent, nearly 60% of the mood disorders resolved by one year post-injury. It was noteworthy that severity of TBI did not distinguish the rate of novel disorders, as non-TBI factors contributed to the emergence of disorders following mild injury.

The prevalence of new onset obsessions and compulsions (OCS) following severe childhood TBI, as well as the psychiatric conditions comorbid with OCS were studied using several injury severity, psychosocial, and psychiatric measures along with magnetic

resonance imaging (MRI) (Grados et al., 2008). Broadly, it was found that OCS are common following severe TBI and that new onset OCS one year post-injury occurred at a rate of 29.2% in a sample of children and adolescents aged 6 to 18 referred to a hospital's rehabilitation unit. Of these, 2.8% were diagnosed with obsessive-compulsive disorder (OCD). When compared to rates in a community sample, these rates of occurrence revealed that severe TBI was associated with frequent OCS but not OCD one year following injury. Females were more heavily represented than males in the group of children with TBI and OCS, which is in contrast to epidemiological studies of OCD that cite males and females as displaying symptoms at equivalent rates. Also associated with TBI+OCS in this sample were comorbid anxiety and affective disorders, including separation anxiety disorder (SAD), specific phobia, mania, dysthymia, depressive symptoms, and hyperarousal PTSD symptoms. Thus, the authors stated, the development of OCS following TBI can be considered a risk factor for associated psychiatric comorbidity in post-TBI recovery. In addition, this study provided further convergent evidence of the relationship between orbitofrontal cortex integrity and OCD symptom expression. New onset obsessions were observed with increased mesial prefrontal and temporal lesions, while thalamic lesions predisposed compulsions only in males.

The social problem solving skills of children with moderate or severe TBI were assessed using semi-structured interviews (Hanten et al., 2008). Children with TBI were compared to children suffering orthopedic injuries, and it was found that the TBI group demonstrated poorer social perspective taking and more impulsive and egocentric problem solving strategies from baseline through one year post-injury. Groups did not

differ, however, in their improvement in performance over the one-year period, suggesting that factors other than recovery from brain injury were affecting improvement. Age, gender, IQ, and family resources were found to influence performance, with older females with higher IQ and greater resources performing better. Little correlation was observed between performance and lesion location, number of lesions, and lesion volume; however, this result could be related to the fact that the children in this sample predominantly had diffuse axonal injury as opposed to focal lesions. Diffuse tensor imaging (DTI) revealed that performance may instead be more significantly related to white matter integrity. More specifically, significant relationships were found between the ability to solve social conflicts and coherence of the left and right dorsolateral frontal subregions, brain regions associated with working memory and the manipulation of information. Marginally significant relations were found for the right ventromedial frontal region, right cingulate, and right dorsolateral prefrontal cortex.

The prevalence and correlates of depression following moderate to severe TBI in children between 6 and 12 years of age were examined using child and parent ratings of depressive symptoms (Kirkwood et al., 2000). This study found that, while children with TBI do appear to be at increased risk for depressive symptoms when compared to children with orthopedic injuries, most children with TBI do not exhibit clinically significant levels of depression following their injuries. Ratings of depression were comparable or even more elevated in children with orthopedic injuries soon after injury; however, they showed a significant decline in their symptoms over time. This contrasts with the TBI group, whose reported symptoms remained relatively stable over the first

year following injury. Clinical significance in addition to statistical significance of these group differences was implied given the medium to large effect sizes.

Psychosocial disturbances observed two to five years following injury. Parents of children sustaining mild, moderate, or severe TBI in the United Kingdom completed questionnaires and two interviews in order that patterns of problems children experience following hospital admission could be examined (Hawley, 2003). The moderate to severe TBI group contained 48 children. Of these 48 children, 28% had developed clinically significant anxiety, while an additional 21.9% were borderline cases. In the mild group, which was composed of 49 children, 14.3% had clinically significant anxiety, while 28.6% had borderline symptoms. In general, anxiety was not one of the problems most worrying parents. Depression was even less of a concern for parents, with only four children in the moderate to severe group exhibiting clinically significant depression, and an additional four children with borderline symptoms. Parents did, however, report behavioral and temper problems for approximately 40% and 60%, respectively, of children in both the mild and moderate/severe groups. In fact, 90% of children described by their parents as having behavioral problems scored at the 'significant' level regarding maladaptive behavior.

Psychological and adjustment problems in children with brain injuries have also been compared to survivors of brain tumors (Poggi et al., 2005). The results of this study revealed that, while psychological and behavioral disorders were evident in both groups of children, children with TBI demonstrated the highest degree of impairment in all domains assessed. Both internalizing and externalizing problems were observed in

children with TBI, whereas tumor patients primarily presented with internalizing problems.

The impact of TBI on the domains of behavior thought to reflect day-to-day function has also been addressed (Anderson et al., 2006). The Personality Inventory for Children (PIC) was administered to 117 children whose age at injury ranged from two to seven. Behavioral function, while closely associated with injury severity, was not related to age at injury. Children suffering from severe TBI exhibited elevated and stable externalizing problems and social skills over the 30 months post-injury. In contrast, internalizing problems and impaired cognitive components of behavior continuously increased over time. A more stable pattern was observed in children with moderate TBI. Specifically, there were smaller increases in mean behavior scores post-injury, and there was little change from 6 to 30 months. Less than 10% of this group exhibited clinically significant behavioral symptoms at any time. Fluctuations in symptoms were again observed in children with mild injuries. The frequency of severe behavior problems doubled from pre-injury to six months, and this elevated frequency remained stable to 30 months post-injury. The problems experienced at six months primarily included internalizing disorders, which the authors speculated was the result of postconcussional symptoms or posttraumatic stress disorder (PTSD). Despite the differences between groups, an increase in behavior problems was observed in all groups by 30 months post-injury. More specifically, clinically significant behavior problems were identified in 20% of the total sample. Fifty-two percent of this group was children with severe TBI, compared with 36% from the moderate group and 12% from the mild group.

Massagli and colleagues (2004) reported that children with mild injuries who are hospitalized likely represent a more severely injured group and so may not be representative of all children with mild TBI. Examined in this study were the incidence and risk of psychiatric illness in each of the first three years following mild TBI. The sample included children receiving outpatient, emergency department, and inpatient treatment. In their analyses, these researchers considered pre-injury psychiatric illnesses and controlled for medical comorbidity and found that psychiatric illnesses were common in the first three years post-injury, occurring in 26% of those with no prior psychiatric history. Incidence was highest in the first year. In particular, the relative risk of hyperactivity was high in the first year post-injury, although occurring in only 3% of children with no pre-injury psychiatric illness. A cause and effect relationship between brain injury and the development of hyperactivity was actually suggested, based on the observation that the significant increase in the incidence of hyperactivity was only found in those with no prior psychiatric illness and was significant only in the first year following TBI. Following the first year post-injury, the incidence of hyperactivity declined; however, prevalence increased, providing evidence for the persistence of the disorder. Finally, in those with prior disorders, novel psychiatric illnesses were observed; in fact, pre-injury psychiatric illness seemed to be a greater risk factor than mild TBI in predicting post-injury psychiatric illness.

Another study (Doherty & McCusker, 2005) investigated the strengths and difficulties experienced by children four years post-injury. The sample assessed included 19 children who had suffered severe head injuries. The total score for 47% of these

children fell within the abnormal range on a brief behavioral screening questionnaire, which measured attributes such as emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior. Further, 61% met the criterion for abnormal on at least one of the subscales, with emotional difficulties emerging as the most problematic area and prosocial behavior emerging as the scale on which children earned the highest scores.

An examination into whether social problem solving skills were predictive of social functioning was accomplished using a semi-structured interview and parent ratings of behavior (Janusz et al., 2002). Compared with children who had sustained orthopedic injuries, children who had sustained severe TBI between the ages of 6 and 12 demonstrated less developmentally advanced social problem solving four years post-injury. Deficits were apparent in situations in which they had to choose a specific strategy and evaluate its effectiveness. The strategies chosen by children with TBI were less developmentally mature, and they relied on less mature reasoning in their assessment of outcomes. Children with TBI were similar to children with orthopedic injuries, however, when it came to defining conflictual social situations and generating alternative solutions to those conflicts. These observations led the authors to suggest that the social problem solving deficits in children with TBI encompass a variety of situations but only involve specific dimensions of social problem solving. Further, a relatively robust yet specific relationship between social problem solving skills and outcomes was found. Specifically, the developmental level of children's preferred strategies to social problems predicted

parent ratings of children's social skills, peer relationships, aggressive behavior, and academic performance.

Rates, risk factors, and correlates of long-term post-injury onset behavior problems were examined in a sample of 84 children with moderate or severe TBI (Schwartz et al., 2003). Compared to a group of orthopedically impaired children, the TBI group had increased rates of behavior problems, even after controlling for pre-injury behavior problems and sociodemographic factors. Behavior disorders emerging post-injury were found to emerge soon after injury and, once present, did not resolve and were correlated with poorer school and adaptive outcomes and greater family distress and burden.

Ganesalingam and colleagues (2006, 2007) examined the impact of childhood TBI on self-regulation and social and behavioral functioning using a sample of uninjured children as well as children who had suffered from moderate to severe TBI. Children were assessed two to five years following injury, and, when compared to the uninjured group, children with TBI more often engaged in externalizing behaviors such as defiance, temper tantrums, destructiveness, and restlessness. In addition, they had difficulty initiating friendships, giving compliments, requesting help, and helping others. Regarding self-regulation, children with TBI demonstrated greater deficits in the cognitive, emotional, and behavioral domains. In other words, they were more impulsive, easily distracted, less attentive, less emotionally aware, and less empathic. In addition, they did not display situationally appropriate affect as often, and their negative affect was poorly regulated, as evidenced by mood swings, flat affect, and socially inappropriate emotional

expressions. Children with TBI also displayed decreased capacity to delay immediate gratification in that they were more likely to focus on the reward and less likely to engage in effective distraction strategies such as looking away from the reward. Finally, these behavioral observations were similar for both the moderate and severe TBI groups (Ganesalingam et al., 2006).

A follow-up study (Ganesalingam et al., 2007) found that the three self-regulation variables mediated the relationship between pediatric TBI and social and behavioral functioning. More specifically, emotional self-regulation was the strongest and most consistent mediator and predicted various aspects of social and behavioral outcomes. Based on this evidence, the authors speculated that emotional self-regulation may be a core deficit in those children who exhibit social and behavioral difficulties after TBI. Measures of cognitive and behavioral self-regulation, on the other hand, did not consistently mediate the relationship between childhood TBI and social and behavioral functioning.

In a study of 69 students aged 10 to 22 who had attended a community-based education and neurorehabilitation center, law-violating acts were found to be common sequelae of TBI (Luiselli, Arons, Marchese, Potoczny-Gray, & Rossi, 2000). Nearly one-third of this sample of children and adolescents with TBI committed law-violating offenses exclusively post-injury. Theft and physical assault were the two most frequently occurring behaviors. Associated with these violations were gender, with males committing more violations than females; age, with adolescents aged 13 to 18 committing 80% of the violations; and alcohol and substance use, a factor in 29.2% of

incidences. Interestingly, 50% of the participants committed their offenses during their enrollment at the center. This reveals that law-violating behavior is likely to be encountered despite the level of supervision and monitoring available in a comprehensive service-delivery center.

Lifetime psychosocial disturbances. Finally, the long-term effects of pediatric mild TBI have also been investigated (Hessen, Anderson, & Nestvold, 2008). In this study, it was found that specific TBI variables, including skull fracture with a combination of post-traumatic amnesia (PTA) longer than 30 minutes and pathological EEG within 24 hours, were associated with significantly elevated MMPI-2 subscales 23 years following initial injury. The subscales found to be elevated most often included those measuring somatic complaints, fatigue, worry about health problems, and negative experience of work capability. Interestingly, no other pre- or post-injury risk factors or postconcussional symptoms could explain these results.

Other Influences on Psychosocial Functioning in Children with Traumatic Brain Injury

While it has been found that behavior problems occur at an excessive rate in children with TBI, the challenge has been to determine for which children the behavior problems are a direct effect of the brain injury. Asarnow and colleagues (Asarnow, Satz, Light, Lewis, & Neumann, 1991) suggest five alternative mechanisms besides the direct effect between brain injury and behavior problems that may be operating to functionally link the two. These include: (a) pre-morbid behavior problems may contribute to the child's risk for incurring the injury, (b) the brain injury may exacerbate a pre-morbid behavior problem, (c) the post-injury behavior problem may be an immediate secondary

effect of the accident, as in PTSD, (d) the post-injury behavior may be a long-term secondary effect of the accident, as when cognitive and other impairments result in frustration, which, in turn, results in conduct problems, and (e) the post-injury behavior may be the result of factors other than the head injury.

Support for and contradictions to these alternatives can be found scattered throughout the literature. For instance, pre-injury behavior was investigated by Olsson and colleagues (Olsson, Le Brocque, Kenardy, Anderson, & Spence, 2008), and they found the pre-injury behavior of children with TBI to be an unlikely influence on their involvement in high or low risk accidents. However, they did discover differences between the pre-injury behaviors of children with and without TBI when the behavior of children involved in high risk accidents was compared to the general population. Specifically, those children involved in high risk accidents had higher levels of externalizing problems, somatic complaints, thought problems, and aggression. The pre-injury behavior of children involved in low risk accidents, on the other hand, was not different from the general population. Other studies have confirmed that 'accident prone', restless, inattentive, and impulsive children are at higher risk for engaging in dangerous behavior and, subsequently, head injuries (Hawley, 2003; Schachar et al., 2004).

In addition to the mechanisms proposed by Asarnow and colleagues (1991), other factors have also been proposed to mediate the relationship between brain injury and post-injury behavior problems. For instance, researchers have found that family dysfunction and fewer family resources result in poorer social competence and more social problems, respectively, in children with severe TBI (Yeates et al., 2004). The

influence of the family environment, a variable that encompassed occupational status, annual family income, and maternal education, affected change primarily over the short term, from 6 to 12 months post-injury. In children with severe TBI, social competence was observed to decline, while, in children with moderate TBI, only those with poorer family functioning showed similar declines. There was little evidence of recovery following the first year post-injury. Other factors negatively influencing social competence included non-White ethnicity, lower SES, and poorer premorbid social competence.

Reciprocal influences between child behavior and family sequelae were observed over time post-injury (Taylor et al., 2001). In particular, more child behavior problems at six months post-injury predicted higher family burden and parent psychological distress at twelve months post-injury. In addition, higher parent distress at six months was associated with more child behavior problems at twelve months. These bi-directional influences are indicative of a negative spiral, where the initial impact of TBI on the child's behavior negatively influences family adjustment, and these problems with family adjustment, in turn, make it difficult for the family to deal effectively with the child's behavior. Alternatively, positive parent-child interactions can result in healthier initial family outcomes, followed by fewer residual child behavior problems. In comparison to children with orthopedic injuries, children with TBI had more behavior problems and higher family burden and distress at follow-up. Further, behavior problems decreased from 6 to 12 months for children with orthopedic injuries but not for children with TBI.

Observational evidence also reveals that parent-child interactions can be affected in both positive and negative directions within the initial months following TBI (Wade et al., 2008). Negatively, lower levels of warm responsiveness suggest adverse changes in parent-child interactions, while more frequent parental scaffolds indicate positive adaptation to the child's injury. Results have been extended to younger children aged three to six as well (Stancin, Wade, Walz, Yeates, & Taylor, 2008). Parents of these younger children reported greater injury-related stress, greater stress associated with the child's recovery, greater psychological distress, and more depressive symptoms than did parents of children with orthopedic injuries. Injury burden and distress were impacted by chronic life stresses and interpersonal resources; thus, these influences may be more important to family adaptation than the nature or severity of the injury. Also impacting elevated burden and distress were the use of denial and other avoidant coping strategies, as well as the child's age at time of injury. These authors suggested that changes in family functioning, such as family stress or maternal depression, that occur shortly after injury likely reflect a response to the injury. Alternatively, those family changes that develop over a longer period of time may occur in response to changes in the child's cognition or behavior arising from the injury.

Finally, SES has exerted a significant influence on behavioral sequelae. For instance, socioeconomic disadvantage has been associated with slower short-term progress in socialization skills (Taylor et al., 2002) and child reports of depressive symptoms (Kirkwood et al., 2000). Researchers have suggested that parents from disadvantaged environments may have limited resources to invest in efforts to improve

the child's recovery, or they may be burdened by other stressors that distract them from these efforts (Taylor et al., 2002). Therefore, a "double hazard" seems to exist, whereby, when TBI is combined with low SES, increased behavioral sequelae is observed. In contrast, this pattern was not detected where only severity or social disadvantage was present (Anderson et al., 2006).

Assessment and Diagnosis of Psychosocial Functioning in Children with TBI

The Diagnostic and Statistical Manual, Fourth Edition (DSM-IV) category of Mental Disorders Due to a General Medical Condition has been recommended as the most comprehensive manner of linking etiology, diagnosis, and treatment, as well as tracking, monitoring, and remaining consistent with the primary neuropsychological etiology of the behavioral problems (Patrick, Rice, & Hostler, 2002). The term *general medical condition* refers to conditions coded on Axis III that are listed outside the "Mental Disorders" chapter of the International Classification of Diseases (APA, 1994). The child's conduct and mental status will be better understood and addressed when the primary medical status, in this case, TBI, is kept in mind (Patrick et al.). In fact, as the child's recovery progresses, this will become even more important since it becomes more likely that the relationship between the child's behavioral presentation and comorbid medical factors will become less apparent and not as appreciated as a current influence on the child's presenting problems. Finally, a basis for intervention can be identified, and the medical condition that is affecting the child's mental status can be addressed. As a result, treatment can be more focused.

As is evident in the previous sections, a descriptive approach to the assessment of personality change in children following head injury has been central, primarily due to the lack of scales available for this purpose (Bond, 1990). Bond describes the Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1962), which was designed to assess behavioral disturbances in adult patients one year following brain injury. In 1987, Levin and colleagues developed a new instrument, a neurobehavioral rating scale (NRS), which retained some of the subscales of the BPRS and which could be used to monitor the process of recovery and change. Four principal components could be assessed, including cognition/energy, metacognition, somatic concern/anxiety, and language. These scales, however, were developed for assessing adult patients. A variety of assessment measures have been used to measure psychosocial sequelae in children and adolescents, including semi-structured interviews, self-report measures, and parent-completed inventories and questionnaires. Regarding semi-structured interviews, the Diagnostic Interview for Children and Adolescents – Revised (DICA-R; Herjanic & Reich, 1982; Reich, 2000) and Interpersonal Negotiation Strategies Interview (INS; Yeates, Schultz, & Selman, 1990) have been used, as well as interview schedules specifically developed for the particular study (Hawley, 2003; Hooper et al., 2004). Children and adolescents have also been asked to complete paper and pencil self-report measures, including the Children's Depression Inventory (CDI; Kovacs, 1992), the Inventory of Depressive Symptomatology (Rush et al., 1986; Rush, Guillon, Basco, Jarrett, & Trivedi, 1996), and the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). On occasion, the teacher's perspective has been solicited. Scales used for this purpose have included the

Sutter-Eyberg Student Behavior Inventory – Revised (SESBI-R; Funderburk & Eyberg, 1989), Social Skills Rating Scale (SSRS; Gresham & Elliot, 1990), and the Achenbach Teacher Report Form (TRF; Achenbach, 1991b).

Most often, however, parent reports are gathered in order to assess a child's psychosocial functioning. Inventories and questionnaires completed by parents in such studies have included the Personality Inventory for Children – Revised (PIC-R; Wirt et al., 1990), the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), the Eyberg Child Behavior Inventory (ECBI; Eyberg & Robinson, 1983), the Social Skills Rating Scale (SSRS; Gresham & Elliot, 1990), the Rowe Behavioral Rating Inventory (Rowe & Rowe, 1992), the Vineland Adaptive Behavior Scale (VABS; Sparrow, Balla, & Cicchetti, 1984), Achenbach's Child Behavior Checklist (CBCL; Achenbach, 1991a), the Problem Resolution Scale (Stilwell, Hawley, & Stilwell, 1998; Stilwell, Stilwell, Hawley, & Davies, 1999), the Attention Deficit Disorders Evaluation Scale (ADDES; McCarney, 1995), and the Conners (Conners, 1997). In addition to these rating scales, parents have been interviewed using many of the same interview schedules listed above as being used with children.

However, as can be seen, none of the rating scales used is designed to be specific to the childhood TBI population. Attempts have been made to apply general behavior rating scales to the childhood TBI population by composing a typology of psychosocial status in children and adolescents with TBI. This research has been completed using two of the scales listed above: the CBCL (Hayman-Abello et al., 2003) and the PIC-R (Butler et al., 1997). The CBCL study (Hayman-Abello et al.) used Q-type factor analysis to

analyze data gathered from 92 adolescents with TBI aged 12 to 18 years. Four subtypes were identified and labeled according to their most prominent features: normal, attention, delinquent, and withdrawn-somatic. The largest percentage of the sample fell within the normal subtype (50%), followed by attention (22%), delinquent (16%), and withdrawn-somatic (12%). Mean normalized total *T*-scores within each subtype were also calculated in order to provide an indication of overall profile elevation for each subtype. These were then compared to Achenbach's (1991a) normative data using the profiles for the nonreferred and referred sample groups. The mean normalized *T*-scores for the TBI sample were higher on all four subtypes than those obtained for children in the nonreferred sample but were lower than the mean scores obtained for children in the clinical sample. Thus, parents of children with TBI observed more behavior problems than parents of nonreferred children but these problems did not represent pathological psychosocial functioning. The only exception was the mean normalized *T*-score for the somatic subtype, which more closely resembled that of the clinical group.

Similar findings were observed in the study using the PIC-R (Butler et al., 1997). For this study, data from 128 children and adolescents were analyzed using four hierarchical agglomerative clustering methods. Interpretation of these analyses suggested the presence of seven subtypes, which were again labeled based on the major feature of each profile. The seven subtypes generated, along with the percentage of the sample falling into that subtype were as follows: normal (27%), cognitive deficit (17%), somatic concern (12%), mild anxiety (12%), internalized psychopathology (7%), antisocial (11%), and social isolation (13%). Further analysis was completed in order to determine

the relationship of injury severity (mild, moderate, and severe) with psychosocial functioning. It was found that those children suffering more severe injuries did not exhibit the more severely disturbed psychosocial subtypes, in particular the internalized psychopathology and antisocial subtypes, in disproportionate amounts. However, there were proportionately more severely injured children in the social isolation subtype and more mildly and moderately injured children in the cognitive deficit subtype. In addition, the normal and antisocial subtypes contained proportionately more moderately injured children, and the somatic concern subtype contained proportionately more moderately and severely injured children. Equal numbers of children comprised the mild anxiety and internalized psychopathology subtypes.

Butler and colleagues (1997) also examined the relationships between psychosocial functioning and both age at injury and time since injury. A one-way ANOVA with post hoc pair-wise comparisons using Fisher's least significant difference method (LSD) revealed a significant effect of age at injury, with younger children more likely to be included in the social isolation, cognitive deficit, and mild anxiety subtypes. More specifically, age at injury was greater for the antisocial subtype than the mild anxiety, cognitive deficit, and social isolation subtypes; age at injury was greater for the normal subtype than the cognitive deficit and social isolation subtypes; and age at injury was greater for the somatic concern subtype than the social isolation subtype. For time since injury, Fisher's LSD method was again used to examine differences between group means. This analysis revealed that children with a longer time since injury were more

likely to be assigned to the social isolation subtype than the antisocial and normal subtypes. No other significant differences between group means were found.

Rationale and Purpose of the Current Study

To date, these are the only two studies that have attempted to identify profiles of psychosocial functioning of children and adolescents with TBI using widely used, general behavior rating scales. However, the CBCL and PIC-R, the rating scales used in these studies, have various limitations. Although the CBCL has been revised, the original edition will be described here since it was the measure used in the study profiling psychosocial functioning. A reviewer in the most recent Mental Measurements Yearbook (2009) states that the CBCL is "unquestionably the most well articulated and well established" research and descriptive tool of its kind. The measurements provided by the CBCL are endorsed and validated by hundreds of researchers, and the CBCL is considered the standard in the field of child psychopathology against which the validity of other instruments is often measured. Nevertheless, the scale does have limitations. First of all, the scale was published in 1991, with normative data collected in 1989 (Achenbach, 1991a). Further, the normative population had certain issues. For instance, the criteria used to distinguish the referred and nonreferred samples created a sample that was somewhat more behaviorally adjusted than the United States population; thus, children who may have had significant problems but had not yet received professional attention may have been excluded. In addition, the referred sample underrepresented the Western and Southwestern regions of the United States and was predominantly White (17th Mental Measurements Yearbook, 2009). Inter-parent agreement coefficients were

modest at .66, and the reliability of the thought problems syndrome scale was inadequate, likely because of its subjective scoring procedures due to the requirement that the administrator clarify parent responses. Finally, there were some problems with item intelligibility for some of the interview items, duplication of items across some scales, and minor misalignments with the DSM-IV diagnostic categories. According to a Mental Measurements Yearbook reviewer, the CBCL identified extreme behavioral and emotional problems better than moderate or mild problems due to its insensitivity to the transition from normal to moderate problems (17th Mental Measurements Yearbook).

The PIC-R also suffered from various limitations. The PIC-2 resolves many of these issues; however, the limitations of the PIC-R are described here since it was the scale used in the study directly related to the current proposed study. Limitations of the PIC-R were related to geographically restricted composition of the standardization sample and lower internal consistency coefficients and interrater (mother-father) agreement. In addition, it was quite cumbersome in that it was composed of 600 items that at times included awkward wording due to frequent use of double negatives (17th Mental Measurements Yearbook, 2009).

In addition to the CBCL and PIC-2, another widely used, general behavior rating scale, the Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) exists. When compared to the CBCL, the BASC-2 possesses similar reliabilities; however, the BASC-2 is more closely linked to diagnostic definitions of behavioral disturbances because it was developed to be used as a clinical assessment tool. The empirical validity research of the BASC-2 is not nearly as extensive as that of the

CBCL, yet, because the BASC-2 is designed to be used clinically, it remains that information regarding the existence and delineation of the characteristics of psychosocial problems in children suffering from TBI based on assessment using the BASC-2 would be helpful to clinicians and, thus, represents research that is important to complete. Further, the research on psychosocial profiles in children with TBI was completed using scales that have since been updated and revised. Thus, this study using the BASC-2 would provide data using a measure that includes current normative data.

Assessment of psychosocial outcomes following pediatric TBI cannot be taken at face value, however. As has been argued in this chapter, the outcomes associated with brain injury in childhood are dependent upon developmental factors. Specifically, Taylor and Alden (1997) report that outcomes vary along three dimensions: the age of the child and the time of insult, the amount of time that has passed since the insult occurred, and the child's age at the time of outcome assessment. Regarding age at injury, children with later injuries have demonstrated the best recovery (Anderson, Catroppa, Morse, Haritou, & Rosenfeld, 2005). Regarding time since injury, research cited earlier in this chapter has demonstrated that, over time, social functioning may become more divergent from that of peers' given any number of negative changes in peer interactions and relationships. Deficits in social information processing as a result of the TBI can work to create a negative impact on the child's peer group and adults. As children are consistently identified as behaving in these negative ways, the evaluations of their peers become increasingly negative, thus engendering a downward spiral leading to chronic social problems that may become difficult to reverse (Coie, 1990). In addition, time since injury

is important to consider given the finding that children generally display the most rapid improvement soon after the injury, with recovery proving to be more gradual in the long-term (Yeates et al., 2002). Finally, age at testing has been the focus of the least amount of research (Yeates et al., 2007). Nevertheless, the effects of age at testing could be observed in a child's failure to meet new developmental milestones as a result of a brain injury (Yeates et al., 2007). In addition, Eslinger and colleagues (Eslinger, Grattan, Damasio, & Damasio, 1992) demonstrated in a case study the phenomenon of "growing into a lesion." In this case, the most disabling cognitive and social consequences were not the most immediate. Instead, social impairment became increasingly evident during early adolescence, three to five years following the injury.

Thus, the focus of this project was to provide parallel research to the studies already completed using the CBCL and PIC-R. The purpose of this study was to develop a BASC -2 based psychosocial profile of children with TBI and compare the derived BASC-2 profiles with known CBCL and PIC-R profiles as well as with the established BASC-2 clinical profiles. In addition the study attempts to determine what, if any, relationship there might be between psychosocial outcome and variables such as gender, time elapsed since injury, age at injury, and age at testing. As mentioned above, this research is important because the BASC-2 is used in clinical, school, and hospital settings. Children who have suffered TBI may be evaluated in these settings due to the psychosocial difficulties they are experiencing, and a research base from which to draw upon and use for comparison would be helpful in these situations. In addition, by using

the BASC-2 as the instrument of choice, this project will contribute to the relatively small quantity of literature that currently exists using this measure.

CHAPTER III

METHOD

This chapter provides a description of the method by which this study was conducted. Information is provided regarding the population from which data was gathered, the measures that were used to assess psychosocial functioning in this population, and the statistical analyses that were completed in order to answer the research questions.

Research Participants

Participants were selected from a database maintained at a pediatric hospital in a large urban city providing treatment and rehabilitation for children and adolescents with TBI. The database included demographic information and neuropsychological test battery scores for children admitted to this hospital. Demographic information available included assessment number (e.g., initial assessment, second assessment), gender, ethnicity, age, handedness, diagnosis, time since injury, type of head injury (i.e., open or closed head injury), cause of injury (e.g., motor vehicle accident, fall, bicycle accident), whether or not the child was restrained in a motor vehicle accident, and Glascow Coma Scale score. The severity of injury as measured by the GCS was not, however, available for each participant. The database was created by reviewing the paperwork, reports, and protocols included in the neuropsychologist's working folder, and a GCS score was not always reported. At times, this was the result of the child transferring to this hospital for

rehabilitation from another local or out-of-state hospital. In such cases, the original medical records were simply not available for entry into the database. Children and adolescents with a wide range of neurological and neuropsychological disorders were included in this database (e.g., anoxia, stroke, ADHD); however, only those children suffering a TBI were included in this study.

Participants were excluded from the current study if a Behavior Assessment System for Children, Second Edition Parent Report Scale (BASC-2 PRS) – Child or BASC-2 PRS – Adolescent had not been completed as a part of their comprehensive neuropsychological test battery. In other words, only those patients aged 6-0 to 21-11 were considered for inclusion, since these are the age ranges assessed by the child and adolescent BASC-2 PRS forms. Information was also gathered regarding gender, age at which participants sustained the TBI, chronological age at the time of the neuropsychological assessment, and time interval between the injury and the assessment.

The final sample consisted of 91 children and adolescents (62 males, 29 females) between the ages of 6 years, 2 months and 20 years, 2 months at the time of neuropsychological assessment (M = 13.43, SD = 3.55). Ethnic composition of the group was primarily Caucasian (76.1%). Other ethnicities represented in the sample included African American (12.5%) and Hispanic (11.4%). Regarding time elapsed since injury, most participants had experienced their TBI 6 to 12 months prior to assessment (52.2%). For 21.1% of the sample, 13 to 24 months had elapsed since their injury, and for 22.2% of the sample, more than 24 months had elapsed since their injury. Only 4.4% were assessed at a point less than six months following their injury. A Glascow Coma Scale

score was available for 47 of the participants. Within this subgroup, GCS scores ranged from 3 to 13 ($M = 6.3$, $SD = 2.97$).

Measures

The Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) is a widely used, multidimensional, multimethod system designed to facilitate differential diagnosis and educational classification of a variety of emotional and behavioral disorders in children. It is multidimensional in that it measures both positive, or adaptive, and negative, or clinical, aspects of behavior. It is multimethod in that it has five components, which can be used individually or in combination. These components include two rating scales, one for teachers and one for parents or caregivers; a self-report scale; a Structured Developmental History form; and a form for recording and classifying directly observed classroom behavior.

The BASC-2 applies a triangulation method for gathering information by analyzing information from three different perspectives. A Self-Report of Personality is available for children and adolescents aged 6-0 through 21-11 to complete. A Teacher Rating Scale completed by a child's or adolescent's teacher, a Student Observation System, and a portable observation program are available to gather information from the school setting. Finally, a Parent Rating Scale, Structured Developmental History, and Parenting Relationship Questionnaire are available for parents to complete in order to provide information regarding the child's behavior in the home and community settings, background information on the child, and information regarding parental relationships. Only the Parent Rating Scale (PRS) was examined for the current study. Parents or

caregivers can complete any one of three forms, depending on the child's age: preschool (ages 2-5), child (ages 6-11), or adolescent (age 12-21). Forms can be completed in approximately 10 to 20 minutes using a four-choice response format (A for almost always, O for often, S for sometimes, and N for never). A Spanish version is available, and a fourth-grade reading level is required.

Content

Validity and response set indexes aid in judging the quality of completed forms. Specifically, the F index helps in the identification of test forms that may be unusable due to the tendency to be excessively negative in reporting the child's behaviors. On the PRS, this index is scored by tallying the number of Almost Always and Never responses to items referring to negative and positive behaviors, respectively. Two other indexes are provided to detect patterned or random responding. A high Consistency index highlights a case in which the respondent has provided different responses to items that are typically answered similarly. The Response Pattern index, on the other hand, detects repeated and cyclical reporting.

Various adaptive and clinical scales are available to measure both adaptive and problem behaviors. On the PRS, scores for the following adaptive and clinical scales are calculated: Activities of Daily Living, Adaptability, Aggression, Anxiety, Attention Problems, Atypicality, Conduct Problems (child and adolescent forms only), Depression, Functional Communication, Hyperactivity, Leadership (child and adolescent forms only), Social Skills, Somatization, and Withdrawal. Because the child and adolescent PRS forms include identical scales, only these forms were analyzed.

The PRS child and adolescent adaptive and clinical scales also comprise four broader composite scales: Internalizing Problems, Externalizing Problems, Behavioral Symptoms Index, and Adaptive Skills. In addition to the adaptive and clinical scales, seven content scales are generated. These include Anger Control, Bullying, Developmental Social Disorders, Emotional Self-Control, Executive Functioning, Negative Emotionality, and Resiliency. These are supplemental scales calculated in order to provide additional information for conceptualization of childhood problems.

Analyses for the present study included consideration of only the clinical scales. The adaptive scales were eliminated from the analysis for several reasons: (a) the adaptive scales measure positive or desirable traits rather than problem areas; (b) adaptive skills are impacted by secondary medical issues (e.g., physical disabilities), and independent living skills may not be validly assessed in a child who has spent much of the time preceding assessment in a hospital; and (c) this study parallels other studies (Butler et al., 1997; Hayman-Abello et al., 2003) using the CBCL and PIC, neither of which include scales measuring adaptive skills. The composite scales were eliminated from the analyses since they are aggregates of the clinical and adaptive scales. Therefore, any analyses performed with them would be duplicating data already in the analysis. Thus, only the clinical scales were included in the final analyses.

The PRS clinical scales on the child and adolescent forms measure maladaptive behaviors, with higher scores representing negative or undesirable characteristics that result in impaired functioning in home or community settings and/or peer relationships. Internalizing scales include Anxiety, Depression, and Somatization. The Anxiety scale

measures characteristics of anxiety, including excessive worry, fears and phobias, self-deprecation, and nervousness. The Depression scale assesses characteristics of depression, including dysphoric mood, suicidal ideation, social withdrawal, and self-reproach. Items assessing somatization address physical symptoms that cannot be attributed to a physical cause or to generally poor physical health. This scale assesses a child's level of sensitivity to and tendency to complain about relatively minor physical problems.

Externalizing scales include Hyperactivity, Aggression, and Conduct Problems. The Hyperactivity scale measures aspects of ADHD related to hyperactivity, including fiddling with things, interrupting others, being overly active, and exhibiting poor self-control. Verbal and physical aggression are measured on the Aggression scale with items related to arguing, name-calling, verbally threatening, destroying others' property, and hitting others. The Conduct Problems scale measures socially deviant and disruptive behaviors such as cheating in school, truancy, and running away from home.

The final three clinical scales include Attention Problems, Atypicality, and Withdrawal. The Attention Problems scale, in conjunction with the Hyperactivity scale, can be used to assess characteristics of ADHD. The Attention Problems scale measures those symptoms of ADHD related to the inability to maintain attention and become easily distracted from the task at hand. Items included in the Atypicality scale measure a child's connectedness and awareness of his or her surroundings, behaviors that are considered odd or strange, and other common markers for more serious psychotic tendencies.

Finally, the Withdrawal scale measures the tendency to avoid social interaction, as well as the child's level of interest in making social contact.

Scoring

The rater responds to items about observed behaviors by answering N for never, S for sometimes, O for often, or A for almost always. Items are then scored according to the scale to which they belong. Responses of N, S, O, or A correspond to scores of 0, 1, 2, or 3, respectively. Points for a particular scale are summed, resulting in a raw score. This raw score is then converted to two types of normative scores, T scores and percentiles. For the BASC-2 clinical scales, elevations above the mean indicate an increased likelihood of significant psychopathology. A normalized T score less than 60 is considered to be within the normal range and suggests that the child does not display behaviors measured by that scale any more often than others his or her age. T scores between 60 and 69 fall in the designated at-risk range, which indicates the presence of a significant problem that might require treatment but may not be severe enough to warrant a formal diagnosis. T scores of 70 and above fall in the clinically significant classification range and represent a high level of maladaptive behavior. The second type of normative score provided for each scale is a percentile. Unlike the T score, which describes the distance from the mean, the percentile describes the rarity of the characteristic. Each BASC-2 scale has a unique distribution shape, which means that the relationship between the T score and percentile varies somewhat between scales.

The examiner is offered a choice of general or clinical norm samples from which to score each profile. Further, the clinical sample is subdivided into additional diagnostic

categories for ages 6 through 18, including learning disability and ADHD. The examiner is also provided the choice of combined sex and separate sex norms. For this study, general, combined sex norms were used when scoring. Items for which no answer or more than one answers have been marked by the respondent are unscorable, and an excess of these unscorable items can undermine the validity of the score generated for the scale to which it applies. Therefore, if there are more than two unscorable items for any given scale, the scale and any composite scale to which the scale belongs are rendered unscorable as well. For this study, if any participant's line of scores was missing a clinical scale score, the participant's scores were eliminated from further analysis.

Development

The BASC-2 was developed in order to improve upon the original BASC (Reynolds & Kamphaus, 1992). Specifically, the authors worked to increase the consistency of items between the TRS and PRS forms and among the different age groupings while still maintaining sensitivity to the different settings and age levels, which is the hallmark of the triangulation method of data collection described above. An effort was also made to rewrite test items that had lower than desirable reliabilities and to add new test items to those scales exhibiting lower reliabilities. Several new scales related to adaptive behavior were also added to the PRS and TRS. More significant changes were made to the SRP due to its lower reliabilities and more restricted normative distributions.

Final item selection and scale definition for the BASC-2 was determined using covariance structure analysis, or confirmatory factor analysis, to ensure reliability, distinctiveness, and interpretability. In addition, two methods were used to assess

possible bias based on sex and ethnicity since an individual's perceptions can affect the manner in which they respond to a particular item, thus obscuring measurement of the underlying dimension. Item bias was assessed for females versus males, African Americans versus non-Hispanics, and Hispanics versus non-Hispanics, and items were removed if evidence of item bias was revealed. An analysis of the readability of items was also completed in order that the reading level could be kept as low as possible. Items were measured using the Flesch-Kincaid Reading Index, and, on the PRS, items were found to be written at an early grade four level.

For the PRS, validity indexes, including the F index, Consistency index, and Response Pattern index, were developed in order to assess the veracity of a respondent's responses. The F index, which measures excessive negativity, was formed by selecting item responses that were chosen very infrequently in the item development samples. The Consistency and Response Pattern indexes assess different aspect of random responding. The Consistency index was constructed by identifying item pairs with high correlations, while the Response Pattern index is a tally of the number of times an item response differs from the response to the previous item.

Standardization and Norms Development

General norms for the BASC-2 were collected from a large, representative sample of children across the United States. Children were sampled from a variety of settings, including public and private schools, mental health clinics and hospitals, and preschools and daycares. Overall, more than 375 sites were sampled in 257 cities and 40 states. Using United States population estimates from the March 2001 Current Population

Survey, the authors of the BASC-2 took care to match their sample with respect to sex, socioeconomic status based on parental education, race/ethnicity, geographic region, and classification in special education or gifted and talented programs. For the child and adolescent PRS forms, this goal was largely achieved, with very few differences between the general norm sample and the U.S. population estimates. The only difference was in the prevalence of emotional/behavioral disturbance or speech/language impairment in general education classrooms, for which there was a slight overrepresentation in the general norm sample. The authors also made an effort to overlap as much as possible the norm samples for the TRS, PRS, and SRP so that scores would be comparable. For the PRS, only one parent was asked to complete the form during data collection. A total of 3600 complete (i.e., less than ten percent of their items unscorable and responses for two or less items missing for any single scale) child and adolescent PRS forms were collected. An equal number of male and female children were sampled at each age grouping in the general norm sample, and an attempt was made to include approximately equal numbers of children at each year of age within each age grouping.

As mentioned previously, a clinical norm group is also available, which examiners can use in addition to or instead of the general norm group. Although the general norm group was used in the current study, a brief overview of the standardization of the clinical norm group is offered here. The clinical norm group was composed of children aged 4 through 18 identified as having been diagnosed or classified with one or more emotional, behavioral, or physical problems, including specific learning disability (LD), speech/language impairment, mental retardation or developmental delay,

emotional/behavioral disturbance, ADHD, and pervasive developmental disorders. Distinct profiles were noted for the LD and ADHD groups; therefore, specific norms were calculated for each of these subgroups as well. Because these groups are a subset of the general population, the clinical norm groups were not demographically matched to the U.S. population.

During norms development, analyses were performed to determine whether age groupings and separate sex norms were justified. These analyses confirmed that the age groupings used on the BASC (Reynolds & Kamphaus, 1992) could be retained and that separate sex norms in addition to the combined sex norms should be offered as an alternate scoring method. Consistent and statistically significant sex differences were found on many of the scales and composites. On the TRS and PRS, females tended to be rated higher than males on Adaptability, Social Skills, and Functional Communication, while males tended to be rated higher on Hyperactivity, Aggression, Atypicality, and Attention Problems.

Reliability and Validity

Internal consistency, test-retest reliability, interrater reliability, scale factor structure, correlations with other instruments, and score profiles of clinical groups were assessed for the TRS, PRS, and SRP. This section will focus on the technical information about the PRS since this is the form that was used in this study.

Internal consistency reliabilities were calculated for the combined, female, and male subgroups of the general norm sample, as well as for the LD and ADHD clinical subsamples. For the general norm sample, scale reliabilities were high, although slightly

lower than for the TRS. Values for the child age group ranged from .83 to .87, while values for the adolescent age group ranged from .83 to .86. Scales with the highest reliabilities across age groups were Hyperactivity, Attention Problems, Social Skills, and Functional Communication. The lowest reliability was observed on the Activities of Daily Living scale. Scale reliabilities for the clinical norm samples were higher, particularly on the Hyperactivity, Aggression, and Activities of Daily Living scales. Overall, internal consistency reliabilities were quite consistent between females and males, between clinical and nonclinical groups, and at different age levels, demonstrating the scales' effectiveness at measuring their behavioral dimensions. The standard error of measurement (SEM) is based on internal consistency reliabilities and represents how much error is associated with any observed score. Those scales with higher reliabilities will have smaller SEMs. For individual scales on the PRS, the median SEM is about four T-score points.

In order to assess test-retest reliability, an interval of 9 to 70 days between ratings was used. PRS individual scale test-retest reliabilities, corrected for range restriction, ranged from .65 to .87 on the child form and from .75 to .88 on the adolescent form, with reliability highest for the Conduct Problems scale on both forms. Somatization on the child form and Hyperactivity, Withdrawal, and Adaptability at the adolescent level demonstrated the lowest test-retest reliabilities.

Interrater reliability was also assessed. For the PRS, children in each age group were rated by two different parents or caregivers within a range of 0 to 70 days. Following adjustment for restriction of range, median interrater reliabilities for the child

and adolescent forms were .69 and .77, respectively. The fact that these reliabilities are lower is not unexpected, given that the settings in which different raters observe a child vary and a child often behaves differently in the presence of different raters. For the clinical scales, the highest interrater reliabilities were for the Withdrawal scale on the child form and the Conduct Problems scale on the adolescent form. The lowest reliabilities were seen on the Aggression and Somatization scales of the child form and the Somatization scale on the adolescent form.

Scale intercorrelations were calculated as a measure of how well each scale is measuring the dimensions it was designed to measure. The known distinction between clinical behaviors and adaptive skills was confirmed, as evidenced by positive correlations within the clinical scales and adaptive scales and negative correlations between the clinical and adaptive scales. Although the correlation between the Anxiety scale and three of the adaptive scales (Social Skills, Activities of Daily Living, and Functional Communication) was positive, this correlation was so slight that the conclusion can be made that essentially no relationship exists between the Anxiety scale and these adaptive scales. Across all age groupings on the PRS, the highest intercorrelations were observed among the scales measuring externalizing behaviors (Hyperactivity, Aggression, and Conduct Problems), as well as attention problems and atypicality.

Two types of factor analysis were used in order to validate the construct of the composites as well as the scales themselves. Scales that demonstrate high intercorrelations are said to measure a common dimension, which, in turn, results in the

formation of a composite scale and score. Covariance structure analysis (CSA) began with a model based on the factor structure of the original BASC PRS with the new scales added to the adaptive skills factor. Modifications to this factor structure were made only if substantial statistical improvements were evident. In all, three modifications were made to the starting model. First, a secondary loading of the Attention Problems scale was added to the Adaptive Skills factor; second, a secondary loading of the Anxiety scale was added to the Adaptive Skills factor; and third, a secondary loading of the Adaptability scale was added to the Internalizing Problems factor. This final change was most effective for the preschool and adolescent age groupings and only marginally effective for the child age group. High loadings were observed for all the PRS scales loading on the Externalizing Problems composite. For the Internalizing Problems composite, the Anxiety, Depression, and Atypicality scales loaded most heavily, with Somatization and Withdrawal contributing less. Finally, the Social Skills, Leadership, Activities of Daily Living, and Functional Communication scales contributed most to the Adaptive Skills composite, with the Adaptability scale contributing to a lesser degree.

Next, oblique and orthogonal rotations within principal-axis factor analysis were completed. Across age groupings, similar three- and four-factor solutions were observed for both rotations, and these results generally were in agreement with the results gained using CSA, with the exception of some additional secondary loadings. The principal-axis analyses revealed an Externalizing Problems factor composed of Hyperactivity, Aggression, Conduct Problems, and, to a lesser degree, Depression, Atypicality, Attention Problems, and Adaptability. The Internalizing Problems factor was defined by

the Anxiety, Depression, and Atypicality scales, with more moderate loadings for Somatization, Withdrawal, and Adaptability. The highest loadings for the Adaptive Skills factor were for the Social Skills, Leadership, Activities of Daily Living, and Functional Communication scales. Lower loadings were observed for Adaptability, Attention Problems, and Withdrawal.

External validity was assessed by correlating BASC-2 PRS scores with other behavior rating scales, including the Achenbach System of Empirically Based Assessment (ASEBA) Child Behavior Checklist (Achenbach & Rescorla, 2000), the Conners' Parent Rating Scale – Revised (CPRS-R; Conners, 1997), the Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000), and the original BASC PRS (Reynolds & Kamphaus, 1992). For the BASC-2 PRS and ASEBA, high correlations were often observed for similarly named composites and scales. For instance, correlations adjusted for restriction of range between the PRS Behavioral Symptoms Index (BSI) and the ASEBA Total Problems score ranged from .73 to .84; correlations between both rating scales' Externalizing Problems scores ranged from .74 to .83; and correlations between both rating scales' Internalizing Problems scales ranged from .65 to .75. Correlations observed at the scale level were also observed to be at a moderate to high level.

Correlations between the PRS and CPRS-R were generally higher among the child sample than the adolescent sample, yielding overall correlations within the moderate to high range. One exception, however, is the correlation for the relationship between Anxiety scales, which was .41 in the child sample and .35 in the adolescent

sample. The PRS authors explain that the two scales seem to be assessing slightly different aspects of anxiety, with the PRS focusing on general nervousness, fear, and worry, and the CPRS-R focusing on emotionality, withdrawal, and timidity.

Overall, correlations between the PRS and BRIEF scales were moderate to high. Correlations between the BRIEF's Global Executive Composite and the PRS Externalizing Problems composite and BSI ranged from .58 to .67 for the child age group and .80 to .86 for the adolescent group. The PRS clinical and adaptive scales demonstrating the highest correlations with the BRIEF were Hyperactivity, Atypicality, Attention Problems, Adaptability, and Functional Communication.

Finally, comparisons between the BASC-2 and the original BASC were made. In general, it was found that mean scale scores on the BASC-2 were zero to three T-score points higher than those on the BASC. Correlations between the two rating scales were high, with most at .90 or higher. Lower correlations were observed most often on those scales where more item changes were made. The lowest correlation observed was .73.

Mean scale score profiles were derived in order to better understand the behavioral strengths and deficits of children and adolescents identified with behavioral or emotional problems. Profiles for the following groups were developed: ADHD, bipolar disorder, depression disorders, emotional/behavioral disturbance (EBD), hearing impairment, LD, mental retardation or developmental delay, motor impairment, pervasive developmental disorders, and speech or language disorder. The profiles developed for the ADHD, bipolar disorder, depression disorders, and EBD will be discussed here since these disorders are of greater interest in terms of this study.

The EBD and ADHD profiles were found to be quite similar to each other. For the ADHD group, the highest average scale scores were observed on the Hyperactivity and Attention Problems scales. Both scores fell within the at-risk range. The scores comprising the profile for the EBD group were, in general, higher than those for the ADHD group, with the highest scores observed on the Hyperactivity, Aggression, Conduct Problems, Depression, and Atypicality scales. Scores on several adaptive scales also fell within the at-risk range, including Adaptability, Leadership, Activities of Daily Living, and Functional Communication. Some of the highest scores were found on the profiles for the bipolar and depression groups with scores for many of the clinical scales falling within the clinically significant range. Because of the small sample size of these groups, the authors advise that caution should be exercised when interpreting these profiles.

Relationships among the PRS, TRS, and SRP

The triangulation method of data collection assumes that the expression of behaviors varies among settings, and, therefore, behaviors are perceived differently by the individuals in each setting. On the other hand, if a behavior is observed in one setting, the likelihood exists that it could be observed in another setting as well. As a result, it is important to understand the similarities and differences among the components of the BASC-2 in terms of the correlations between scales across the PRS, TRS, and SRP.

When comparing the PRS and TRS, correlations between scales measuring the same construct are, on average, larger than those between scales measuring different constructs. Of the clinical scales on the child form, correlations between scales measuring

the same construct range from a high of .52 on the Attention Problems scale to a low of .20 on the Anxiety scale. Correlations between scales measuring different constructs range from a high of .43 (observed between the PRS Hyperactivity and TRS Attention Problems scales, the TRS Hyperactivity and PRS Attention Problems scales, and the TRS Learning Problems and PRS Attention Problems scales) to a low of -.07 (observed between the PRS Anxiety and TRS Conduct Problems and Hyperactivity scales). Of the clinical scales on the adolescent form, correlations between scales measuring the same construct range from a high of .49 on the Conduct Problems scale to a low of .29 on the Anxiety and Atypicality scales. Correlations between scales measuring different constructs range from a high of .47 (observed between the PRS Conduct Problems and TRS Aggression scales) and a low of .02 (observed between the PRS Anxiety and TRS Conduct Problems scales). For all scales except for three, the correlations between the scales measuring the same constructs are higher than the correlations among the scales measuring different constructs. On the child scale, there is a stronger correlation between the TRS Aggression scale and the PRS Conduct Problems scale ($r = .40$) than between the TRS and PRS Aggression scales ($r = .38$). On the adolescent scale this same pattern is observed, with the correlation for the TRS Aggression and PRS Conduct Problems scales ($r = .47$) higher than the correlation between the TRS and PRS Aggression scales ($r = .44$). In addition, on the adolescent scale, the TRS Atypicality scale correlation is stronger with the PRS Hyperactivity scale ($r = .30$) than with the PRS Atypicality scale ($r = .29$). In general, the authors state that these data support the convergent and discriminant

validity of the BASC-2 scales and that the correlation between parent and teacher ratings strengthens as the child's age increases.

The relationship between the SRP and the behavior ratings provided by parents and teachers is less straightforward. Few of the SRP scales are found on the PRS and TRS; therefore, it follows that fewer similar scale comparisons can be made. Overall, the SRP scales correlate only moderately with parent ratings and even less so with teacher ratings, giving the impression that a child's self-report provides unique information. The validity of the SRP is supported, however, based on the expected negative correlation between adaptive and clinical scales and the positive correlations between those scales that are similar among forms.

Other Research Using the BASC-2

The BASC-2 is a widely used clinical assessment tool. Because it was designed to be and primarily functions as a clinical assessment tool, it has not been as widely used as a research tool. In addition, much of the research conducted using the BASC-2 has been completed within the context of dissertations, leaving much of the BASC-2 research unpublished. In fact, only three published studies using the BASC-2 PRS were located. Both teacher and parent ratings on the BASC-2 were used to support the convergent and divergent validity of the Devereux Student Strengths Assessment (Nickerson & Fishman, 2009). In addition, teachers and parents completed their respective BASC-2 forms in order that behavioral profiles in children with epilepsy could be determined (Titus, Kanive, Sanders, & Blackburn, 2008). Finally, parent ratings were used to determine

whether children suffering from migraine headaches and resulting sleep disturbance have greater behavioral problems (Heng & Wirrell, 2006).

In her review of the BASC-2, Tan (2007) concluded that the instrument is a comprehensive assessment tool that provides reliable and valid data. She also supported its use in educational assessments, while at the same time recommending that assessors remain aware of the limitations of the instrument, especially when making important educational decisions about individual students. Reviews in the *Mental Measurements Yearbook* (2009) emphasized the impressive psychometric properties of the BASC-2 PRS and claimed that these are the instrument's greatest strengths. Other strengths include the standardization norms, the inclusion of validity scales, and the careful blending of both problematic and adaptive behaviors. One reviewer agreed with Tan that other measures besides the BASC-2 should be used when making diagnostic decisions since, while the rating scales provide good information regarding external and self-report measures of behavior, the Student Observation System (SOS) and Structured Developmental History (SDH) are obvious weaknesses of the multimethod and multidimensional assessment system. Other reviewers further emphasized the need for repeated measurements of a child's behavior given the response to intervention requirements of the new Individuals with Disabilities Education Improvement Act (2004) and state that the BASC-2 may not be particularly useful for treatment planning. The modest correlations between the PRS and TRS are also implicated as a limitation.

Data Analysis

Subtype Generation by Cluster Analysis

The primary purpose of this study was to group participants based on the similarity of their BASC-2 profiles; therefore, profiles for all participants using all nine of the BASC-2 clinical scales (i.e., Aggression, Anxiety, Attention Problems, Atypicality, Conduct Problems, Depression, Hyperactivity, Somatization, and Withdrawal) were subjected to agglomerative hierarchical cluster analyses. Broadly, agglomerative hierarchical methods begin with the most specific objects and build larger and larger nested clusters in a step-by-step fashion. More specifically, beginning with all, or *n*, objects included in the analysis, the two most similar objects form the first cluster. More and more individuals or groups are merged step-by-step for *n*-1 steps until all subjects are recombined into a single group and a full tree structure is formed (Borgen & Barnett, 1987). This treelike system provides information regarding both specific and general clusters and their relative relation to each other. Because *n*-1 to 1 final clusters are formed, the number of clusters in the final solution is not specified, which allows the researcher to consider alternate classifications with different numbers of groups. A final characteristic of hierarchical methods is that they are noniterative. In other words, once a grouping has occurred at any given step, it is fixed and will not be reconfigured at a later step (Borgen & Barnett).

Whenever multivariate subtyping techniques are applied, even to random data, groups of subjects will always be produced. Therefore, it is important to determine the validity of the subtypes generated through cluster analysis by replicating subtypes either

across different samples from the same population or across different subtyping techniques (Borgen & Barnett, 1987; Fuerst, Risk, & Rourke, 1989). The latter method was employed in this study, as correspondence between the cluster analysis derived subtypes provides good evidence for the reliability of results.

A preliminary run using UPGMA and Ward's methods was completed with no limits placed on the number of clusters that should be included in the solution. However, these two methods did not produce cluster solutions that demonstrated good agreement with one another; therefore, a broader, more exploratory, approach to the analysis was undertaken. In SPSS, the following hierarchical cluster methods are available: between-groups linkage (also called UPGMA), within-groups linkage (also referred to as "average linkage within groups"), nearest neighbor or "single linkage" method, furthest neighbor or "complete linkage" method, centroid clustering (also called the "weighted pair-group method using centroid averages or WPGMC), median clustering (also called the "unweighted pair-group method using centroid averages or UPGMC), and Ward's method. To take full advantage of an exploratory approach, cluster analyses were run using each of these methods using the Euclidean distance as the interval measure. Since squared Euclidean distance is preferred over simple Euclidean distance as the distance measure for the centroid, median, and Ward's methods, a second run using squared Euclidean distance was completed for these three methods. In addition, with these exploratory analyses, limits were placed on the minimum and maximum number of subtypes to be included in each solution. Given the seven-subtype solution derived in the Butler and colleagues (1992) study, which the current study is intended to parallel, a

minimum of two and a maximum of seven clusters were specified. Thus, two-, three-, four-, five-, six-, and seven-cluster solutions were run and analyzed for each of the hierarchical cluster methods mentioned above. A decision regarding the most reliable and parsimonious solution was made based on the results of these analyses.

To determine statistical differences between clusters in the final solution, a repeated measures MANOVA was calculated. Mean normalized total T scores within each subtype were obtained to provide an indication of overall profile elevation for each psychosocial subtype. These mean normalized T scores served as the repeated measures dependent variables in the MANOVA, with the psychosocial subtypes serving as the between subjects factors. Pairwise comparisons were calculated to determine which BASC-2 subscales were statistically higher than others within each factor.

Validation of the Cluster Solution

To validate any cluster solution, it is important to compare the resulting subtypes on variables that were not included in the original clustering process. Variables including gender, age at injury, months elapsed since injury, and age at testing were examined for this purpose. Chi-square analyses were conducted for gender, ethnicity, and months elapsed since injury because of their categorical nature. Months elapsed since injury were initially coded based on the following four categories: less than 6 months, 6-12 months, 13-24 months, and greater than 24 months. However, some cells contained a count less than five; therefore, the four categories were collapsed into the following two categories: less than or equal to 12 months and greater than 12 months. Analysis of variance was calculated for age at injury, age at testing, and GCS given their continuous nature.

Relationship to Known Subtypes

Visual inspection was used in order to compare the subtypes derived in this study with subtypes derived in the Butler and colleagues (1997) and Hayman-Abello and colleagues (2003) studies. In addition, the subtypes derived in this study were statistically compared to the BASC-2 clinical sample profiles, as reported in the BASC-2 manual (Reynolds & Kamphaus, 2004). Each BASC-2 subscale mean was compared to the subscale mean derived in the current study using one-sample *t*-tests. It should be noted that, since clinical profiles in the BASC-2 manual are provided separately for children and adolescents, the sample in this study was divided accordingly prior to statistical analysis.

Conclusion

This study was designed to parallel existing research regarding subtypes of psychosocial functioning in children with traumatic brain injury and to address some of the limitations of these existing studies by using a recently normed, widely used general behavior rating scale. The BASC-2 was chosen because it is closely linked to diagnostic definitions of behavioral disturbances and was designed to be used as a clinical assessment tool. Because it was designed to be used as a clinical assessment tool, the research literature includes few studies using the BASC-2; however, research is certainly necessary given its widespread use. Clinicians working with the pediatric traumatic brain injured population would benefit from information regarding the existence and delineation of the characteristics of psychosocial problems in this unique population.

Thus, the overarching purpose of this study was to develop a BASC-2 based psychosocial profile of children with TBI. This was accomplished by subjecting each participant's clinical scale profile to agglomerative hierarchical cluster analyses. Validation of the final solution was completed by answering the following questions:

1. How do these derived BASC-2 profiles compare to known CBCL and PIC-R profiles? This was accomplished by visually comparing the subtypes derived in these analyses with the subtypes derived in the Butler and colleagues (1997) and Hayman-Abello and colleagues (2003) studies.
2. How do these derived BASC-2 profiles compare to known BASC-2 clinical profiles? One-sample *t*-tests were used to compare the subtypes derived in these analyses with the BASC-2 clinical sample profiles, as reported in the BASC-2 manual (Reynolds & Kamphaus, 2004).
3. What is the relationship between psychosocial outcome and variables such as gender, time elapsed since injury, age at injury, and age at testing? Chi-square analyses were conducted for gender and months elapsed since injury because of their categorical nature, and an analysis of variance was used with age given its continuous nature.

CHAPTER IV

RESULTS

This chapter summarizes the results of the statistical analyses that were performed. Descriptive statistics regarding the study's population are provided. In subsequent sections, the various psychosocial cluster solutions derived via cluster analysis are explored, including the differences between subtypes based on various psychosocial variables. Finally, validity of the subtype analysis was determined by describing the current subtype analyses' relationship to known subtypes and other variables such as injury severity, age at injury, time since injury, age at assessment, and gender.

Descriptive Statistics

The current sample included 91 children and adolescents. Characteristics of the participants in terms of gender, ethnicity, time elapsed since injury, age at assessment, age at injury, and GCS score are reported in Table 1.

Means and standard deviations for the BASC-2 PRS variables are reported in Table 2. It should be noted that scores obtained from the BASC-2 PRS are T-scores with a mean of 50 and standard deviation of 10. *T*-scores between 41 and 59 are considered Average. Scores in the At-Risk range are between 60 and 69 while scores in the Clinically Significant range are 70 and above. All means reported in Table 2 fell within the Average range.

Table 1

Sample Frequencies and Descriptives

Variable	*n*	%	*M*	*SD*	Range
Gender	91				
Male	62	68.1			
Female	29	31.9			
Ethnicity	88				
Caucasian	67	73.6			
African American	11	12.1			
Hispanic	10	11.0			
Time since injury	90				
<6 months	4	4.4			
6-12 months	47	51.6			
13-24 months	19	20.9			
>24 months	20	22.0			
Age at testing	91		13.43	3.55	6.17-20.17
Age at injury	90		11.76	4.00	2.25-18.50
GCS score	47		6.30	2.97	3.00-13.00

Table 2

Means and Standard Deviations across BASC-2 PRS Variables

Variable	*M*	*SD*	Range
Hyperactivity	57.31	13.64	37-93
Aggression	55.73	12.94	36-87
Conduct Problems	53.37	13.37	34-99
Anxiety	52.38	14.06	30-88
Depression	58.70	15.90	39-109
Somatization	51.05	13.14	35-100
Atypicality	57.89	14.50	40-114
Withdrawal	51.29	11.05	35-85
Attention Problems	57.36	10.45	36-84

Psychosocial Subtype Derivation

Cluster analysis was completed in an attempt to identify homogeneous subgroups in this population of children with TBI. As described previously, analyses using UPGMA and Ward's methods were attempted initially; however, there was not good agreement between the solutions derived using these methods. Therefore, a variety of agglomerative hierarchical techniques were explored in an effort to arrive at a more parsimonious solution. Two common methods used to establish the reliability of hierarchical techniques include replication of the subtypes in a different sample from the same population or

replication using different subtyping techniques. Establishing internal reliability becomes especially important in exploratory studies using multivariate subtyping techniques since the structure of the data set is unknown or poorly understood. As this was the case in this study, a decision was made to establish internal reliability by replicating the derived cluster solution using additional clustering techniques. Inspection of the results of these exploratory analyses as well as cross-tabulations between each pair of analyses revealed best results with the Ward's and centroid methods using the squared Euclidean distance as the distance criterion for grouping cases. Briefly, Ward's method was designed to minimize the variance within clusters at each stage of grouping. This method merges single subjects or groups of subjects that result in the least increase in the within-groups sum of squares (or error sum of squares) (Borgen & Barnett, 1987). With the centroid method, clusters are merged at each stage based on the smallest sum of distances between cluster means (centroids) for all variables in the cluster. The centroid method also weights for differences in cluster size. Agreement between the solutions derived from these two methods was good, and, thus, these solutions were retained.

Examination of the cluster solutions using these methods suggested the presence of two subtypes. Descriptive labels were assigned by this researcher to each subtype based on the major features of the profile: Normal and Pervasive Emotional Difficulties. It should be noted that the initial sample was screened for outliers, and two subjects consistently emerged as outliers. However, they were not judged to be extreme outliers and, when cluster analyses were run a second time without these subjects included,

results remained the same. Therefore, the subjects were not deleted from the sample, as they seemed to be statistical but not clinical outliers.

Agreement between the two methods on the two-cluster solution was good, with only two cases being differentially placed when comparing the results generated from both methods. Rand's statistic was 0.98, demonstrating that these two subtypes were replicated with excellent accuracy by the two clustering techniques. (For Rand's statistic, a value of 0.0 indicates purely chance agreement, while 1.0 indicates complete agreement.) Although both Ward's and centroid methods produced highly similar solutions, Ward's method maximizes between-group differences and minimizes within-group distances and is preferred by some researchers for this reason (Borgen & Barnett 1987). Therefore, the solution using Ward's method was selected for the purpose of reporting results. Psychosocial subtype characteristics are displayed in Table 3. For each of the two subtypes, mean BASC-2 scores on all nine scales were calculated to obtain the profiles presented in Figure 1. Review of the means across these subtypes aided in delineating the differentiating factors between subtypes.

Normal Subtype

The profile for the Normal subtype did not contain any clinically significant or at-risk level score elevations. In other words, no score fell within the range of scores equal to or greater than 60*T*. Parents of children in this subtype did not express undue concern about their child's psychosocial functioning. This subtype was the largest, accounting for 86% of the sample.

Table 3

Demographic Characteristics of Participants by Psychosocial Subtype

	Cluster	
	Normal	PED
n	78	13
Gender (%)		
Female	32.1	30.8
Male	67.9	69.2
Ethnicity (%)		
Caucasian	76.3	75.0
African American	11.8	16.7
Hispanic	11.8	8.3
Age at Assessment		
M	13.6	12.4
SD	3.4	4.2
Age at Injury		
M	11.9	11.2
SD	4.0	4.2

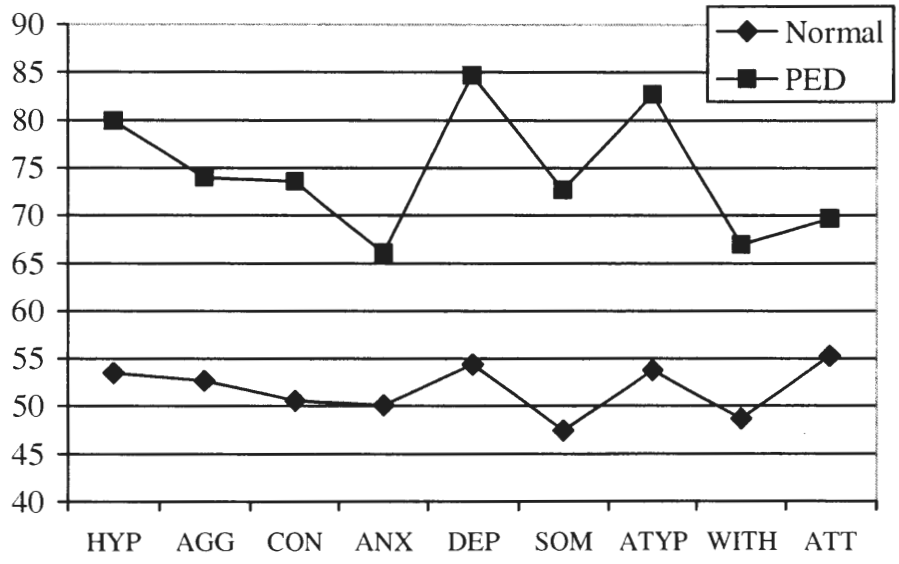

Figure 1. Mean BASC-2 profiles for the two-cluster solution. HYP – Hyperactivity; AGG = Aggression; CON = Conduct; ANX = Anxiety; DEP = Depression; SOM = Somatization; ATYP = Atypicality; WITH = Withdrawal; ATT = Attention Problems.

Pervasive Emotional Difficulties Subtype

This profile was characterized by clinically significant elevations on all subscales except for Anxiety, Withdrawal, and Attention Problems. Scores on these three subscales fell within the at-risk range. Children falling within this subtype appear to have significant difficulties with externalizing behavioral control as well as symptoms related to depression. In addition, these children behave in ways that are often viewed by others as being strange or odd. As a result, these children may not interact or integrate well with other children in the school setting and may require specialized assistance regarding

management of acting out behaviors and depressive symptoms. This subtype accounted for 14% of the sample.

Further Subtype Analysis

Although the two-cluster solution appeared most parsimonious, the analyses using Ward's method retained their integrity throughout the three-, four-, and five-cluster solutions. The drawback to retaining a three-, four-, or five-cluster solution using Ward's method in place of the two-cluster solution is that none of the other clustering techniques provided support in the form of replicability. For example, Rand's statistic fell to 0.57, 0.55, and 0.34 for the three-, four-, and five-cluster solutions, respectively, when Ward's method and centroid clustering technique results were compared. While each of these statistics indicates better than chance results (Milligan & Cooper, 1986), they do not suggest good agreement between cluster solutions. An external criterion such as Rand's statistic is necessary to evaluate the degree of similarity between two partitions of the same data. Milligan and Cooper (1986) suggested a value of 0.9 for the Rand statistic in order to reflect good similarity between cluster structures; therefore, it can be deduced that these cluster solutions have produced solutions that are less similar and may represent agreement due to chance. This is especially evident when these values of Rand are compared to the 0.98 value achieved for the two-cluster solution.

Because valuable information of clinical significance could be lost otherwise, the subtypes composing the three-, four-, and five-cluster solutions are described below. For each of the three-, four-, and five-cluster solutions, mean BASC-2 scores on all nine scales were calculated to obtain the profiles presented in Figures 2, 3, and 4. It should be

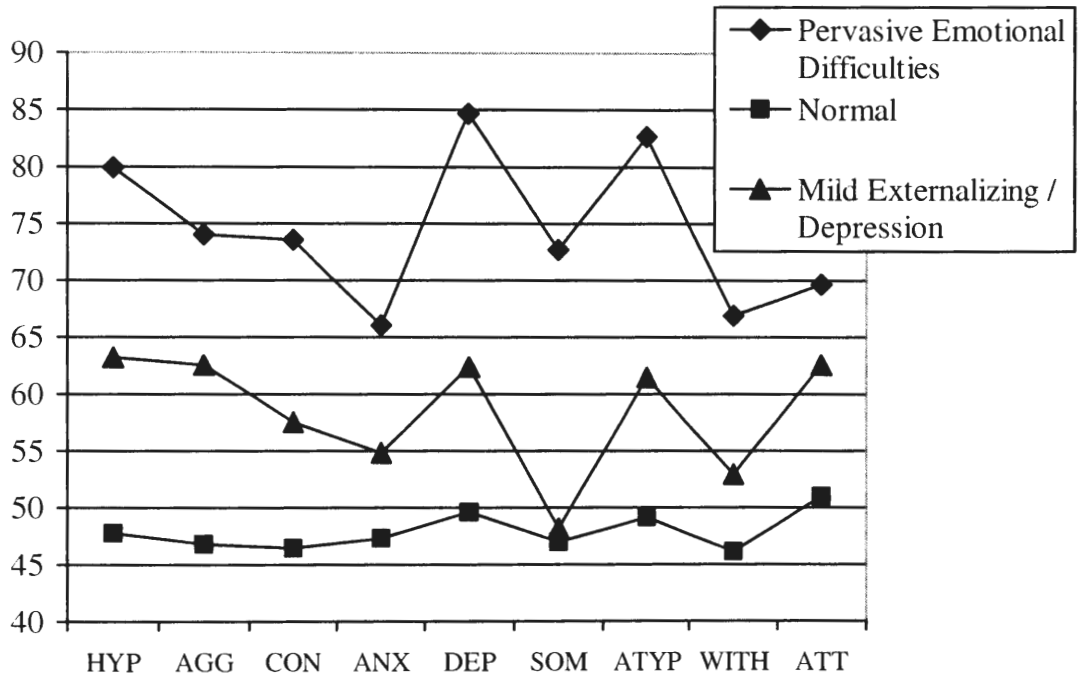

Figure 2. Mean BASC-2 profiles for the three-cluster solution. HYP – Hyperactivity; AGG = Aggression; CON = Conduct; ANX = Anxiety; DEP = Depression; SOM = Somatization; ATYP = Atypicality; WITH = Withdrawal; ATT = Attention Problems.

subtype accounted for 32% of the sample; within the five-cluster solution, it accounted for 16% of the sample.

noted that the Normal and Pervasive Emotional Difficulties subtypes were retained virtually unchanged throughout each of the cluster solutions. Within the three-cluster solution, another subtype was differentiated and labeled Mild Externalizing/Depression. Within the four-cluster solution, the acting out and depressive symptoms were further differentiated, resulting in two separate clusters, Mild Externalizing/Attention Problems and Mild Depression. Within the five-cluster solution, the Mild Externalizing/Attention

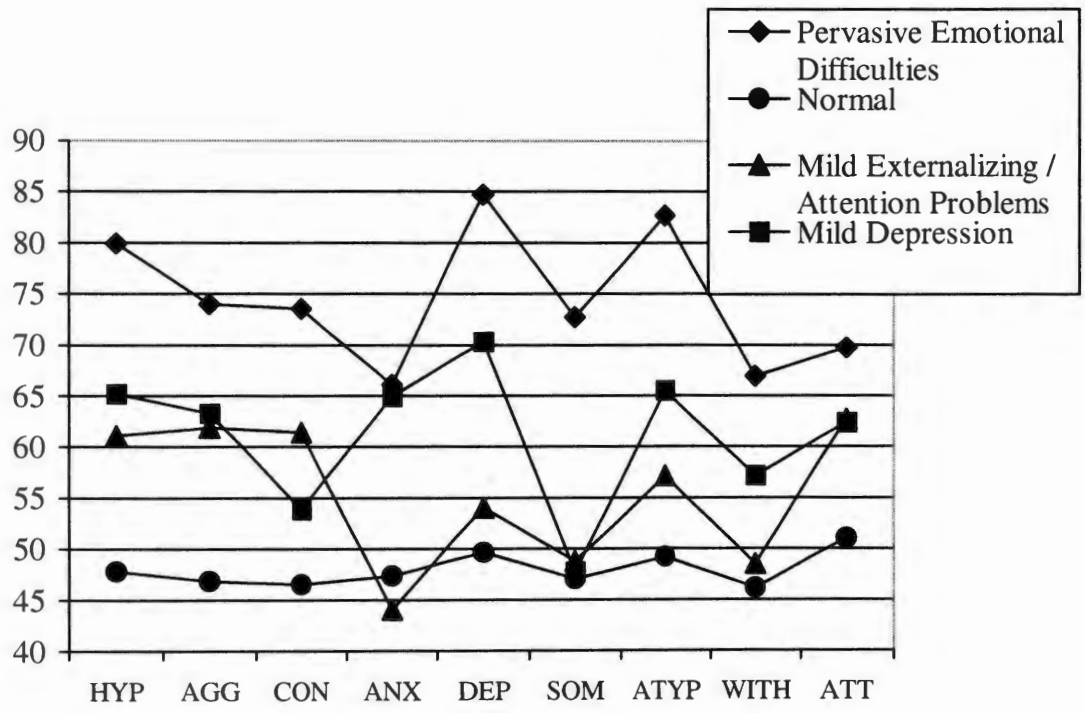

Figure 3. Mean BASC-2 profiles for the four-cluster solution. HYP – Hyperactivity; AGG = Aggression; CON = Conduct; ANX = Anxiety; DEP = Depression; SOM = Somatization; ATYP = Atypicality; WITH = Withdrawal; ATT = Attention Problems.

Problems subtype was retained; however, the depressive symptoms again emerged as coexisting with mild acting out in the Mild Externalizing/Depression subtype. Finally, the fifth subtype was characterized by scores exclusively within the normal range; however, this subtype was differentiated from the Normal subtype in that scores for Anxiety and Somatization were higher. Subtypes emerging in the three-, four-, and five-cluster solutions are described in the following sections.

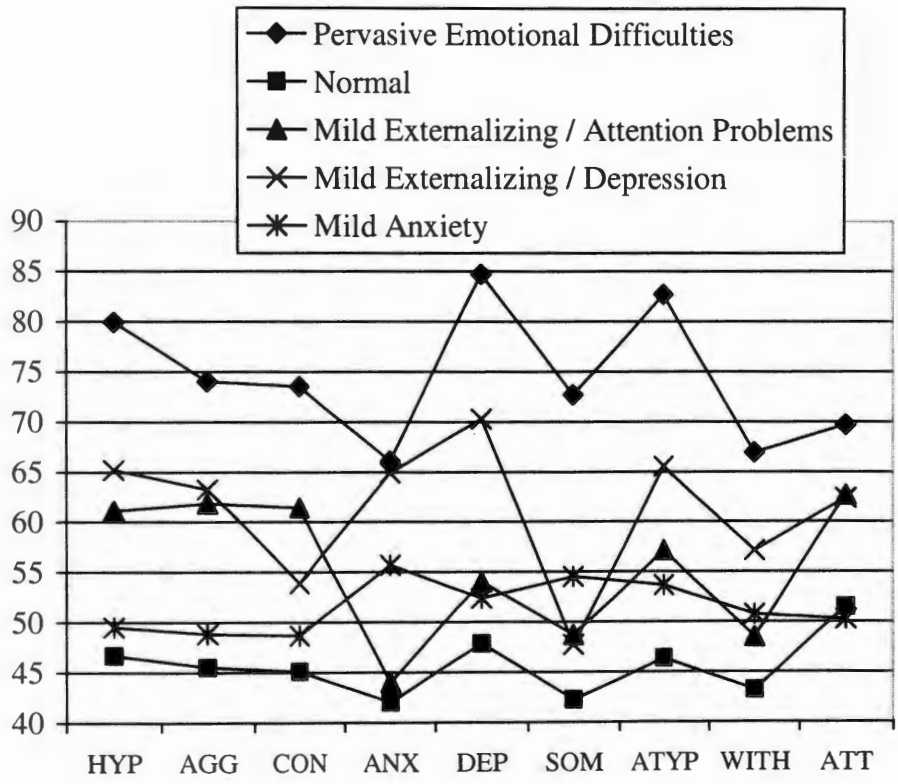

Figure 4. Mean BASC-2 profiles for the five-cluster solution. HYP – Hyperactivity; AGG = Aggression; CON = Conduct; ANX = Anxiety; DEP = Depression; SOM = Somatization; ATYP = Atypicality; WITH = Withdrawal; ATT = Attention Problems.

Mild Externalizing/Depression Subtype

This subtype had a mean BASC-2 profile with at-risk level elevations on the Hyperactivity, Aggression, Depression, Atypicality, and Attention subscales. In the five-cluster solution, the mean score for the Depression subscale reached the clinically significant level. Children in this subtype are likely to suffer from relatively severe problems with depression, along with difficulties with inattention and externalizing

behaviors. Within the three-cluster solution, this subtype accounted for 32% of the sample; within the five-cluster solution, it accounted for 16% of the sample.

Mild Externalizing/Attention Problems Subtype

This subtype had a mean BASC-2 profile with at-risk level elevations on the Hyperactivity, Aggression, Conduct, and Attention Problems subscales. The behavioral characteristics of children in this subtype include attention deficits, higher than average motor activity, irresponsibility, impulsiveness, hostility, and argumentativeness. Within both the four- and five-cluster solutions, this subtype included 15% of the sample.

Mild Depression Subtype

This subtype was characterized by a relatively normal BASC-2 profile, with the exception of at-risk level elevations on the Hyperactivity and Atypicality subscales and a single clinically significant elevation on the Depression subscale. Parent descriptions of behavior of children in this subtype included some over-activity along with significant symptoms of depression. This subtype emerged only in the four-cluster solution and accounted for 16% of the sample.

Mild Anxiety Subtype

This subtype was also characterized by a relatively normal BASC-2 profile. However, it was statistically different from the Normal subtype in that the Anxiety and Somatization subscale scores were higher. Thus, these children were described as having more health-related complaints, fearfulness, and worry than some other children with normal profiles, but fewer than would be needed for careful monitoring or clinical

attention. This subtype only emerged in the five-cluster solution and comprised 21% of the sample.

Subtype Differences across Psychosocial Variables

Ward's Two-Cluster Solution

A multivariate General Linear Model (GLM) was computed with the BASC-2 subscales as repeated dependent measures (within-subjects factors) and the two psychosocial subtypes derived from the Ward's method cluster analysis serving as the between-subjects factors. Homogeneity of variances/covariances matrices was analyzed to determine if the data met the criteria for univariate or multivariate approaches to the analysis. In this case, a multivariate approach to the data could not be completed due to the violation of the equality of homogeneity of the covariance matrices of the dependent variable as determined by Box's M test, $F(45, 1496.84) = 1.81$, $p < .01$. Therefore, a univariate GLM was undertaken. The assumption of sphericity as tested by Mauchly's Test of Sphericity was not met ($p < .001$). Given this violation of sphericity, the Greenhouse-Geiser epsilon adjustment was applied to the data. Greenhouse-Geiser was chosen because this is considered a conservative adjustment, especially when sample size is low. Using these adjusted values, tests of within-subjects effects showed an overall significant main effect for the BASC-2 PRS subscales across the psychosocial subtypes, $F(5.18, 460.80) = 10.76$, $p < .01$, $\eta^2 = .11$. This was a moderate effect. The interaction of BASC-2 subscales and the psychosocial subtypes was also significant, $F(5.18, 460.80) = 4.71$, $p < .01$, $\eta^2 = .05$, although this constituted a weak effect with only 5% of the variance in the BASC-2 subscales accounted for by the psychosocial subtypes. Because

the interaction was significant, simple effects of each cluster were also examined. Simple effects for both the Normal and PED clusters were also significant, $F(5.61, 432.18) = 9.24$, $p < .01$, $\eta^2 = .11$ for the Normal subtype and $F(3.21, 38.57) = 3.81$, $p < .05$, $\eta^2 = .24$ for the PED subtype.

Univariate between-subjects tests showed that the psychosocial subtypes were significantly related to the BASC-2 subscales, $F(1, 89) = 126.38$, $p < .01$, $\eta^2 = .59$. The effect size was large, with 59% of the variance accounted for in the BASC-2 subscales by the psychosocial subtypes. Table 4 demonstrates the significant differences between the subtypes across the psychosocial variables based on pairwise comparisons ($p < .05$).

Ward's Three-, Four-, and Five-Cluster Solutions

Because clinical significance can be drawn from the less statistically reliable three-, four-, and five-cluster solutions derived using Ward's method, a more detailed analysis of their statistical foundations appears warranted. Multivariate GLM statistics were again computed. In all three cluster solutions, Box's Test of the equality of covariance matrices was significant, indicating that univariate, as opposed to multivariate, approaches were more appropriate. In addition, the assumption of sphericity was violated in all cases; therefore, again, the Greenhouse-Geiser epsilon adjustment was applied. For all three solutions, tests of within-subjects effects showed overall significant main effects for the BASC-2 PRS subscales across the psychosocial subtypes, $F(5.17, 454.89) = 14.37$, $p < .01$, $\eta^2 = .14$ for the three-cluster solution, $F(5.43, 472.22) = 17.61$, $p < .01$, $\eta^2 = .17$ for the four-cluster solution, and $F(5.62, 483.24) = 14.95$, $p < .01$, $\eta^2 =$

Table 4

Means and Standard Deviations for BASC-2 Variables for Psychosocial Subtypes Using Ward's Two-Cluster Solution

	Normal (n = 78) M (SD)	PED (n = 13) M (SD)	Significance
Hyp	53.54 (10.06)	79.92 (10.03)	**
Agg	52.68 (10.79)	74.00 (9.32)	**
Con	50.59 (9.18)	73.54 (17.66)	**
Anx	50.10 (12.24)	66.08 (16.87)	**
Dep	54.37 (11.35)	84.69 (14.69)	**
Som	47.45 (8.23)	72.69 (16.40)	**
Atyp	53.76 (10.04)	82.69 (12.33)	**
Wdw	48.68 (8.35)	66.92 (12.63)	**
Att	55.31 (9.53)	69.69 (6.55)	**

Note. Hyp = Hyperactivity; Agg = Aggression; Con = Conduct Problems; Anx = Anxiety; Dep = Depression; Som = Somatization; Atyp = Atypicality; Wdw = Withdrawal; Att = Attention Problems; PED = Pervasive Emotional Difficulties. Column differences greater than 10.23 for PED and 2.63 for Normal indicate significant subscale differences by group. ** $p < .01$ indicate significant group differences by subscale.

.15 for the five-cluster solution. Effect size was moderate in all cases, with 14%, 17%, and 15% of the variance in the BASC-2 subscales accounted for by the psychosocial subtypes in the three-, four-, and five-cluster solutions, respectively.

The interactions of BASC-2 subscales and the psychosocial subtypes were also significant in each cluster solution, $F(10.34, 454.89) = 5.20$, $p < .01$, $\eta^2 = .11$ for the three-cluster solution, $F(16.28, 472.22) = 6.71$, $p < .01$, $\eta^2 = .19$ for the four-cluster solution, and $F(22.48, 483.24) = 6.25$, $p < .01$, $\eta^2 = .23$ for the five-cluster solution. Effect size increased with each successive cluster solution, reaching almost 25% with the five-cluster solution. Because these interactions were significant, simple effects of each subtype in each solution were also examined. Within the three-cluster solution, the simple effects for each subtype were also significant, $F(5.25, 252.17) = 3.30$, $p < .01$, $\eta^2 = .06$ for the Normal subtype, $F(3.21, 38.57) = 3.81$, $p < .05$, $\eta^2 = .24$ for the PED subtype, and $F(4.84, 135.59) = 9.31$, $p < .01$, $\eta^2 = .25$ for the Mild Externalizing/Depression subtype. Within the four-cluster solution, all simple effects were again significant, $F(5.25, 252.17) = 3.30$, $p < .01$, $\eta^2 = .06$ for the Normal subtype, $F(3.21, 38.57) = 3.81$, $p < .05$, $\eta^2 = .24$ for the PED subtype, $F(3.50, 45.48) = 11.51$, $p < .01$, $\eta^2 = .47$ for the Mild Externalizing/ Attention Problems subtype, and $F(3.94, 55.13) = 8.75$, $p < .01$, $\eta^2 = .39$ for the Mild Depression subtype. Within the five-cluster solution, all simple effects were again significant, $F(5.16, 149.77) = 8.51$, $p < .01$, $\eta^2 = .23$ for the Normal subtype, $F(3.21, 38.57) = 3.81$, $p < .05$, $\eta^2 = .24$ for the PED subtype, $F(3.50, 45.48) = 11.51$, $p < .01$, $\eta^2 = .47$ for the Mild Externalizing/Attention Problems subtype, $F(3.94, 55.13) = 8.75$, $p <$

.01, $\eta^2 = .39$ for the Mild Externalizing/Depression subtype, and $F(5.14, 92.55) = 3.00$, $p < .05$, $\eta^2 = .14$ for the Mild Anxiety subtype. It is interesting to note that the size of the effect of the PED subtype did not change throughout all four cluster solutions, suggesting that this is a statistically stable subtype and that it was the original Normal subtype that was further partialled in order to derive the additional subtypes in the three-, four-, and five-cluster solutions.

Finally, univariate between-subjects tests showed that the psychosocial subtypes in each cluster solution were significantly related to the BASC-2 subscales, $F(2, 88) = 168.37$, $p < .01$, $\eta^2 = .79$ for the three-cluster solution, $F(3, 87) = 129.08$, $p < .01$, $\eta^2 = .82$ for the four-cluster solution, and $F(4, 86) = 131.14$, $p < .01$, $\eta^2 = .86$ for the five-cluster solution. The effect sizes in each case were large. Tables 5, 6, and 7 demonstrate the significant differences between the subtypes across the psychosocial variables based on pairwise comparisons ($p < .05$).

Relationship to Known Subtypes

Visual inspection of Figures 1 through 4 suggested that the subtypes derived in this study appeared somewhat different to subtypes obtained in previous research of children with TBI. Butler and colleagues (1997) using the PIC-R described seven subtypes labeled Normal, Cognitive Deficit, Somatic Concern, Mild Anxiety, Internalized Psychopathology, Antisocial, and Social Isolation. As expected, the Normal subtypes were similar in that these profiles did not contain any clinically significant elevations. In addition, their Normal subtype was the most common, accounting for 27% of their sample. The Cognitive Deficit subtype contained a single elevation on the PIC-R

Table 5

Means and Standard Deviations for BASC-2 Variables for Psychosocial Subtypes Using Ward's Three-Cluster Solution

	Normal (n = 49) *M* (*SD*)	PED (n = 13) *M* (*SD*)	ME/D (n = 29) *M* (*SD*)
Hyp	47.80[a] (6.53)	79.92[b] (10.03)	63.24[c] (7.06)
Agg	46.82[a] (5.96)	74.00[b] (9.32)	62.59[c] (9.86)
Con	46.49[a] (6.14)	73.54[b] (17.66)	57.52[c] (9.37)
Anx	47.31[a] (9.51)	66.08[b] (16.87)	54.83[a] (14.85)
Dep	49.61[a] (7.23)	84.69[b] (14.69)	62.41[c] (12.58)
Som	47.00[a] (8.15)	72.69[b] (16.40)	48.21[a] (8.45)
Atyp	49.18[a] (6.43)	82.69[b] (12.33)	61.48[c] (10.39)
Wdw	46.14[a] (7.63)	66.92[b] (12.63)	52.97[c] (7.86)
Att	51.02[a] (8.09)	69.69[b] (6.55)	62.55[b] (7.15)

Note. Hyp = Hyperactivity; Agg = Aggression; Con = Conduct Problems; Anx = Anxiety; Dep = Depression; Som = Somatization; Atyp = Atypicality; Wdw = Withdrawal; Att = Attention Problems; PED = Pervasive Emotional Difficulties; ME/D = Mild Externalizing/Depression. Column differences greater than 10.23 for PED, 2.63 for ME/D, and 2.61 for Normal indicate significant subscale differences by group. Row means with different superscripts indicate significant differences between groups, $p < .01$.

Table 6

Means and Standard Deviations for BASC-2 Variables for Psychosocial Subtypes Using Ward's Four-Cluster Solution

	Normal (n = 49) *M* (*SD*)	PED (n = 13) *M* (*SD*)	ME/AP (n = 29) *M* (*SD*)	MD (n = 14) *M* (*SD*)
Hyp	47.80[a] (6.53)	79.92[b] (10.03)	61.14[c] (5.80)	65.20[c] (7.75)
Agg	46.82[a] (5.96)	74.00[b] (9.32)	61.86[c] (8.59)	63.27[c] (11.18)
Con	46.49[a] (6.14)	73.54[b] (17.66)	61.43[a] (7.51)	53.87[a] (9.68)
Anx	47.31[a] (9.51)	66.08[b] (16.87)	44.00[a] (9.45)	64.93[b] (12.16)
Dep	49.61[a] (7.23)	84.69[b] (14.69)	54.00[a] (4.80)	70.27[c] (12.57)
Som	47.00[a] (8.15)	72.69[b] (16.40)	48.71[a] (9.27)	47.73[a] (7.90)
Atyp	49.18[a] (6.43)	82.69[b] (12.33)	57.14[a] (11.15)	65.53[a] (8.02)
Wdw	46.14[a] (7.63)	66.92[b] (12.63)	48.50[a] (5.88)	57.13[c] (7.28)
Att	51.02[a] (8.09)	69.69[b] (6.55)	62.71[b] (7.29)	62.40[b] (7.28)

Note. Hyp = Hyperactivity; Agg = Aggression; Con = Conduct Problems; Anx = Anxiety; Dep = Depression; Som = Somatization; Atyp = Atypicality; Wdw = Withdrawal; Att = Attention Problems; PED = Pervasive Emotional Difficulties; ME/AP = Mild Externalizing/Attention Problems; MD = Mild Depression. Column differences greater than 10.23 for PED, 5.29 for ME/AP, 8.07 for MD, and 2.75 for Normal indicate significant subscale differences by group. Row means with different superscripts indicate significant differences between groups, $p < .05$.

Table 7

Means and Standard Deviations for BASC-2 Variables for Psychosocial Subtypes Using Ward's Five-Cluster Solution

	Normal (n = 49) M (SD)	PED (n = 13) M (SD)	ME/AP (n = 14) M (SD)	ME/D (n = 15) M (SD)	MA (n = 19) M (SD)
Hyp	46.70[a] (6.15)	79.92[b] (10.03)	61.14[c] (5.80)	65.20[c] (7.75)	49.53[a] (6.91)
Agg	45.53[a] (5.35)	74.00[b] (9.32)	61.86[c] (8.59)	63.27[c] (11.18)	48.84[a] (6.44)
Con	45.10[a] (5.30)	73.54[b] (17.66)	61.43[c] (7.51)	53.87[c] (9.68)	48.68[a] (6.86)
Anx	42.00[a] (6.38)	66.08[b] (16.87)	44.00[a] (8.45)	64.93[b] (12.16)	55.68[a] (7.38)
Dep	47.87[a] (7.91)	84.69[b] (14.69)	54.00[a] (4.80)	70.27[b] (12.57)	52.37[a] (5.06)
Som	42.23[a] (4.38)	72.69[b] (16.40)	48.71[a] (9.27)	47.73[a] (7.90)	54.53[a] (6.98)
Atyp	46.37[a] (5.03)	82.69[b] (12.33)	57.14[a] (11.15)	65.53[c] (8.02)	53.63[a] (5.95)
Wdw	43.23[a] (5.48)	66.92[b] (12.63)	48.50[a] (5.88)	57.13[c] (7.28)	50.74[a] (8.39)
Att	51.50[a] (9.09)	69.69[b] (6.55)	62.71[b] (7.29)	62.40[b] (7.28)	50.26[a] (6.37)

Note. Hyp = Hyperactivity; Agg = Aggression; Con = Conduct Problems; Anx = Anxiety; Dep = Depression; Som = Somatization; Atyp = Atypicality; Wdw = Withdrawal; Att = Attention Problems; PED = Pervasive Emotional Difficulties; ME/AP = Mild Externalizing/Attention Problems; ME/D = Mild Externalizing/Depression; MA = Mild Anxiety. Column differences greater than 10.23 for PED, 5.29 for ME/AP, 5.68 for MA, 8.07 for ME/D, and 2.87 for Normal indicate significant subscale differences by group. Row means with different superscripts indicate significant differences between groups, $p < .05$.

Intellectual Screening scale. The BASC-2 does not contain an equivalent scale since the parent form does not inquire about cognitive skills, age-appropriate development, and/or academic performance. Regarding the Somatic Concerns subtype, health-related complaints were reported most often within the Pervasive Emotional Difficulties subtype but did not emerge in a profile with a single significant elevation.

Concerns regarding internalized symptoms were reported in the PIC-R Mild Anxiety, Internalized Psychopathology, and Antisocial subtypes. Of note, the Antisocial subtype contained elevations on scales measuring somatic concerns, depression, withdrawal, anxiety, and psychosis, along with delinquency. The final PIC-R subtype, Social Isolation, was characterized by elevations on the scales measuring cognition along with psychosis, including social adaptation, social isolation, and emotional lability. It is possible that, had the BASC-2 adaptive scales been included in these analyses, a subtype similar to their Social Isolation subtype could have emerged, given the adaptive scales' ability to measure some of these characteristics.

Hayman-Abello and colleagues (2003), using the CBCL, described four subtypes, which they labeled Normal, Attention, Delinquent, and Withdrawn-Somatic, based on the most prominent features associated with each profile pattern. Again, their Normal subtype was similar to the Normal subtype derived in this study in that no subscales were elevated beyond the average range of scores and most of their participants were assigned to this subtype (50% of those assigned). The CBCL Attention subtype was characterized by a single elevation on the CBCL Attention subscale with all other scores falling below 65*T*. For the Delinquent subtype, a single elevation was observed on the Delinquent

subscale with a secondarily high score on the Attention subscale. All other scores fell below 60*T*. Finally, the Withdrawn-Somatic subtype was characterized by a spike on the Withdrawn subscale with secondary elevations on the Somatic and Anxious-Depressed subscales.

Therefore, visual comparisons between the current BASC-2 subtypes and the PIC-R and CBCL subtypes just described reveal a major similarity in that most participants were categorized within a Normal subtype, indicating no psychosocial concerns from a parental point of view. Another similarity was observed between the PIC-R and BASC-2 Mild Anxiety subtypes in that a higher score was observed on anxiety subscales while other scores remained within the average range. One difference, however, between the PIC-R and BASC-2 Mild Anxiety subtypes was that the PIC-R subtype was characterized by a significantly elevated score on the Anxiety subscale, while the BASC-2 subtype's anxiety score remained within the average range but was elevated beyond the other scores in the profile.

Regarding internalized psychopathology, the PIC-R identified a subtype characterized by these symptoms. On the BASC-2, internalized symptoms were most often observed in conjunction with externalized symptoms (i.e., Mild Externalizing/ Depression subtype). In the four-cluster solution, a subtype characterized by mild depression was delineated; however, this cluster solution was not retained on any other cluster solution. Interestingly, the CBCL solutions also did not identify a subtype dedicated to internalized psychopathology. The most similar is likely the Withdrawn-

Somatic subtype; however, this subtype may be more similar to the PIC-R Social Isolation subtype than the Internalized Psychopathology subtype.

Regarding externalized behaviors, both the PIC-R and CBCL studies identified subtypes with elevated scores on subscales measuring these behaviors (i.e., Antisocial subtype on the PIC-R and Delinquent subtype on the CBCL). On the BASC-2, externalizing behaviors were often observed alongside either internalized behaviors (i.e., Mild Externalizing/Depression subtype) or attention problems (i.e., Mild Externalizing/ Attention Problems subtype) or both (i.e., Pervasive Emotional Difficulties subtype). While the CBCL study identified a specific subtype characterized by primary attention problems, the PIC-R did not. As already inferred, attention problems on the BASC-2 were most often observed alongside externalizing problems. One significant difference between the BASC-2 profiles and the PIC-R and CBCL profiles is the lack of a BASC-2 subtype containing somatic concerns. Both the PIC-R and CBCL studies identified specific subtypes with elevations on their respective somatic subtypes, while, on the BASC-2, scores on the somatization subscale were never elevated beyond the average range except on the Pervasive Emotional Difficulties subtype.

Subtypes derived in the current study were also statistically compared to the BASC-2 clinical profiles reported in the manual (Reynolds & Kamphaus, 2004). One-sample *t*-tests were used to accomplish this. In addition, the sample had to be divided between children and adolescents since, in the manual, means are provided separately for scores from the child and adolescent forms. Further, the BASC-2 manual divides the clinical sample into several subgroups, including Attention-Deficit/Hyperactivity

Disorder, Autism/Asperger's/Pervasive Developmental Disorder, Bipolar Disorder, Depression Disorders, Emotional/Behavioral Disturbance, Hearing Impairment, Learning Disability, Mental Retardation/Developmental Delay, Motor Impairment, and Speech/Language Disorder. The clinical subgroups that most directly relate to this study include Bipolar Disorder, Depression Disorders, and Emotional/Behavioral Disturbance; therefore, statistical comparisons were completed using means reported for these BASC-2 clinical subgroups. Means and results of *t*-test analyses for the child portion of the sample are reported in Table 8, while results for the adolescent portion of the sample are reported in Table 9.

Tables 8 and 9 demonstrate that the BASC-2 clinical subgroup profile means are largely significantly different from the profile means derived from the current TBI sample. Further, it is interesting to note that, not only are the means significantly different from each other, but, in some cases, the variability in scores is quite different as well. This seems to occur most often when comparing the current sample to the BASC-2 child sample's Depressive Disorders group. For example, for the Aggression subscale, the current sample standard deviation is 15.27 while the BASC-2 sample is 1.40. Therefore, there is quite a bit more variability in scores with the current sample than with the BASC-2 clinical sample. When there is a difference in variability, the amount of variability is generally greater in the current sample than in the BASC-2 sample. One exception is for the Withdrawal scale, where the reverse is true. For the adolescent portion of the sample, there is less difference in variability. The only striking differences are for the Depression scale, where variability is quite different between the current sample and both the Bipolar

Table 8

Subtype Comparisons to BASC-2 PRS Clinical Subgroups, Child Sample

			Current Sample	
		M (*SD*)	*M* (*SD*)	*t*
Hyp	BD	73.30 (13.40)	57.16 (12.85)	7.11**
	DD	67.50 (9.20)	57.16 (12.85)	4.55**
	EBD	65.50 (13.10)	57.16 (12.85)	3.67**
Agg	BD	68.00 (9.90)	56.97 (15.27)	4.09**
	DD	74.00 (1.40)	56.97 (15.27)	6.31**
	EBD	64.80 (11.70)	56.97 (15.27)	2.90**
Con	BD	71.10 (14.50)	54.78 (12.91)	7.15**
	DD	78.50 (7.80)	54.78 (12.91)	10.39**
	EBD	64.60 (13.90)	54.78 (12.91)	4.30**
Anx	BD	57.00 (10.90)	51.78 (13.90)	2.12*
	DD	57.50 (20.50)	51.78 (13.90)	2.33*
	EBD	54.40 (13.30)	51.78 (13.90)	1.07
Dep	BD	67.80 (12.00)	57.19 (14.48)	4.15**
	DD	79.50 (21.90)	57.19 (14.48)	8.72**
	EBD	65.40 (16.10)	57.19 (14.48)	3.21**
Som	BD	59.60 (15.10)	50.00 (12.55)	4.33**
	DD	57.00 (5.70)	50.00 (12.55)	3.15**

Table 8 (continued)

	EBD	55.50 (14.60)	50.00 (12.55)	2.48*
Atyp	BD	72.10 (9.70)	61.56 (16.68)	3.57**
	DD	71.50 (4.90)	61.56 (16.68)	3.37**
	EBD	66.60 (15.30)	61.56 (16.68)	1.71
Wdw	BD	57.40 (9.50)	51.94 (11.59)	2.67*
	DD	56.50 (20.50)	51.94 (11.59)	2.23*
	EBD	60.90 (13.70)	51.94 (11.59)	4.38**
Att	BD	67.00 (6.70)	59.91 (10.46)	3.84**
	DD	68.00 (1.40)	59.91 (10.46)	4.38**
	EBD	63.90 (7.60)	59.91 (10.46)	2.16*

Note. BD = Bipolar Disorder; DD = Depression Disorders; EBD = Emotional/Behavioral Disturbance; Hyp = Hyperactivity; Agg = Aggression; Con = Conduct Problems; Anx = Anxiety; Dep = Depression; Som = Somatization; Atyp = Atypicality; Wdw = Withdrawal; Att = Attention Problems.

* $p < .05$, ** $p < .01$

Disorders and Depressive Disorders group. Interestingly, the current sample has greater variability when compared to the Bipolar Disorders group but less variability when compared to the Depressive Disorders group.

Exceptions to these differences between the current sample and the BASC-2

Table 9

Subtype Comparisons to BASC-2 PRS Clinical Subgroups, Adolescent Sample

			Current Sample	
		M (*SD*)	*M* (*SD*)	*t*
Hyp	BD	73.40 (9.80)	57.39 (14.16)	8.68**
	DD	62.00 (17.90)	57.39 (14.16)	2.50*
	EBD	69.00 (14.70)	57.39 (14.16)	6.30**
Agg	BD	68.90 (7.80)	55.05 (11.57)	9.20**
	DD	61.80 (16.70)	55.05 (11.57)	4.48**
	EBD	65.30 (13.90)	55.05 (11.57)	6.81**
Con	BD	68.10 (11.40)	53.37 (13.70)	8.26**
	DD	68.50 (21.70)	53.37 (13.70)	8.48**
	EBD	67.70 (15.00)	53.37 (13.70)	8.03**
Anx	BD	59.40 (10.10)	52.71 (14.26)	3.60**
	DD	54.20 (16.00)	52.71 (14.26)	0.80
	EBD	56.40 (12.60)	52.71 (14.26)	1.99
Dep	BD	68.80 (7.70)	59.53 (16.68)	4.27**
	DD	76.10 (26.60)	59.53 (16.68)	7.63**
	EBD	66.40 (15.40)	59.53 (16.68)	3.17**
Som	BD	58.30 (10.00)	51.63 (13.52)	3.79**
	DD	55.80 (11.30)	51.63 (13.52)	2.37*

Table 9 (continued)

	EBD	56.70 (14.4)	51.63 (13.52)	2.88*
Atyp	BD	55.90 (10.00)	55.90 (12.89)	<0.01
	DD	61.40 (18.00)	55.90 (12.89)	3.28**
	EBD	62.90 (15.40)	55.90 (12.89)	4.17**
Wdw	BD	62.50 (4.70)	50.93 (10.84)	8.20**
	DD	59.30 (11.70)	50.93 (10.84)	5.93**
	EBD	60.00 (12.00)	50.93 (10.84)	6.43**
Att	BD	62.90 (5.10)	55.98 (10.26)	5.18**
	DD	53.30 (12.00)	55.98 (10.26)	2.01
	EBD	63.70 (9.10)	55.98 (10.26)	5.78**

Note. BD = Bipolar Disorder; DD = Depression Disorders; EBD = Emotional/Behavioral Disturbance; Hyp = Hyperactivity; Agg = Aggression; Con = Conduct Problems; Anx = Anxiety; Dep = Depression; Som = Somatization; Atyp = Atypicality; Wdw = Withdrawal; Att = Attention Problems.

* $p < .05$, ** $p < .01$

clinical samples include similarities in the child portion of the sample with the Emotional/Behavioral Disturbance group in terms of level of anxiety and atypicality. The adolescent portion of the sample was similar to the Depression Disorders group in terms

of level of anxiety and attention and the Emotional/Behavioral Disturbance group in terms of level of anxiety. In addition, the means for the adolescent portion of the current sample and the BASC-2 Bipolar Disorders sample were exactly the same in terms of atypicality.

Relationship of Other Variables with Psychosocial Functioning

Cross-tabulations and one-way ANOVAs were calculated to determine the relationship of various variables with psychosocial functioning. Specifically, variables including gender, ethnicity, age at assessment, age at injury, GCS score, and time elapsed since injury were investigated. It should be noted that the relationship of these variables was compared to subtypes generated within the two-cluster solution.

Cross-tabulations of gender and ethnic classification with psychosocial subtype were constructed. Percentages of males and females, along with Caucasian, African American, and Hispanic participants are presented in Table 3. Results of the Pearson Chi-Square demonstrated no significant differences between either gender or ethnicity and the psychosocial subtype to which subjects were assigned (for gender, χ^2 (1, N = 91) = 0.01, p = .93; for ethnicity, χ^2 (2, N = 88) = 0.31, p = .86).

One-way ANOVAs with GCS score, age at assessment, and age at injury as independent variables and psychosocial subtype as the dependent variable were calculated. Once again, this analysis revealed no differences between these variables and the psychosocial subtype to which subjects were assigned (for GCS, F(1, 45) = 0.17, p = .69; for age at assessment, F(1, 89) = 1.24, p = .27; for age at injury, F(1, 88) = 0.28, p = .60).

The only significant difference in psychosocial subtype classification was observed with time elapsed since injury (χ^2 (1, N = 90) = 4.83, p < .05). Specifically, the Pearson Chi Square revealed a significant difference only for the Pervasive Emotional Difficulties subtype. An examination of the relative frequencies suggested that a disproportionate number of children injured within the last twelve months were assigned to this subtype.

Summary

The results presented in this chapter are summarized below in terms of the research questions outlined in chapter 3.

1. How do these derived BASC-2 profiles compare to known CBCL and PIC-R profiles? Mixed results were found when profiles derived from the CBCL (Hayman-Abello et al., 2003) and PIC-R (Butler et al., 1997) were compared to the current BASC-2 profiles. The most striking similarity is the presence of a Normal subtype containing a majority of the participants, while the most striking differences seems to be the number of subtypes derived based on scores from each psychosocial measure. While the current study found two reliable profiles, the PIC-R study found seven, and the CBCL study found four. When these subtypes were compared to subtypes generated in solutions other than the two-cluster solution, additional similarities and differences between subtypes were noticed. These will be described in more detail in the following chapter.

2. How do these derived BASC-2 profiles compare to known BASC-2 clinical profiles? The profiles derived with a TBI sample were largely significantly different from the BASC-2 clinical subgroup profiles.
3. What is the relationship between psychosocial outcome and variables such as gender, time elapsed since injury, age at injury, and age at testing? No significant differences were found between subtypes based on gender, ethnicity, age at assessment, or age at injury. The only significant difference found was for time elapsed since injury for those participants classified within the Pervasive Emotional Difficulties subtype.

CHAPTER V

DISCUSSION

This chapter will present a brief summary of the present study, followed by a discussion of the major findings and their implications. The chapter concludes with a discussion of the limitations of this study and suggestions for future research.

Summary of the Study

The primary goal of this investigation was the development of a profile of psychosocial functioning in children who had sustained a TBI, based on cluster analysis of the BASC-2 clinical scales. Participants for this study were selected from an assessment database compiled at an urban children's hospital providing therapy and rehabilitation to children and adolescents with brain injuries and other medical conditions. Specifically, the results of the BASC-2 PRS forms were selected for analysis in order that a profile of psychosocial functioning from a parental or caregiver's perspective could be gained. The BASC-2 was selected as the measure of choice because it is a widely used instrument in clinical and school settings; however, very little research exists in the current literature regarding the BASC-2 and traumatic brain injured children or adolescents. Therefore, information regarding psychosocial functioning following TBI using results from the BASC-2 was an area of research yet to be explored. In addition, two other studies investigating the psychosocial functioning of children with TBI have been completed (Butler et al., 1997; Hayman-Abello et al., 2003) and parallel research

seemed necessary to assess the correspondence of their research using the PIC-R and CBCL with research using the BASC-2.

Data analysis initially included the UPGMA and Ward's methods of cluster analysis; however, the solutions generated by these methods did not correspond to each other; therefore, a broader, more exploratory, approach was undertaken. Following cluster analysis using a wide variety of methods, the two-cluster solutions generated by the Ward's and centroid methods emerged as the strongest and most reliable. Three-, four-, and five-cluster solutions using Ward's method also emerged as stable; however, they were not supported statistically since no other method generated similar clusters. Nevertheless, it is the opinion of this researcher that these profiles offer valuable clinical information that would be lost if they were discarded due to a lack of convergent statistical evidence. Therefore, these additional subtypes are also discussed, albeit with a certain amount of caution.

In order to further validate the two-cluster solution, additional statistical analyses were completed. Specifically, the psychosocial subtypes derived were examined in relation to the following: (a) subtypes derived in previous studies of children with TBI using other measures of psychosocial functioning (i.e., Butler et al., 1997; Hayman-Abello et al., 2003), (b) clinical profiles derived from the BASC-2 standardization sample, (c) the severity of the TBI as measured by GCS score, (d) the age at which the TBI was sustained, (e) the age at which the child or adolescent was assessed, (f) the amount of time elapsed between sustaining the TBI and the assessment, and (g) demographic variables including gender and ethnicity.

Characteristics of the Typology

Two robust clusters or subtypes, labeled Normal and Pervasive Emotional Difficulties (PED), were derived. This allowed for descriptions of these children in terms of heterogeneous psychosocial functioning. The pattern of scale elevations indicated that children assigned to the Normal group had significantly lower overall profile elevations. No clinically significant elevations were observed in the profile for the Normal subtype, resulting in a flat profile across all BASC-2 clinical scales and suggesting that these children were relatively free of pathology. Thus, parents were not expressing any concerns about their child's psychosocial functioning. This subtype was largest, accounting for 86% of the sample.

In contrast, the PED group's mean profile contained elevations in the at-risk or clinically significant range on all BASC-2 clinical scales. These children are perceived by parents as having significant externalizing behaviors, symptoms of depression, and behaviors viewed as atypical or odd. In addition, they appear to be showing either subclinical or emerging symptoms of anxiety, social withdrawal, and attention problems. As a result, these children may not interact or integrate well with other children in the school setting and may require specialized assistance regarding management of acting out behaviors and depressive symptoms.

While these two subtypes accurately describe the data in a statistical manner, they are quite broad and provide little in the way of increased understanding of the psychosocial functioning of children who have sustained a TBI. It is simply not enough for a school psychologist to describe a child with a brain injury as either emotionally

disturbed or not. Further, treatment planning and behavioral management of these school-age children must be individualized to a greater degree in order to provide the most effective learning environment possible. Therefore, the clinical significance of the subtypes generated using further exploratory cluster analytic methods appears important and even vital.

Four further differentiated subtypes emerged in the exploratory portion of the cluster analysis process. Children categorized within the Mild Externalizing/Depression subtype were perceived by parents as exhibiting a range of mild externalizing behaviors and behaviors viewed as odd or strange. In addition, however, these children are experiencing significant feelings of depression, which they are likely expressing via their externalizing behaviors. Thus, these children may be viewed by others as having mild behavior problems when, in reality, these behaviors are masking significant symptoms of depression, which deserve special attention and treatment planning. Not surprisingly, this cluster of symptoms also appears to affect their ability to focus and concentrate, resulting in mild attention problems as well.

Children grouped within the Mild Externalizing/Attention Problems subtype were characterized by mild elevations on a range of externalizing behaviors and attention problems. These children may, on the surface, appear quite similar to the children in the Mild Externaling/Depression subtype. However, in contrast, their externalizing behaviors are not masking underlying internalizing symptoms as described above. Thus, their behavior problems must be approached in a different manner with stronger behavior management plans.

The Mild Depression subtype is, again, similar to the Mild Externalizing/ Depression subtype, given its focus on mild hyperactivity and atypicality with underlying, clinically significant, symptoms of depression. Children falling within this subtype differ in that their externalizing behaviors are not as aggressive and they do not possess the attention problems observed in other subtypes.

Finally, the Mild Anxiety subtype is characterized by scores contained within the average range, although it is important to note that these average-range scores were consistently higher than those observed in the Normal subtype. Higher (although still within the average range) scores were observed on scales measuring anxiety and somatization. Even though the elevations of scores in this profile were less than 70*T*, the shape is still important because the profile is representative of the *average* of all children in the subtype (Butler et al., 1997). Thus, the delineation of this separate subtype is important because it likely alerts school psychologists to a group of children who, on the surface, appear to be functioning normally. However, disregard for their worries, fears, and health concerns may contribute to greater psychosocial problems in the future.

Internal Reliability

Two commonly used methods of demonstrating reliability include replication of the subtypes in a different sample from the same population or replication using different subtyping techniques. Demonstrating internal reliability is especially important in exploratory studies using multivariate subtyping techniques since the structure of the data set is unknown or poorly understood. This was the case in this study; therefore, internal reliability was demonstrated by replicating the derived cluster solution using additional

clustering techniques. Specifically, the two-cluster solution was replicated with good agreement using two different clustering techniques, namely the Ward's and centroid methods.

Relationship to Known Subtypes

A second method of assessing the reliability of the subtypes was to examine their relationship to subtypes generated in previous studies. The proportional assignment of participants to each subtype could not be directly compared to the subtypes generated by Butler and colleagues (1997) and Hayman-Abello and colleagues (2003) because different measures were used in each study. However, visual comparisons between the current BASC-2 subtypes and the PIC-R and CBCL subtypes revealed a major similarity in that most participants were categorized within a Normal subtype, indicating no psychosocial concerns from a parental point of view. Another similarity was observed between the PIC-R and BASC-2 Mild Anxiety subtypes in that a higher score was observed on anxiety subscales while other scores remained within the average range. One difference, however, between the PIC-R and BASC-2 Mild Anxiety subtypes was that the PIC-R subtype was characterized by a significantly elevated score on the Anxiety subscale, while the BASC-2 subtype's anxiety score remained within the average range but was elevated beyond the other scores in the profile. One possible explanation for this difference between scores on the two scales is the manner in which each scale measures anxiety. The BASC-2 anxiety subscale measures characteristics such as excessive worry, fears and phobias, self-deprecation, and nervousness (Reynolds & Kamphaus, 2004). The PIC-R anxiety subscale, on the other hand, measures moodiness, fearfulness, worry,

common fears, poor self-concept, insecurity, and over-sensitivity (Wirt et al., 1984). Thus, the two scales seem to be measuring slightly different aspects of anxiety. Further, it is interesting to note that the PIC-R anxiety scale was eliminated from the revised PIC-2. In contrast to the PIC-R, the PIC-2 includes the physical manifestations of anxiety in the somatic concerns scale and the fear/ worry and depression aspects in the psychological discomfort scale. The fact that revisions to the PIC-R anxiety scale were made suggests that the scale was found to be less than successful at measuring the construct.

The PIC-R also identified a subtype characterized by symptoms related to internalized psychopathology. On the BASC-2, internalized symptoms were most often observed in conjunction with externalized symptoms (i.e., Mild Externalizing/Depression subtype). On the four-cluster solution, a subtype characterized by mild depression was delineated; however, this cluster solution was not retained in any other cluster solution. Interestingly, the CBCL solutions also did not identify a subtype dedicated to internalized psychopathology.

Regarding externalized behaviors, both the PIC-R and CBCL studies identified subtypes with elevated scores on subscales measuring these behaviors (i.e., Antisocial subtype on the PIC-R and Delinquent subtype on the CBCL). On the BASC-2, externalizing behaviors were often observed alongside either internalized behaviors (i.e., Mild Externalizing/Depression subtype) or attention problems (i.e., Mild Externalizing/ Attention Problems subtype) or both (i.e., Pervasive Emotional Difficulties subtype). While the CBCL study identified a specific subtype characterized by primary attention problems, the PIC-R did not. As already inferred, attention problems on the BASC-2

were most often observed alongside externalizing problems. One significant difference between the BASC-2 profiles and the PIC-R and CBCL profiles is the lack of a BASC-2 subtype containing significant somatic concerns. Both the PIC-R and CBCL studies identified specific subtypes with elevations on their respective scales measuring somatic symptoms, while, on the BASC-2, scores on the somatization subscale were never elevated beyond the average range except on the Pervasive Emotional Difficulties subtype. A hypothesis regarding this observation that would require further investigation in order to confirm or disconfirm is that the PIC-R and CBCL may be more sensitive to the influence of physical problems associated with TBI than the BASC-2.

Relationship to a Clinical Sample

Finally, the current typology was compared to the profiles of various clinical samples presented in the BASC-2 manual. Specifically, the current typology was compared to the BASC-2 profiles for the Bipolar Disorder, Depressive Disorder, and Emotional/Behavioral Disturbance groups. The child portion of the sample was significantly different from all BASC-2 clinical groups except for the Emotional/Behavioral Disorder group on the Anxiety and Atypicality scales. The adolescent sample was similar to the Bipolar Disorder group in terms of level of atypicality, the Depressive Disorders group in terms of level of anxiety and attention problems, and the Emotional/Behavioral Disorder group in terms of level of anxiety.

Thus, it is apparent that, for the most part, the children with TBI were dissimilar to groups of children diagnosed with psychiatric and behavioral disorders. This is likely the case because, when taken together, all means for the TBI profile fell within the

average range. In other words, when the TBI sample is viewed as a whole, it looks more normal than abnormal, and this is likely because, even when broken down into the various subtypes, a large majority of the sample fell within the Normal subtype. Thus, it is not surprising that, when the profile of average-range scores from the TBI sample was compared to clinical profiles containing many clinically significant scores, significant differences were observed.

External Validity

When multivariate subtyping techniques are applied to any data set, a subtype structure will invariably be imposed upon it, making the demonstration of external validity extremely important. Thus, the subtype structure must be viewed in relationship to variables not included in the original cluster analysis. In addition, it must be determined whether or not the subtypes generated are meaningful with respect to what is known from the literature about children's psychosocial functioning following TBI. These issues will be discussed in the following sections.

Relationship of Psychosocial Functioning to Injury Severity

Analyses revealed no significant association between severity of injury as measured by GCS score and psychosocial subtype membership, indicating that children sustaining more severe head injuries were not disproportionately assigned to the Pervasive Emotional Difficulties subtype. This is likely due, at least in part, to the small number of participants for which a GCS score was available. A GCS score was recorded for only 47 participants, and only six of these were classified in the Pervasive Emotional Difficulties subtype. However, while a lack of statistical power may have contributed to

the lack of significance, it should be noted that similar results were found in the Butler and colleagues (1997) study as well. While they did find a significant association between injury severity and psychosocial functioning, their participants with the most severe injuries were not disproportionately assigned to their most severely disturbed psychosocial subtypes. Further, Hayman-Abello and colleagues (2003) did not reveal significant differences between subtype membership with regard to injury severity. Interestingly, in their study, one-half of the children who had sustained severe injuries were assigned to their Normal subtype.

Relationship of Psychosocial Functioning to Time Variables

Of interest was whether psychosocial outcome was influenced by age at the time of injury, age at the time of assessment, or the amount of time elapsed between the TBI and the assessment. Again, no significant association was found between psychosocial subtype membership and age at the time of injury or age at the time of assessment. However, significant differences were observed in regards to elapsed time. Specifically, within the first year following injury, a greater percentage of children were classified within the Pervasive Emotional Difficulties subtype as opposed to the Normal subtype. After the first year, however, roles reversed, with more children classified as normal than with emotional difficulties. Thus, it appears that either there was some improvement in psychosocial functioning with recovery or, alternatively, parents became more accustomed to their children's behavior and were more equipped and better able to manage more difficult behaviors.

In the Butler and colleagues (1997) study, analysis of time since injury approached significance. Their results showed that children tested several years following injury tended to fall into two of the three more pathological subtypes, namely the Social Isolation and Internalized Psychopathology subtypes. Children tested sooner after their injuries, on the other hand, were more often assigned to the Normal and Antisocial subtypes. These results are in contrast with the results from the current study; however, Butler and colleagues explained that their results may be due to referral bias. In other words, children assessed at a later date may have been referred for such an assessment only if they were experiencing significant problems.

Relationship of Psychosocial Functioning to Demographic Variables

The demographic variables tested for their potential association to particular psychosocial subtypes included gender and ethnicity. Analyses revealed no significant associations between either variable and psychosocial subtype membership. Therefore, based on these results, it is unlikely that a child's psychosocial functioning following TBI can be inferred based on that child's gender or ethnic classification.

Comparison of Current Results to Previous Research

Much of the research previously reviewed appears to support the results generated in the current investigation. For instance, in much of the research (e.g., Bloom et al., 2001; Max et al., 2004), injury severity did not distinguish between the rate of occurrence of psychiatric disorders following TBI. The current study supports this research in that there was no relationship between a child's level of injury severity and whether that child was more likely to be classified within a particular subtype.

Another significant finding generated by this study was that, within the first year following injury, a greater percentage of children were classified within the Pervasive Emotional Difficulties subtype than within the Normal subtype, whereas after the first year, a greater percentage were classified as normal than as having emotional difficulties. This finding is also supported by previous research. For instance, in their research regarding personality change due to traumatic brain injury (PC), Max and colleagues (2006) found that rates of PC fell from 22% within the first 6 months following injury to between 12 and 13% within the first 24 months following injury. Similar findings were generated by Max and colleagues (2004) regarding secondary attention deficit/ hyperactivity disorder (SADHD). One-third of those developing SADHD experienced symptoms relief within 18 months following injury. Mood disorders have also been found to resolve by one year post-injury (Bloom et al., 2001). Further, the rate at which children suffering from brain injuries developed serious psychosocial problems was similar in current and previous studies. Anderson and colleagues (2001) found that more than 80% of their sample earned scores that remained within the normal range of functioning. In a later study, Anderson and colleagues (2006) confirmed these results, stating that less than 10% of their sample exhibited behavioral symptoms at any one time and that clinically significant behavioral problems were identified in only 20% of their sample. Kirkwood and colleagues (2000) found that, while there was an increased risk for depressive symptoms following TBI, most children did not exhibit symptoms that reached clinically significant levels.

Descriptions of the range of profiles developed in this study beyond the two most reliable subtypes revealed that, when children did experience psychosocial difficulties, they were most often externalizing problems. When internalizing problems did occur, they were either quite mild in nature or were comorbid with other externalizing behaviors. Other researchers have found similar results. Hawley (2003) found that parents were not overly concerned with symptoms of anxiety and depression but were observing more behavioral and temper problems in their children. Ganesalingam and colleagues (2006) also reported more externalizing behaviors, including defiance, destructiveness, impulsivity, and poor emotional awareness. Interestingly, generalized emotional difficulties emerged as the most problematic area in a study conducted by Doherty and McCusker (2005). Similarly, Ganesalingam and colleagues (2007) reported emotional self-regulation to be the strongest and most consistent mediator and predictor of behavioral outcomes. They reasoned that emotional self-regulation may be a core deficit in those children who experience behavioral difficulties following brain injuries.

A conclusion such as this may provide some insight into why, in the current study, two subtypes emerged most consistently. In the most reliable solution, children who were experiencing psychosocial problems were not further differentiated beyond pervasive emotional problems. Difficulty with self-regulation, as described by Ganesalingam and colleagues, could be the underlying factor in that poor self-regulation affects all aspects of psychosocial functioning, thus resulting in generalized problems rather than isolated psychiatric conditions. Another explanation might be that externalizing behaviors are more problematic for parents, more observable, and more

likely to generate parental concern than internalizing behaviors. Symptoms related to internalizing problems are often less tangible and, as a result, less recognizable and easier to ignore or miss (Bidaut-Russell et al., 1995).

Limitations and Suggestions for Future Research

The sample in the current study consisted of 91 participants. This sample size is just large enough to make cluster analysis a viable statistical option but may have been too small to conclude that certain relationships between variables actually do exist. In other words, Type II errors could have resulted, thus obscuring true relationships between variables. Further, because there were so few children classified with Pervasive Emotional Difficulties, cell sizes in some of the crosstabulations were small. For example, for gender, only four females were classified as PED, while for ethnicity, only one participants made up the cell for Hispanics classified as PED. In addition, GCS scores were available for only 47 participants, thus limiting the conclusions that could be drawn regarding the effects of injury severity on psychosocial functioning. Given the variability in the effects of injury severity on psychosocial functioning reported in this and other studies of children with TBI, this relationship deserves and requires clarification. Future studies could also remedy problems with sample bias that may have been present in this study. The source of participants for this investigation was an urban children's hospital. Therefore, only children treated in this one hospital in this one city who were tested neuropsychologically were included. Using a study design where neuropsychological test results from children in multiple hospitals or centers are used is needed for generalization of these results.

Because information regarding premorbid functioning was not available in the data set used for these analyses, children in the current study were not excluded on the basis of premorbid psychosocial problems as was the case in the Butler and colleagues (1997) study. As a result, causal conclusions that the psychosocial sequelae of pediatric TBI are related to the brain injuries sustained during head trauma cannot be made in this study. Given the research reviewed previously, the importance of examining variables associated with preinjury child and family functioning is important. Thus, future subtyping research should accommodate for this type of inquiry in order that a better investigation of the direct sequelae of TBI beyond the influence of premorbid psychosocial status can be attained.

It must also be emphasized that the BASC-2 PRS is a parent-response questionnaire. Thus, the PRS provides only the parent's or primary caregiver's perception of the child's psychosocial functioning, and perception alone cannot be equated to actual behavior or psychiatric disturbance. Parental perceptions also often differ drastically from a child's or adolescent's self-reported behaviors or a teacher's perceptions of behaviors (e.g., DiBartolo & Grills, 2006).

In addition, the existence of postinjury psychosocial problems may be underestimated for several reasons. First, in the first few months following injury, parents may, first and foremost, be grateful that their child is alive and thus overlook the severity of any behavioral problems that may exist. Second, due to their neurological and physical disabilities, these children may not be mobile or cognizant enough to engage in some of the more serious psychosocial problems. While the BASC-2 is a well-normed, reliable

instrument that allows researchers to formulate hypotheses regarding patterns of children's behavior, the use of semistructured clinical interviews can also be incorporated to provide a more comprehensive assessment of postinjury psychosocial functioning.

As has already been mentioned, future research is needed to establish the reliability of the typology derived using a new sample of children and a variety of statistical subtyping techniques. Discriminant function analysis is often used for confirmation, testing, and validation of a known structure, and this type of analysis may be a viable option in future studies. A wider range of BASC-2 scales should also be investigated in order to develop a more fine-grained typology of psychosocial functioning. Future research is also needed to answer the question regarding whether or not there is a set of characteristics that differentiates children with TBI who develop adaptive psychosocial functioning from those who develop maladaptive psychosocial functioning. Another question that requires investigation is what set of characteristics differentiates children with TBI who develop particular patterns of psychosocial functioning. In other words, are there relationships between various cognitive abilities, neuropsychological skills, or locations of lesions and psychosocial disturbance? Such multidimensional classifications of a child's psychopathology may better reflect overall postinjury clinical presentation and allow for the identification of characteristics that may be potential buffers or exacerbaters of dysfunction (Saunders, Hall, Casey, & Strang, 2000). Further, a strong link has been found between school performance and behavioral problems (Hawley, 2004). With a multidimensional classification of psychopathology, prognosis can be more accurately determined, and a school psychologist's ability to

formulate effective treatment protocols will be increased. However, this also implies that early recognition and understanding via assessment is necessary. According to parents, few children suffering TBIs are assessed and receive clinical input from a psychologist following the TBI (Hawley). Thus, if no assessment is conducted, it follows that many teachers will not know about the TBI, particularly if the injury occurred more than a year ago, and will not associate behavioral problems and poor school performance with the TBI (Hawley).

Changes in psychosocial functioning over time can only be discerned through further investigation. One major contribution of this study is confirmation of the conclusion that the psychosocial sequelae of pediatric TBI cover a variety of patterns. While most children appear to fall well within the normal range of functioning, potential psychosocial problems range from rather severe, pervasive disturbances characterized by both internalizing and externalizing behaviors, to mild disturbances in relatively circumscribed areas. In addition, the present discussion of psychosocial profiles following TBI and the comparison to established developmental profiles for other psychiatric groups potentially enable the practitioner to differentiate psychosocial disturbance relative to TBI from psychiatric disturbance that is developmentally acquired. A classification such as the one presented in this paper creates a template against which other individuals can be compared and leads to a better understanding of prognosis and treatment associated with that particular pattern of functioning. Continued replication of these results as well as more complex and detailed investigations will be imperative.

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