2021-05-28

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Benjamin D. Eschler
Brigham Young University

BYU ScholarsArchive Citation
Eschler, Benjamin D., "Predictors of Psychosocial Functioning Following Pediatric Neuropsychological Assessment" (2021). *Theses and Dissertations*. 8994.
https://scholarsarchive.byu.edu/etd/8994

Predictors of Psychosocial Functioning Following Pediatric Neuropsychological Assessment

Benjamin D. Eschler

A dissertation submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Shawn D. Gale, Chair
Derin J. Cobia
Dawson Hedges
Rebecca Lundwall
John B. Fulton

Department of Psychology

Brigham Young University

ABSTRACT

Predictors of Psychosocial Functioning Following Pediatric Neuropsychological Assessment

Benjamin D. Eschler
Department of Psychology, BYU
Doctor of Philosophy

Pediatric neuropsychological evaluations are often used to help with diagnostic clarification, aid with treatment planning, and propose recommendations. Yet, little is known about the effects that a neuropsychological evaluation may have on psychosocial outcome and functioning. The present study sought to replicate customer satisfaction results and recommendation adherence results from previous studies while including a longitudinal measure of psychosocial functioning to determine change over time in a pre-test post-test design. Parents of children who underwent a neuropsychological evaluation between May 2016 and December 2020 were invited to complete a survey including the consumer satisfaction questionnaire and treatment adherence questions. They were then sent the Behavioral Assessment System for Children – 3rd Edition (BASC-3). Parents provided consent for access to their children's medical records to extract baseline BASC-3 scores as well as other demographic information. Results indicated that parents were very satisfied with the neuropsychological evaluation. Recommendation adherence ranges from an average of 48% for school counseling and 89% for autism therapies. Changes in psychosocial functioning were only detected on the internalizing index of the BASC from baseline to follow-up, $t=2.63$, $p=0.01$. A significant correlation was found between time since evaluation and change in the adaptive functioning index of the BASC-3, Pearson $r=-0.36$, $p=0.002$.

Keywords: pediatric, neuropsychological assessment, psychosocial functioning

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Purpose of a Neuropsychological Assessment

Neuropsychological assessment is the process of characterizing and diagnosing cognitive dysfunction (Allott et al., 2011). Often, a neuropsychological evaluation is used as the first step in cognitive rehabilitation after brain injury (Longley et al., 2012). The results of the evaluation are used to detail the nature and severity of a patient's cognitive profile and to then provide recommendations to guide rehabilitation and intervention (Benedict & Zivadinov, 2007). A comprehensive neuropsychological evaluation typically includes a clinical interview, review of medical records, one (or more) testing sessions, a feedback session, and a written report or medical note outlining the findings of the evaluation and recommendations for treatment (Board of Directors, 2007). Providing effective interventions is one of the major cornerstones of all neuropsychological evaluations (Silver, 2006). Goals of a neuropsychological evaluation include characterizing cognitive and behavioral function, prioritizing differential diagnoses, planning and monitoring treatment, and addressing other related legal or functional issues (Schroeder et al., 2019). Currently, a majority of neuropsychologists work for an institution such as a hospital, where many are housed in behavioral health, neurology, neurosurgery, psychiatry, psychology, or rehabilitation medicine departments (Sweet et al., 2021). A growing number of neuropsychologists are specializing in pediatric neuropsychology, where typical patient populations include attention deficit/hyperactivity disorder (ADHD), seizure disorder, neurological conditions, traumatic brain injuries, and other developmental disorders such as pervasive developmental delay or specific learning disability.

Recent studies have sought to identify and establish the value of neuropsychological assessments, and a recent review found that neuropsychological findings help to predict cognitive and psychosocial outcomes (Donders, 2020). Of note, this study reviewed 56 studies which included only five studies of pediatric populations. Most of the existing studies have established that while patient and caregiver satisfaction are generally high (Bennett-Levy et al., 1994; Farmer & Brazeal, 1998; Bodin et al., 2007), little objective evidence exists to describe the short- and long-term outcomes of neuropsychological assessments across a variety of populations. The current evidence mainly relies on qualitative data and suggests that neuropsychological evaluations may help with diagnostic clarification (Prigatano & Morronn-Strupinsky, 2010), screen for other comorbid conditions (Scott et al., 2016), lead to greater implementation of services (Pritchard et al., 2014), and reduce the frequency of hospitalizations in the year following an assessment (VanKirk et al., 2013). More evidence-based outcome studies are needed to demonstrate efficacy and cost-effectiveness of neuropsychological assessments (Prigatano & Morrone-Strupinsky, 2010).

Outcome Following a Neuropsychological Assessment

The purpose of a neuropsychological assessment is often multi-faceted and usually seeks to answer a referral question, typically from a physician or other provider in addition to the needs and questions of the patient (Lezak et al., 2012). The most common referral source for all neuropsychological evaluations (adult, pediatric, or lifespan) come from neurology or primary care settings (Sweet et al., 2021). In these setting, the assessment is often mostly focused on diagnostic clarifications and the qualification of cognitive strengths and weaknesses. In contrast, neuropsychologists who are integrated as part of a rehabilitation care team following traumatic brain injury or stroke will often supply objective cognitive data that are used to guide treatment goals and discharge planning (Johnson-Greene, 2018). There is a relative dearth of studies examining psychosocial functioning following a neuropsychological assessment. To date, the majority of studies surrounding neuropsychological assessments have taken a customer satisfaction approach from patients, caregivers, and physicians (Bennett-Levy, 1994; Farmer & Brazeal, 1998; Bodin et al., 2007).

The physician's perspective. Physicians are one group of primary stakeholders in the assessment process given their referral stream to neuropsychology. Allott et al. (2011) sought to understand the perspective of physicians on neuropsychological assessment in a youth mental health setting (patients aged 15-25 years old) by surveying their attitudes and use of the service. Results of the study found that physicians were generally satisfied with the report and that their referral questions were answered a majority of the time (64% agreed the referral question was "answered" and 36% indicated it was "mostly answered"). Physicians also indicated that the neuropsychological assessment helped by providing diagnostic clarification, altering the treatment plan according to the patient's cognitive profile, and assisting the patient to access services and advocacy. They also indicated that they would prefer shorter and briefer reports, more targeted recommendations, and a more applicable summary. This sentiment was echoed in another study, where referral sources (84.9% physicians and 15.1% clinical psychologists, physician assistants, nurse practitioners, social workers, and other professionals; 51% worked with adults, 30.5% pediatrics, 19% geriatric, and 10.2% lifespan) identified the diagnosis and recommendations sections of the neuropsychological report as the most useful (Postal et al., 2017). In this study, 29% of referring providers indicated that the neuropsychological assessment improved patient treatment compliance (Postal et al., 2017). In another study (Tremont et al., 2002), physicians who referred adult patients to an outpatient hospital-based neuropsychology clinic rated that they were satisfied on a 4-point Likert scale (ranging from "Not at all" to "Very Much So") with the diagnosis and recommendations from the neuropsychological report.

Satisfaction did not vary across different physician specialties (e.g., neurology, psychiatry, internal medicine, or neurosurgery).

The consumer satisfaction approach. Most studies looking at the effectiveness of neuropsychological evaluations have taken a qualitative approach which have focused on the degree of customer satisfaction of the patient or the caregiver (Longley, 2012). While most of these studies reported a high level of customer satisfaction, few of these studies have attempted to quantify improvement following a neuropsychological evaluation.

One of the earliest investigations into the utility of neuropsychological evaluations was completed by Bennett-Levy and colleagues (1994). They found that patients (16 years and older) rated their neuropsychological experiences as a positive (56%) to neutral experience (35%). Patients in this study had a variety of diagnoses and the most common diagnoses were head injury (36%) and stroke (15%). Some (36%) of the respondents indicated that their mood improved after the session. Farmer and Brazeal (1998) reported similar findings from parents of a sample of children who had received a neuropsychological assessment (children were age 3-18 years at the time of the survey and diagnosis included learning disability, attention-deficit hyperactivity disorder, traumatic brain injury, developmental delays, and behavior disorders). Parents and guardians in this study reported a high level of satisfaction following a neuropsychological assessment of their child. They indicated that the assessment helped them improve access to school services for their child, increased their understanding of the child’s strengths and weaknesses, and helped them gain a better understanding of their child. Parents further indicated that the written report, time spent with the clinician, and the oral feedback session were the most useful aspects of the evaluation (Farmer & Brazeal, 1998). Other studies have shown similar results, with parents reporting high levels of satisfaction, feeling like their money was well spent, and gaining insight into their child (Arffa & Knapp 2008; Bodin et al., 2007; Shepherd & Leathem, 1999; Westervelt et al., 2007; Stark et al., 2014). Other studies investigating beliefs surrounding the assessment process found that while overall satisfaction of the evaluation was high, almost half did not think it had improved their child's life or school services (Bodin et al., 2007).

Changes in functioning: The role of feedback and implementation of recommendations. A major part of any neuropsychological evaluation includes the delivery of feedback, whether written or oral (Board of Directors, 2007). The goal of providing feedback is to simplify the complex and often nuanced information of the evaluation so that it is more accessible to the patient and/or their caregiver (Rosado et al., 2018). Furthermore, the feedback session often culminates in recommendations to improve quality of life and enhance the functioning of the patient (Silver et al., 2006). Research on the effectiveness of the feedback session on improved functioning has been largely qualitative, with little objective evaluation of functional change reported in the literature.

While the current state of the literature is primarily qualitative in nature, it generally supports the trend that feedback (versus no feedback) increases self-reported quality of life, understanding of the condition, and ability to cope with their condition (Rosado et al., 2018). In the few randomized controlled trials investigating the benefits of feedback, results have been mixed. One randomized controlled trial (RCT) (Beardmore et al., 1999) compared the benefit of a psychoeducational session on traumatic brain injuries versus an information session that targeted issues related to coping at school for parents of children with traumatic brain injuries. In both of these sessions, the evaluator provided information individually to the child and reviewed details of either their injury (length of post-traumatic amnesia, timeline of the accident, discussed the child’s pertinent strengths and weaknesses) or a day in school (went over a typical day at school, discussed different study skills). Of note, none of the children received specific recommendations based on their neuropsychological profile, just related to their injury or difficulties that they identified throughout the course of the session. All of the children had sustained a severe TBI 1 to 5 years prior to the study and were recruited from pediatric rehabilitation programs. Results indicated that parents in the psychoeducational group reported less stress than the school coping skills group. No differences were found for awareness of the children’s deficits, or for changing the children’s behavioral problems. Two other RCTs investigated the impact of neuropsychological assessment with and without feedback in adults with multiple sclerosis and their caregivers (Lincoln et al., 2002) and adult stroke survivors and their caregivers (McKinney et al., 2002). Neither study found a relationship between the feedback condition and improved functional outcome or psychological distress in the patients. However, the Lincoln study may not have reflected optimal standard of care for clinical practice as feedback was delivered by “assistant psychologists” who were supervised by neuropsychologists (Longley et al., 2012). On the other hand, feedback has sometimes been linked with improved quality of life and perceived stress compared to no feedback both at baseline and 6-to-8-week follow-up (Rosado et al., 2018). Rosado’s study included only adults who underwent neuropsychological testing in a university outpatient setting. All participants were offered the opportunity to have a feedback session. Thus, the no feedback group were those participants who refused a feedback session. Providing detailed, personalized information to a group of veterans about their injuries and treatment was connected to improvement in functional independence and increased participation in treatment (Pegg et al., 2005). Sometimes, whether or not feedback is given is inconsistent, and one study showed that only 68% of patients had a feedback session (Bennett-Levy et al., 1994), while another reported that approximately 73% of neuropsychologists give in-person feedback to patients (Postal et al., 2017).

Providing feedback to patients is meant to help them understand their condition and how the results of the evaluation may impact their lives (Postal & Armstrong, 2013). An integral part of the feedback session is to ensure a sound understanding of the recommendations, which are thought to indirectly lead to improved outcome, functioning, and decreased psychological distress (Smith et al., 2007). Increased adherence to recommendations has been shown to correlate positively with outcome following neuropsychological evaluation (Blechschmidt, 2016). Adult veterans who received written information in addition to oral feedback are more likely to recall recommendations, and patients often prefer to receive written feedback (Fallows & Hilsabeck, 2013). The exact mechanism of how patients improve after a feedback session is not entirely clear, though some guardians have noted that improvement in their child was related to gaining a better understanding of their child following a psychoeducational assessment (Human & Teglasi, 1993). In a sample of pediatric brain tumor survivors who underwent neuropsychological evaluation, a majority of parents and teachers indicated that they had a “sound” understanding of the report, though only 47% of the recommendations were implemented at home and 41% at school (Cheung et al., 2014). These results likely indicate that a sound understanding of the report and recommendations is not enough to aid in and ensure implementation of the recommendations. Other studies in pediatric populations have reported higher levels of recommendation adherence, varying from 60% to 94% (Maclellan et al., 2017; Blechschmidt, 2016; Devries, 2016). Simpler recommendations and recommendations for changes at home were the most likely to be implemented (Cheung, 2014; Maclellan et al., 2017). These studies reported that the recommendations that were least likely to be implemented were those that required drastic changes (such as a teacher changing their curriculum) or more time and resources (including special exam accommodations). They noted that the largest barrier to implementing recommendations was how invested the child was as they could not “force” the child into accepting or completing the recommendations. Approximately two-thirds of parents followed through on referrals to occupational therapy or speech therapy while less than half (47%) sought referrals to clinical psychology. In Cheung’s (2014) study, 4/15 parents found that the large number of recommendations was overwhelming and indicated that they would have appreciated a more gradual introduction of recommendations or to have the recommendations saved for a later date.

To date, only one study has investigated the change in psychiatric symptoms following a pediatric neuropsychological assessment. Hansson et al. (2016) assessed self-reported psychiatric symptoms using the Beck Youth Inventories before and after a collaborative therapeutic neuropsychological assessment over multiple sessions. Children either received treatment as usual, waitlist controls, or a neuropsychological assessment. It is worth noting that their process of assessment included parental involvement in ways that differ from common practices here in the United States (i.e., parents/guardians were allowed to help choose which tests would be administered, were allowed to be present during testing, and assessments typically took 5 to 13 sessions). They found that the collaborative assessment group had lower scores on all subscales of the Beck Youth Inventories at follow-up, and that post-treatment reductions in anxiety and anger subscales (as compared to pre-treatment scores) were maintained at 6-month follow-up. The treatment as usual group also showed lower scores on the Beck Youth Inventories post-treatment, although they were not assessed at the 6-month follow-up. While this study did not follow a typical clinical course, it established that the process of a neuropsychological assessment may reduce patients' psychological distress and that the feedback session(s) may be an important factor in this change.

Pritchard and colleagues (2014) conducted a study to understand the effect of a neuropsychological assessment on youth (ages 3-17) with attention-deficit hyperactivity disorder (ADHD). They found that at 5-month follow-up, parents of children who underwent a neuropsychological assessment reported beginning parent-management training programs, special education services, and medication management when compared to parents of children who did not receive a neuropsychological evaluation (Pritchard et al., 2014). Both groups reported improvement in behavioral and emotional symptoms with no group differences noted for behavioral/emotional difficulties or the family difficulties subscale (Pritchard et al., 2014). However, the neuropsychology assessment group was rated as showing less severe social difficulties than the group who did not receive an assessment.

Predictors of Change

There are a number of complex factors that affect change in children and their functioning as they recover from injury, from illness, or receive treatment for psychiatric difficulties. For example, in a population of adults with mild traumatic brain injury mood symptoms and prior psychiatric history were found to account for unique variance in adaptability at 3-month follow-up (Scott et al., 2016). Pediatric traumatic brain injury has been shown to produce long-term deficits in executive functioning, and these deficits have been linked to problems with psychosocial functioning (Mangeot et al., 2002). This executive dysfunction is thought to contribute to difficulties controlling behavior and emotion which then creates distress in social relationships and activities of daily living (Mangeot et al., 2002). Executive dysfunction has been linked with poor psychosocial outcomes in other pediatric populations, including type 1 diabetes (Perez et al., 2016), brain tumor survivors (de Ruiter et al., 2016), preterm birth and low birthweight children in adolescence (Burnett et al., 2013), and typically developing children (Cassidy, 2016). Other predictors of psychosocial functioning following neurological insult include family functioning, parental education, and age at injury (Anderson et al, 2014; Li & Liu, 2012; Moran et al., 2016).

Aims and Hypotheses of the Current Study

The overarching aim of this project was to determine if children who have received a neuropsychological evaluation experience a change in their psychosocial functioning as rated by parental reports of psychosocial functioning/distress. Secondarily, if children's psychosocial functioning did change, we sought to identify predictors of that change.

Aim 1. The first aim of this study was to replicate the results of previous studies (Farmer & Brazeal, 1998; Bennett-Levy et al., 1994; Bodin et al., 2007) and determine the levels of parent/guardian satisfaction following a neuropsychological evaluation of children in an outpatient clinic of a children's hospital. We additionally sought to replicate findings regarding implementation of and adherence to treatment recommendations (Blechschmidt, 2016; Devries, 2016).

Hypothesis 1.1. We hypothesized that guardians of children who received a neuropsychological evaluation would report high levels of satisfaction with the neuropsychological assessment. These data were collected via the consumer satisfaction measure created by Bodin and colleagues (2007).

Hypothesis 1.2. We hypothesized that guardians would report differences in adherence to recommendations based on the type of recommendation. We predicted that school recommendations and referrals to other medical providers would have higher proportions of recommendation adherence than recommendations at home (to include bibliotherapy).

Aim 2. To determine whether guardian-ratings of child psychosocial functioning via the Behavioral Assessment Scales for Children (BASC) improved as a function of receiving a neuropsychological evaluation when compared to psychosocial functioning at the time of assessment.

Hypothesis 2.1. We hypothesized that children's psychosocial functioning would improve from the time of assessment to follow-up.

Aim 3. To identify predictors of change in psychosocial functioning in a sample of children from various diagnostic populations who have received a neuropsychological evaluation. These analyses will be exploratory and contingent upon Aim 2.

Hypothesis 3.1. It was hypothesized that time since evaluation and better executive functioning (lower scores on the BRIEF) would predict improvement in psychosocial functioning.

Methods

The primary approach of this study involved conducting a survey of parents whose children with underwent an outpatient neuropsychological evaluation as part of their care in the Pediatric Behavioral Health (PBH) clinic at Primary Children's Hospital (PCH) in Salt Lake City, Utah. The main purpose of the survey was to investigate customer satisfaction, adherence to recommendations, and changes in children's psychosocial functioning.

Participants

The parents of children who underwent neuropsychological evaluation in the outpatient PBH clinic at PCH between May 2016-December 2020 were contacted by e-mail address. All patients were seen in the same clinic by either a board-certified neuropsychologist, a pediatric psychologist who completes neuropsychological evaluations, or a trainee (i.e., pre-doctoral intern or postdoctoral fellow) under their supervision. Although the PBH clinic sees children and adolescents with a range of diagnoses and presentations, referral management practices attempt to primarily serve patients with a diagnosed medical condition that can affect cognitive or social functioning. All parents or guardians of patients who were under age 18 at the time of the survey (or the patients themselves if older than 18 at the time of the survey) who underwent a neuropsychologic evaluation during the specified timeframe were contacted and there were no exclusion criteria.

After submission to the joint institutional review board (IRB) of the University of Utah and Intermountain this study was granted IRB exemption (IRB # 00127852). As part of the IRB procedures, official informed consent was waived. Instead, participants were informed that completion of the survey would constitute their informed consent to participate in the study and grant access to their online medical records in order to extract demographic data as well as cognitive and other data (i.e., neuropsychological tests utilized, diagnoses, statement of the validity of the evaluation) from the neuropsychological report.

The data analysis team at Primary Children's hospital provided e-mail addresses for all patients seen in the clinic between May 2016 and December 2020. 510 patients or their parents and guardians were contacted via e-mail to invite them to participate in the study. 115 (22.5%) of these 510 responded by completing the initial survey. Please see **Table 1** for the demographic features of respondents and their children. As consent was given contingent upon participants completion of the study, the demographics were not available for any non-respondents. Ten participants' archival data were not available on the electronic medical record (due to a change in software at PCH). Thus, these participants' data were excluded from any analyses involving archival data.

Procedure

An online survey (sponsored by REDCap) was sent to parents of children who were age 4-18 at the time of the assessment. We contacted the parents of 510 children who fit the above criteria. Participants were first sent an explanation of the study via e-mail, and then a week later a link to participate in the study. They were then sent three (3) reminder e-mails every two weeks following this initial survey link to be consistent with previous studies. We received a total of 115 completed surveys. Eleven of these surveys were completed by participants who had turned eighteen between the time of the initial survey and the follow-up.

All of the participants who completed this initial survey were then sent an age-appropriate Behavior Assessments Scales for Children, 3rd Edition via the Q-Global platform (BASC-3). As with the customer satisfaction survey, reminders were sent three times, two weeks apart. 94 of the 115 participants completed the BASC-3. Of these respondents 11 were adults and complete self-report BASC-3.

Measures

The online survey included several measures that were adapted from similar previous studies.

Archival measures. Participants were asked to provide consent for the investigators to access their medical record for demographic information and prior neuropsychological testing data. All of these data were extracted from electronic medical records, where available. Most parents or guardians completed the BASC, BASC-2, or BASC-3 as part of an initial clinical evaluation through the neuropsychology service at PCH. A majority of, but not all, parents similarly completed a version of the Behavior Rating Inventory of Executive Functioning (BRIEF, 1st or 2nd edition or the preschool version, BRIEF-P).

Behavioral Assessment Scales for Children, various editions (BASC, BASC-2, BASC-3). The Behavioral Assessment Scales for Children were developed to measure psychosocial functioning and include indices of internalizing symptoms, externalizing symptoms, and an overall behavioral symptoms composite. The behavioral symptoms index encompasses the internalizing and externalizing scales and can be used as an omnibus proxy for psychosocial functioning as a whole and has been used as such in previous research (McClendon et al., 2011). A majority of the participants in the present study were administered either the BASC-2 or the BASC-3 at the time of their initial assessment. While parent-, teacher-, and self-report exists for both versions of the BASC exist, the parent-report version was used for participants under the age of 18 at the time of follow-up, while the self-report version was sent to those who turned 18 in the interval between evaluation and follow-up.

The parent-report form of the BASC-3 has internal consistency ratings of 0.74-0.80 and has a test-retest reliability of 0.70-0.85 (Deighton et al., 2014). While the BASC-2 (data are still not available for the BASC-3), has been shown to be sensitive to change in symptom severity, it may take a longer period of time for change to be detectable, (i.e., often months to years) when compared to other measures specifically designed to measure symptom change secondary to treatment. This is likely secondary to the design of the BASC, as many of its scales were designed to evaluate more static constructs (McClendon et al., 2011). Of note, the BASC-2 and BASC-3 have been used as outcome measures to determine change over time and/or the effectiveness of treatment (Antshel et al., 2007; Jones et al., 2018, Catroppa et al., 2012; Wozniak et al., 2007; Robinson et al., 2014; Plourde et al., 2018). Correlations between the composite indices on the BASC-2 and the BASC-3 were between 0.97 and 0.99 for externalizing symptoms, internalizing symptoms, adaptive functioning, and the behavioral symptoms index (Reynolds & Kamphaus, 2015).

Behavior Rating Inventory of Executive Functioning Forms

Behavior Rating Inventory of Executive Functioning, 2nd Edition (BRIEF-2). The BRIEF-2 is a parent-completed questionnaire designed to assess the executive dysfunction in children (Gioia et al., 2015). Reliability ratings for the parent-completed measure have been reported with a coefficient alpha between 0.79 to 0.97 (Hendrickson & McCrimmon, 2019). The BRIEF-2 can be summed up into 9 subscales which then load onto three higher order scales. A total score can also be calculated. Each of the subtests and higher order scales show adequate validity, with correlation coefficients reported between 0.44 and 0.77 (Hendrickson & McCrimmon, 2019).

The parent report of the BRIEF-2 has 63 items where parents rate behaviors as occurring “never,” “sometimes,” or “often.” These responses are summed to provide the 8 subscales: inhibit, self-monitor, shift, emotional-control, initiate, working memory, plan/organize, task monitor, and organization of materials. The higher order scales are behavior regulation index (comprised of the inhibit and self-monitor scales), emotion regulation index (shift and emotional control), and the cognitive regulation index (initiate, working memory, plan/organize, task monitor, and organization of materials). The global executive composite is calculated by summing the other indices and using a normative table to then obtain the global executive composite T-score (Mean = 50, SD = 10). This T-score is often used as a summary measure of executive dysfunction, with higher scores indicative of more severe executive dysfunction. The BRIEF-2 also provides validity indices of inconsistency, negativity, and infrequency.

Behavior Rating Inventory of Executive Functioning, 1st Edition (BRIEF). The BRIEF is the original version of the BRIEF-2 (Henderson & McKrimmon, 2019). The BRIEF has 86 questions and respondents answer "never," "sometimes," or "often" for a variety of behaviors (Gioia et al., 2000). While the BRIEF-2 has three indexes, items on the BRIEF are calculated into just two indexes (Behavioral Regulation Index and the Metacognition Index). These indexes are combined into the Global Executive Composite. The Cronbach alpha coefficient measure of internal consistency for reliability ranges from 0.80 to 0.98 across studies (Gioia et al., 2000).

Behavior Rating Inventory of Executive Functioning – Preschool Version (BRIEF-P). The BRIEF-P is a version of the BRIEF that was adapted to be more specific for preschool-aged children (Gioia et al., 1996). It consists of 63 items that form 3 broad indexes (inhibitory self-control, emergent metacognition, and flexibility) and one global score (Global Executive Composite). Normative data is available for children aged 2 to 5 years 11 months. Cronbach's alphas for the BRIEF-P range from 0.80 to 0.90 (Sherman & Brooks, 2010).

Comparing the different versions of the BRIEF. No new clinical items were developed or included in the BRIEF-2 from the BRIEF to allow for more longitudinal research (Dodzik, 2017). The BRIEF-2 included changes to how the factor structure was organized and updated the normative dataset.

Measures on the Online Survey. In addition to obtaining repeat measures from the baseline assessment, parents were asked to complete a survey that assessed their perspective and satisfaction with the neuropsychological assessment procedure and their child's current psychosocial functioning.

Consumer Satisfaction Measure. The consumer satisfaction measures used by Bodin and colleagues (2007) were included to assess parents' opinions regarding their satisfaction with and opinion of the neuropsychological evaluation. This measure contains 30 Likert-scale question which are comprised of questions from the Client Satisfaction Questionnaire (CSQ), Assessment Impact Questionnaire (AIQ), Measure of Processes of Care (MPOC), and items developed and used by Bodin and colleagues for the purposes of their study. Each of these measures has been demonstrated to show adequate reliability and validity. Psychometrics for this combined measure are not available, but the CSQ has a coefficient alpha = 0.83 to 0.93 (Attkisson & Greenfield, 1995). Different version of the MPOC have demonstrated internal consistencies between 0.75 and 0.87 with test-retest reliability at $r = 0.78$ to 0.91 (Siebes et al., 2007). The AIQ does not have published psychometric properties. Parents rated their experience based on a Likert scale from 1 to 5 (1 = strongly disagree to 5 = strongly agree).

Recommendation Adherence Measure. Devries (2016) and Blechschmidt (2016) created a survey asking parents to indicate the types of interventions that were recommended (e.g., changes at school, changes at home, family therapy, and non-medical interventions such as occupational or physical therapy) and the degree to which parents implemented those recommendations on a 3-point Likert-scale ranging from “Not at all” to “Somewhat” to “Very much.” This was adjusted to a sliding scale where parents rated the degree (in percentage) to which they or the school implemented the recommendations from 0-100 to allow for greater variability in responses. These questionnaires were part of exploratory studies and have not been psychometrically validated, however they are thought to represent the best practices of the field (Blechschmidt, 2016). As many patients in our sample have medical complications (such as diabetes, genetic disorders, eosinophilic esophagitis), we included a question asking if there have been any changes in the child’s medical condition since assessment (i.e., a Likert-scale question:

"Compared to the time of the neuropsychological evaluation, my child's medical functioning has: severely declined, declined, remained stable, improved, or substantially improved).

Feedback Quality. Blechschmidt (2016) also included questions evaluating parents' experiences of the feedback session. Questions included the evaluator's trustworthiness and expertise, the atmosphere of the feedback session (i.e., did the caregiver feel rushed), and overall usefulness of the feedback session.

Statistical Analysis

Aim 1. The first aim of this study was to replicate the results of previous studies (Farmer & Brazeal, 1998; Bennett-Levy et al., 1994; Bodin et al., 2007) and determine the levels of parent/guardian satisfaction following a neuropsychological evaluation of children in an outpatient clinic of a children's hospital. We additionally sought to replicate findings regarding implementation of and adherence to treatment recommendations (Blechschmidt, 2016; Devries, 2016).

Hypothesis 1.1. We hypothesized that guardians of children who received a neuropsychological evaluation would report high levels of satisfaction with the neuropsychological assessment. These data were collected via the online survey hosted by RedCAP.

Data analysis. In order to investigate this hypothesis, percentages of satisfaction were calculated and described to understand the proportion of parents who found utility in the neuropsychological evaluation.

Hypothesis 1.2. We hypothesized that guardians would report differences in adherence to recommendations based on the type of recommendation. We predicted that school recommendations and referrals to other medical providers would have higher proportions of recommendation adherence than recommendations at home (to include bibliotherapy).

Data analysis. A one-way analysis of variance (ANOVA) was conducted to determine if there were differences between the nine types of recommendations ("other" recommendations were left out of this analysis due to significant variability in what these "other" recommendations may include). Bonferroni analyses were then conducted to determine which comparisons yielded significant differences.

Aim 2. To determine whether guardian-ratings of child psychosocial functioning via the Behavioral Assessment Scales for Children (BASC) improved as a function of receiving a neuropsychological evaluation when compared to psychosocial functioning at the time of assessment.

Hypothesis 2.1. We hypothesized that children's psychosocial functioning would improve from the time of assessment to follow-up.

Data analysis. Paired t-tests were conducted to determine if there was a difference between follow-up BASC scores and baseline BASC scores. Paired t-tests were conducted between baseline and follow-up BASC scores for the following indices: Behavioral Symptoms, Internalizing Symptoms, Externalizing Symptoms, and Adaptive Functioning. As a follow-up analysis, we wanted to determine if these results differed based on baseline functioning, namely if children who were in the "At-Risk" and "Clinically Significant" categories (as determined by the BASC manual as a T-score of 60 or greater for the Behavioral Symptoms, Internalizing Symptoms, and Externalizing Symptoms indices or a T-Score of 40 or lower for the Adaptive Functioning index) yielded significant change between baseline and follow-up when the participants not in these categories at baseline were excluded from the analysis. Paired t-tests were conducted under the following conditions for the above stated BASC indices: when the baseline GEC on the BRIEF was greater than 59, when the baseline Externalizing Symptoms index on the BASC was greater than 59, when the baseline Internalizing Symptoms index on the BASC was greater than 59, when the baseline Behavioral Symptoms index on the BASC was greater than 59, and when the baseline Adaptive Functioning index on the BASC was less than 41. All other participants were removed from these analyses and then the paired t-tests were conducted.

Aim 3. To identify predictors of change in psychosocial functioning in a sample of children with various conditions who have received a neuropsychological evaluation. These analyses will be exploratory and contingent upon Aim 2.

Hypothesis 3.1. It was hypothesized that time since evaluation and better executive functioning (lower scores on the BRIEF) would predict improvement in psychosocial functioning. Children with an acquired injury (such as a traumatic brain injury) would show greater recovery than children with epilepsy or a genetic disorder.

Data analysis. Several multiple regressions were conducted to determine predictors of change in psychosocial functioning. A change score between for each of the BASC indices (Behavioral Symptoms, Internalizing Symptoms, Externalizing symptoms, and Adaptive Functioning) was calculated by subtracting the follow-up T-score from the baseline T-score (i.e., change score = baseline – follow-up). As higher T-scores on these indices of the BASC are indicative of more difficulty, a positive value change score would indicate improvement from baseline to follow-up, while a negative value T-score indicated worsening of symptoms. A multiple regression was then conducted for each of these indices, with time since injury and BRIEF GEC scores regressed upon the BASC change scores.

To determine the differences between disorder, we assigned each participant to a primary diagnosis category consistent with the Rosado et al. (2018). Four separate one-way ANOVAs were then conducted to determine if the change scores for each of the BASC categories were different based on diagnostic category.

Results

Replication of Prior Satisfaction and Adherence Measures

Customer Satisfaction (Hypothesis 1.1). We hypothesized that guardians of children who received a neuropsychological evaluation would report high levels of satisfaction with the neuropsychological assessment consistent with the results of Bodin and colleagues (2007). A review of individual outcomes indicated that respondents were generally positive about the neuropsychological evaluation and procedure. For example, to the question, “Overall, how satisfied were you with our services?”, 63.2% of respondents indicated “Very satisfied” while 25.6% of participants responded that they were “Mostly satisfied.” **Tables 2-5** present the percentage of responses to each of the questions that Bodin developed along with the percentage of responses from Bodin’s original study. On other items included in Bodin’s survey that were originally part of the UCSF Customer Satisfaction Questionnaire indicated that respondents, participants responded that they would come back to the clinic (68.4% responded “yes, definitely” and 23.9% responded “yes, generally”) and would refer the clinic to a friend (70.7% responded “yes, definitely” and 19.8% responded “yes, generally”). Finally, respondents indicated that 44.4% agreed that the evaluation “helped a great deal” in responding to their child’s difficulties and another 40.2% responded that the evaluation was “somewhat helpful.”

Recommendation Adherence (Hypothesis 1.2). Recommendation adherence data varied based on recommendation type, from an average of 59% of recommendations implemented for bibliotherapy (i.e., purchasing a self-help book) to 88.5% average implementation of autism therapy recommendations. Of note, a cursory analysis of the number of participants to the responses revealed significant discrepancies between how many participants indicated they had received a type of recommendation (i.e., for ABA therapy for autism) and how many responded to what extent they had implemented these responses. For example, only 9 participants indicated that they received a recommendation to include therapy for autism, however 77 included a percentage to what extent they had implemented these recommendations. To rectify this discrepancy, we explored the raw data and removed all adherence responses where the participant indicated that they had not received a particular recommendation. **Table 6** includes the means and standard deviations of the magnitude (in percentage) of implementation for each recommendation type.

Participants who selected the “other recommendations” category were asked to indicate what the other recommendations included. 15 participants indicated that they had received an “other recommendation.” Sample responses to this question included: “play games and puzzles,” “self-study suggestions,” “social skills,” “errorless learning,” and “diet.” “Other recommendations” adherence was not included in any analyses due to the heterogeneity of those types of recommendations.

A one-way ANOVA was conducted to determine whether a difference in recommendation adherence existed between the remaining nine different types of recommendations. This one-way ANOVA revealed that significant differences existed F (8,284) = 2.18, *p* = 0.029. Bonferroni post-hoc analyses were conducted to determine which recommendations had significantly different adherence rates from other recommendation types. However, due to the overly conservative nature of Bonferroni analysis, none of these analyses were significant found to be significant. Thus, independent t-tests were conducted for all 36 comparisons and then we used the Benjamini-Hochberg Procedure with a false discovery rate of ten percent to determine where the significant differences in recommendation adherence types may exist while also decreasing the risk of type 1 error. These analyses revealed significant differences for ten of the independent t-tests. Adherence rates to school counseling (M = 49.79) were found to be significantly lower than adherence to all other recommendation types except the use of a tutor (M = 66.4) and bibliotherapy (M = 59). Adherence rates to bibliotherapy (M = 59) were significantly lower than adherence to school accommodations (M = 73.79), medical referrals (M = 77.06), referrals to rehabilitation therapy (M = 78.13), and referrals for autism-related therapies (M = 88.5). Taken together, these results revealed that adherence to referrals for school counseling and bibliotherapy were the least utilized recommendation types for this sample. The significant *p*-values for the Benjamini-Hochberg Procedure are presented in **Table 7.**

Change in Psychosocial Functioning (Hypothesis 2.1)

We hypothesized that children’s psychosocial functioning would improve from the time of assessment to follow-up on four different indices of the BASC. **Table 8** contains summary statistics for the BASC and BRIEF measures at baseline and follow-up. See **Table 9** for the results of the paired-samples t-test. Altogether, none of the paired samples t-tests revealed significant differences between the BASC scales at the time of baseline and at follow-up.

Given that no difference was detected in BASC scores between baseline and follow-up assessment we hypothesized that perhaps this sample included participants whose symptoms were not significant enough at baseline to detect or even expect a change at follow-up. That is, many participants at baseline may have been in the typical range for these indices at baseline which possibly created too much statistical noise and eliminated our ability to detect a change should it exist. To test this hypothesis, we removed any participants who were not in the "At-Risk" or "Clinically Significant Range" on the BASC at the time of baseline. **Table 10** depicts the percentage of our sample who fit these criteria (i.e., a T-score of 60 or higher on the Externalizing, Internalizing, and Behavioral Symptoms indices of the BASC or the Global Executive Composite of the BRIEF, or a T-score of 40 or lower on the Adaptive Functioning index of the BASC). Another set of t-tests were then conducted using these new sample compositions. These results are depicted in **Table 11.** Of interest, these t-test analyses only revealed one significant result. For the participants who had elevated baseline Internalizing indices, we observed a significant reduction in the BASC Internalizing Index from baseline (M = 72.88, SE = 1.84) to follow-up (M = 68.21, SE = 1.99, $p = 0.01$.

Predictors of Change (Hypothesis 3.1)

Change in internalizing symptoms. As the only significant difference detected in the analyses above was for the Internalizing index, only two linear regressions were conducted for the participants who were in the at-risk or clinically significant categories on their baseline internalizing index of the BASC. A linear regression was conducted to determine if time since evaluation (in days) was a significant predictor of the change score (follow-up internalizing score subtracted from the baseline internalizing score). Time since evaluation did not significantly predict change in internalizing BASC score, $b = 0.008$, t = 1.87, $p = 0.07$. A second linear regression was conducted to see if baseline executive functioning (Global Executive Composite score or GEC) of the BRIEF predicted change in internalizing symptoms. Executive functioning was not found to be a significant predictor for change in internalizing symptoms, $b = -0.236$, t = -1.29, $p = 0.207$.

Relationship with the larger dataset. For exploratory purposes we analyzed the relationship between certain hypothesized predictors and the change scores on the BASC. We hypothesized that time since evaluation and executive dysfunction would be significant predictors, so we performed correlations to determine if any relationship existed. **Table 12** illustrated the Pearson correlations and *p*-values for executive dysfunction (GEC) and **Table 13** the relationship between time since evaluation (in days) and change on the BASC indices. For these analyses, the only significant correlation was found between time since evaluation and change in the adaptive functioning index of the BASC, $r = -0.36$, $p = 0.002$. These correlations were conducted on the entire dataset and not only for the at-risk and clinically significant groups.

Differences by Diagnostic Classification. We identified four different diagnostic categories for the main diagnosis for each participant that were consistent with previous studies (Rosado et al., 2018). These categories were congenital disorders (i.e., VACTERL syndrome, craniosynostosis, cerebral palsy, agenesis of corpus callosum, neurofibromatosis, down syndrome, chromosomal anomaly, specific learning disorder, Tourette's syndrome, ADHD, n = 49), epilepsy (n = 13), other medical diagnosis (i.e., leukemia, heart transplant, panhypopituitarism, extreme prematurity, Fetal Alcohol Syndrome; n = 5), and acquired brain injury (to include concussion, diagnosis of TBI, stroke, cerebrovascular accident, and hypoxic brain injury; n = 33). Four separate one-way ANOVAs were conducted (one for each of the scales of the BASC) to determine if difference existed in change scores among these different diagnostic classifications. No significant group differences were detected for any of the scales. The results of these ANOVAs are presented in **Table 14.**

Discussion

Implications of Findings

Customer Satisfaction (Hypothesis 1.1). One of the first aims of this study was to replicate the findings of previous studies regarding consumer satisfaction using the customer satisfaction survey created by Bodin and colleagues. Broadly speaking, the present study replicated these findings. Specifically, both studies found that over 80% of respondents indicated that they were overall mostly satisfied or very satisfied with the evaluation. A general trend between the two studies was that the respondents of the current study tended to be more positive (i.e., a greater proportion ranked the top level of the Likert scale) than during Bodin's study. For example, in Bodin's study 36% of respondents indicated that they were overall "Very Satisfied" with the evaluation, while the proportion of the current study's respondents was 63.2%. This trend continued for every single individual item we replicated from Bodin's study.

The other end of the Likert scales for each of these individual questions was increasingly similar to Bodin's results. For the lowest level of the scale (i.e., "Quite dissatisfied," "Poor," or "Strongly disagree") responses were generally within a percentage or two of Bodin's findings. For the second to last lowest response (i.e., "Mildly dissatisfied," "Fair," and "Disagree") there was more variability on whether the present study had a smaller proportion of respondents in these categories than Bodin's responses or had a larger proportion, but often these differences did not appear to be significantly different. For example, when asked if the services helped parents better deal with their child's problems, Bodin's results had 2% say "no, it made it worse" compared to our 2.6%; Bodin's respondents showed that 19% indicated that "no, it didn't help" while the current study's respondents only had 8.5% in this category. Taken together, along with the high proportion on the highest end of the scale, these data would suggest that the current evaluation had a more positive skew in participants' perceptions of the neuropsychological evaluation.

The current study helped to expand some of Bodin's finding by including two open-ended questions as part of the survey: "What part of the evaluation did you find least useful?" and "What part of the evaluation did you find most useful?". These questions allowed participants the opportunity to go beyond the structured format of the survey instrument and provide some additional feedback to the portions of the evaluation that they found the most or the least useful. Sample responses are included in **Table 15** for the "most useful" responses and **Table 16** for the "least useful" responses. The responses to both of these questions were quite variable and may provide further insight into ways to improve the neuropsychological evaluation and aspects of the evaluation that provide incremental value and utility. Responses to the "most useful" question were analyzed and grouped into various themes, such as learning about strengths and weaknesses or gaining a better understanding of the child and these results are also available in **Table 15**, and a total of 89 comments were evaluated. Many comments fit more than one category (i.e., many participants responded, "diagnosis and recommendations" and these responses were counted for both categories "diagnosis" and "recommendations" separately). Responses to which aspects of the evaluation were least useful were much more variable and thematic interpretation was not possible. Thus, several sample responses were provided to represent the breadth of participant responses.

Recommendation Adherence (Hypothesis 1.2). While many participants indicated that the recommendation section of the neuropsychological reports was one of the most useful aspects of the evaluation, satisfaction with the evaluation procedure may not predict adherence with the recommendations from the evaluation. The second aspect of the replication process of this study was to replicate previous findings on recommendation adherence. The results of the current study were consistent with previous studies on adherence (Dreyer et al., 2010;

MacNaughton and Rodrigue, 2001) where overall adherence was from 67 to 82 percent. The data from this study help to establish and confirm that differences do exist between types of recommendations, and these analyses revealed that referrals to school counseling and bibliotherapy were the least utilized. The poor adherence to school counseling may be indicative of a lack of resources available through the schools as hypothesized by Cheung (2014) and Maclellan et al. (2017). Further investigation into the importance, utility, and availability of counseling through the school system may prove useful in further understanding why this recommendation was so poorly used. Regarding bibliotherapy, self-help books have been found to help both adults (Marrs, 1995) and parents of children (Tarver et al., 2014) experience better mental health. Tarver et al. (2014) indicated that there has been a growth in other forms of self-directed parenting therapy, such as the use of the internet and other video-based instruction guides. McKenna et al. (2010) interviewed providers who referred bibliotherapy recommendations and found that low literacy and low interest in reading often presented as barriers for implementing this recommendation. Bibliotherapy and other forms of multimedia have been shown to improve parenting skills and the addition of a therapist to help guide therapy improved outcomes (Weisenmuller et al., 2021). While bibliotherapy has been shown to be an effective tool for improving mental health and parenting behaviors, adherence may be low when compared to other forms of recommendation due to urgency or perceived need for help.

The current study also helps to elucidate the types of recommendations have the highest magnitude of adherence whilst also providing a much larger sample than previous studies such as Blechschmidt (2016). When compared to Blechschmidt’s (2016) results, the results of the current study may depict a more nuanced understanding of how adherent parents were to recommendations given the format of the questions: that is parents were asked to rate the magnitude of their adherence to different recommendations on a sliding scale (from 0 to 100%) as opposed to a Likert scale with only three options. The current study revealed that autism recommendations had the highest average implementation rates while bibliotherapy was the lowest. The other recommendation types, such as school accommodations, medical referrals, or other therapies had very similar adherence rates, with average ratings ranging from 70 to 78%. It is difficult to further compare the results of the current analysis with Blechschmidt's results as they were listed as percentages who responded to each level of a Likert scale. The adherence rates of the current study for autism therapies are higher than those in other studies such as Moore and Symons (2009) who found that 76% of parents adhered to referrals for autism therapies and 84% for medical treatment recommendations. They further found that the severity of the diagnosis was a predictor of increased adherence such that parents of children with a diagnosis of autism were more adherent to therapy and all recommendations than parents of children with a diagnosis of Asperger's disease. Thus, the perceived need for therapy or services may serve as a mediating factor for treatment adherence.

In Blechschmidt's (2016) study, they determined that many barriers to adherence included that guardians did not know how to implement a recommendation, were met with resistance from a child or spouse regarding the recommendation, or that the recommendation was too time-consuming. The results of our open-ended question "What part of the evaluation did you find least useful?" were generally consistent with these ideas. Many of the respondents indicated that they either did not know what to do next or that the school refused to accept the recommendations offered by the neuropsychologist. A potential solution to this barrier would be to have more consistent "warm hand-offs" with schools or with other providers. One respondent indicated that the neuropsychologist attended his or her child's IEP meeting at the school and found this to be extremely helpful. We estimate that attendance at IEP meetings occurs with <5% of our patient population. Future studies will likely benefit from seeking to better understand the nature of recommendation adherence and ways that neuropsychologists can better assist their patients in taking the necessary next steps to change.

Change in Psychosocial Functioning (Hypothesis 2.1). One of the main purposes of identifying recommendation adherence and barriers to that adherence is to help facilitate positive change in patient's lives (Combs et al., 2020). The present study sought to provide further insights into the outcomes following pediatric neuropsychological evaluations by introducing a quantitative measure to help quantify and possibly explain those outcomes. Surprisingly, however, we were met with a paucity of significant differences in participant's psychosocial functioning from baseline assessment to follow-up. The exact reasoning for why these differences were not detected is not clear, but a few suggestions will be offered later in the limitations section of this paper. One hypothesis that we were able to test regarding why we were unable to detect significant change is that many of our participants were too "high functioning" at baseline. If a significant proportion of our participants were in the typical range at baseline, change statistics may have become too watered down as these participants may present a floor effect without room to decrease their scores on this evaluation. To test this hypothesis, we removed all children who were not in the "At-Risk" or "Clinically Significant" ranges on the BASC to determine whether the change was undetectable as a result of statistical "noise." These post-hoc analyses revealed that for the children in our sample who were in the at-risk or more severe levels at baseline, they experienced a significant change in their internalizing symptoms from baseline to follow-up. This finding is consistent with Pritchard's (2014) work which found that neuropsychological assessment could help to decrease internalizing symptomatology (i.e., anxiety and depression) in children with ADHD.

Qualitative indicators of change from this study and others (Bodin, 2007; Combs et al., 2020) would suggest that guardians often believe that their children's psychosocial functioning improves following a neuropsychological evaluation. Results of the present study indicated that 29% of our respondents strongly agreed that the evaluation helped to improve their child's life and another 40.2% agreed less strongly. Unfortunately, qualitative indicators appear to be the major format for qualifying change in the context of neuropsychological assessments (Blechschmidt, 2016; Devries, 2016). The present data may indicate that there is a disconnect between more subjective questions such as "has your child's functioning improved," and using objective measurement of children's behavior such as the BASC family of instruments. Many other studies have tried to establish change in children's behavior by asking parents to rate how their child was prior to an injury as compared to now, which has the negative consequence of confirmation bias or rosy retrospection such that parents may be over or underestimating the changes and improvement in their children (Combs et al., 2020). Thus, continued use of consistent longitudinal studies are essential in uncovering the role of neuropsychological evaluations in promoting actual change in patient's lives.

Predictors of Change (Hypothesis 3.1). Across a number of different analyses trying to identify predictors of change, we discovered that time is a significant predictor of change in adaptive functioning. These results, specifically, are in line with more recent research investigating the "real-world functioning" of children who underwent a neuropsychological evaluation. Combs and colleagues (2020) sought to better understand the role that neuropsychological evaluations might play in changing pediatric patient's lives, specifically towards their day-to-day functional abilities. They found that neuropsychological evaluations were helpful in improving children’s functioning as parents rated that their children had less problems several months post evaluation. Additionally, it is well understood and documented that time is a major predictor of change, especially for children who sustained a traumatic brain injury (Li & Liu, 2012). Thus, the data from this study may suggest that time alone may be a factor for the improvement, and we are not implying that it is the time from a neuropsychological evaluation alone that is predictive of functional change.

Finally, the current study failed to identify diagnostic classification as a predictor of differences in changes in psychosocial functioning. It is likely that there was too much heterogeneity within each diagnostic group to be able to fully detect change. For example, our acquired brain injury group included mild, moderate, and severe TBIs in addition to cerebrovascular insult. Additionally, all of the participants in our study were seen in a hospital setting. Thus, different medical conditions may influence the trajectory for functional change based on a number of factors including stress, familial support, socioeconomic status, the stability of the disease or injury, and many more (Price et al., 2016). Neuropsychological assessments have been found to add additional incremental predictive value in the care of individuals with mild cognitive impairment or dementia and traumatic brain injury, but only moderate support for stroke, epilepsy, multiple sclerosis, and ADHD (Donders, 2020). This review found that the neuropsychological evaluation could help to predict whether or not children were in special education three months post-injury but did not find any other significant predictors of psychosocial functioning.

Limitations

While this study demonstrated several ways that neuropsychological evaluations can be beneficial, its scope is limited for a number of reasons. First, the BASC family of instruments may not be sensitive enough to change (McClendon, 2011). While the BASC has been used to measure and diagnose a variety of disorders, it may not be the best measure for evaluating change over time, such as gains from psychotherapeutic intervention. Secondly, the current sample used a convenience sample of all children who were seen in the clinic and did not have a standardized time frame for follow-up assessment. While a significant, positive correlation was found between time since evaluation and improved scores on the BASC, the variable time frames may have decreased any significance. Further analyses and study may help to determine a better time frame or follow patients in a more longitudinal pattern with repeat follow-up at 6 weeks, 3 months, and 6 months, for example. Third, as this study was reflective of clinical practices as they are and not a standardized research protocol, different versions of the BASC were often used from baseline to follow-up. It is possible that these changes in normative data sets for these measurements decrease the sensitivity to change. Finally, the current sample was extremely heterogeneous for patient diagnoses. While the prognosis for many of these diagnoses may suspect more drastic/expedient changes (i.e., for mild traumatic brain injury versus epilepsy), it is likely that this study lacked enough statistical power to detect whether different groups were more likely to experience change. Even if change had been detected, we would not be able to infer causation to the neuropsychological evaluation as a control group was not included.

Future Research

Future research should continue to focus on establishing the connection between neuropsychological evaluations and substantive change in patient’s lives and in their functioning. One such method would be to devise a prospective, longitudinal study that included a wait-list control group to address the threat to internal validity caused by history and maturation. Such a study could also include a measure designed to detect change such as the Youth Outcome Questionnaire (YOQ). The YOQ was designed to detect change in response to therapeutic assessment and is relatively short such that it would not impose an undue burden on a parent or caregiver as part of intake paperwork.

The data collected as part of this study may also be further analyzed to continue to answer question relevant to pediatric neuropsychological evaluations. For example, validation studies of Bodin's measure could be conducted to determine the reliability and validity of this measure in a separate population. Additionally, certain questions from the Bodin measure could be devised and tested within this group to determine if there is any added benefit from taking a summative approach to measuring guardian-satisfaction in regard to neuropsychological evaluations. Another potential study could investigate the questions pertaining to the feedback session and parental satisfaction. As the field of pediatric neuropsychology continues to develop and adjust to an ever-changing healthcare environment, it is essential to determine the utility of neuropsychological evaluations and how to best enhance patient's lives and their access to resources. This study helps to lay a steppingstone as we establish that connection.

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Appendix

Table 1

Participant Characteristics

Child/Patient Characteristics	Mean (SD)	Range
Age (in years) at time of assessment	10.2 (4.1)	2-20
Age at time of survey (in years)	12.38 (0.40)	4-21

	Number of Participants	Percentage of Participants
Sex		
Male	70	62
Female	43	38
Ethnic Background		
Asian	2	1.7
Black or African American	5	4.3
Native American or Alaska Native	2	1.7
Native Hawaiian or Pacific Islander	2	1.7
White	111	95.7
Mother's Highest Education		
Less than high school	2	1.7
High School	10	8.5
Some college or trade school	44	37.6
Bachelor's Degree	38	32.5
Graduate Degree	3	2.6
Father's Highest Education		
Less than high school	7	6.1
High School	11	9.6
Some college or trade school	32	27.9
Bachelor's Degree	28	24.3
Graduate Degree	14	12.2
Medical Status		
Severely declined	0	0
Declined	13	11.1
Remained stable	58	49.6
Improved	31	26.5
Substantially improved	15	12.8
Primary Diagnosis*		
Congenital	49	48.0
Epilepsy	13	12.7
Other medical	5	4.9
Traumatic brain injury	33	32.4
Psychiatric	2	2.0

* Congenital (VACTERL syndrome, craniosynostosis, cerebral palsy, agenesis of corpus callosum, neurofibromatosis, down syndrome, chromosomal anomaly, specific learning

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disorder, Tourette's syndrome, ADHD, and ASD); Other Medical Diagnosis (Leukemia, Heart Transplant, Panhypopituitarism, Extreme Prematurity, Fetal Alcohol Syndrome); TBI (to include concussion, stroke, cerebrovascular accident, hypoxic brain injury); Psychiatric Diagnosis (PTSD, Anxiety)

Table 2

Individual item responses to the Assessment Impact Questionnaire (AIQ) listed as percentages with results from the original study by Bodin et al. (2007) for comparison.

Item	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Helped to understand my child's problem	0.9	5.1	8.5	44.4	41
Bodin's Results	*2*	*7*	*6*	*64*	*21*
Helped to understand child's strengths	0.9	5.1	20.5	43.6	29.9
Bodin's Results	*3*	*7*	*11*	*62*	*17*
Suggested ways to deal with child's problem	1.7	6.8	17.9	42.7	30.8
Bodin's Results	*4*	*3*	*12*	*68*	*12*
Helped improve school services	3.4	14.5	23.9	25.6	32.5
Bodin's Results	*4*	*17*	*22*	*45*	*12*
Made me feel less "parental stress"	5.1	22.2	23.9	27.4	21.4
Bodin's Results	*3*	*24*	*20*	*41*	*12*
Identified other professionals or groups for help	3.4	13.7	26.5	41.9	14.5
Bodin's Results	*7*	*24*	*17*	*45*	*7*

Table 3

Individual item responses to the Measures of Processes of Care (MPOC) listed as percentages with results from the original study by Bodin et al. (2007) for comparison.

Item	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Provided a caring atmosphere	1.7	0.9	3.4	30.8	63.2
Bodin's Results	*1*	*5*	*10*	*50*	*34*
Accepted me and my family	0.9	0.9	5.1	26.5	66.7
Bodin's Results	*2*	*0*	*6*	*57*	*35*
Provided adequate information about my child's functioning	1.7	6.0	6.0	29.9	56.4
Bodin's Results	*3*	*12*	*5*	*54*	*27*
Provided enough time for me to talk	0.9	1.7	4.3	30.8	62.4
Bodin's Results	*2*	*6*	*2*	*53*	*37*
Listened to what I had to say about my child	1.7	0	4.3	27.4	66.7
Bodin's Results	*2*	*1*	*6*	*53*	*38*
Answered my questions completely	2.6	4.3	5.1	28.2	59.8
Bodin's Results	*3*	*4*	*9*	*53*	*30*
Told me about options for treatment	0.9	9.5	14.7	38.8	36.2
Bodin's Results	*4*	*16*	*14*	*46*	*20*
Provided advice on how to get more information	0.9	8.5	12.8	41.9	35.9
Bodin's Results	*4*	*18*	*18*	*43*	*16*

Table 4

Individual item responses to the Client Satisfaction Questionnaire (CSQ) listed as percentages with results from the original study by Bodin et al. (2007) for comparison.

Item	No definitely not	No not really	Not sure	Yes generally	Yes definitely
Would you come back to our clinic	0.9	1.7	5.1	23.9	68.4
Bodin's Results	*3*	*6*	*11*	*33*	*47*
Would you recommend us to a friend	1.7	3.4	4.3	19.8	70.7
Bodin's Results	*2*	*7*	*11*	*34*	*46*
Did you get the service you wanted	2.6	9.4	8.5	33.3	46.2
Bodin's Results	*3*	*15*	*7*	*46*	*29*
	None	A few	Not sure	Most	Almost all
Did the evaluation meet your child's needs	2.6	12.0	8.5	37.6	39.3
Bodin's Results	*7*	*21*	*6*	*45*	*21*
	Quite dissatisfied	Mildly dissatisfied	Not sure	Mostly satisfied	Very satisfied
How satisfied are you with the amount of help you received?	2.2	3.3	4.3	29.6	60.6
Bodin's Results	*2*	*13*	*8*	*43*	*34*
Overall, how satisfied are you with services	4.3	5.1	1.7	25.6	63.2
Bodin's Results	*3*	*8*	*7*	*46*	*36*
	No, it made it worse	No, it didn't help	Not sure	Yes, it somewhat helped	Yes, it helped me a great deal
Have the services helped you deal with your child's problems	2.6	8.5	4.3	40.2	44.4
Bodin's Results	*2*	*19*	*11*	*37*	*31*
	Poor	Fair	Good	Excellent	No opinion
Rate the quality of the service you received	0.9	4.3	10.3	83.8	0.9
Bodin's Results	*3*	*8*	*27*	*60*	*2*

Table 5

Individual item responses to the original items from Bodin's Questionnaire listed as percentages with results from the original study by Bodin et al. (2007) for comparison.

Item	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Helped improve my child's life	2.6	6.0	22.2	40.2	29.1
Bodin's Results	*4*	*13*	*28*	*45*	*10*
	No definitely not	No not really	Not sure	Yes generally	Yes definitely
Was the office staff courteous and helpful	0.9	0.9	1.7	25.6	70.9
Bodin's Results	*0*	*2*	*2*	*47*	*49*
	Poor	Fair	Good	Excellent	No opinion
Rate your satisfaction with help getting insurance approval	5.1	4.3	17.9	61.5	11.1
Bodin's Results	*6*	*5*	*25*	*48*	*15*
Rate satisfaction with insurance coverage	7.7	9.4	13.7	58.1	11.1
Bodin's Results	*7*	*5*	*27*	*51*	*9*
Satisfaction with time on wait list	6.0	18.8	27.4	40.2	7.7
Bodin's Results	*15*	*15*	*39*	*29*	*2*
How accessible were our services	3.4	11.2	31.0	50.0	4.3
Bodin's Results	*3*	*9*	*50*	*36*	*1*
How helpful was the feedback session	5.1	8.5	25.6	55.6	5.1
Bodin's Results	*3*	*9*	*34*	*43*	*11*
How helpful was the written report	6.0	5.1	17.1	64.1	7.7
Bodin's Results	*4*	*10*	*28*	*51*	*6*

Table 6

Self-Reported Percentage of Recommendation Implementation

Recommendation Type	Mean (SD)	N
School accommodations	73.79 (28.77)	85
Outpatient Psychotherapy	70.61 (31.09)	53
School Counseling	49.79 (31.06)	14
Use of a Tutor	66.4 (39.12)	15
Medical Referrals	77.06 (23.42)	18
Psychiatric Medications	74.30 (33.88)	33
Books	59 (32.47)	29
Rehabilitation Therapy	78.13 (29.61)	40
Autism Therapies	88.5 (19.84)	6

Table 7

Significant p-values from independent t-tests as a post-hoc analysis using the Benjamini-Hochberg Procedure with a false discovery rate of 0.10 and 36 comparisons for differences in recommendation adherence based on recommendation type

	School Counseling	Bibliotherapy
School Accommodations	0.005	0.023
Outpatient Psychotherapy	0.029	
Medical Referrals	0.008	0.046
Psychiatric Medications	0.025	
Rehabilitation Therapy	0.004	0.013
Autism Therapy	0.012	0.041

Table 8

T-Scores of BRIEF and BASC Scores

	Baseline Mean (SD); n	Follow-up Mean (SD); n
BASC		
Internalizing	59.2 (15.21); 95	60.6 (13.7); 84
Externalizing	58.4 (14.28); 95	60.8 (15.2); 91
Behavioral Symptoms	61.8 (13.4); 95	64.1 (14.9); 83
Adaptive Functioning	40.97 (11.44); 94	39.74 (10.86); 84
BRIEF		
Global Executive Composite	66.8 (12.6); 81	-

Table 9

Results of BASC Paired t-tests

BASC Scale	N	t	p
Externalizing	72	-1.74	0.09
Internalizing	77	-0.83	0.41
Behavioral Symptoms	71	-1.42	0.16
Adaptive Functioning	71	0.94	0.35

Table 10

Percentage of Respondents with Initial T-Scores in the "At-Risk" or Higher Range*

	Percentage
BASC	
Externalizing	44% (n = 42/95)
Internalizing	43% (n = 41/95)
Behavioral Symptoms	57% (n = 54/95)
Adaptive Functioning	41% (n = 39/94)
BRIEF	
Global Executive Composite	69% (n = 59/85)

**At-Risk Range defined as a T-Score of >59 for Externalizing, Internalizing, and Behavioral Symptoms Indices and a T-Score of <41 for the Adaptive Functioning Index.*

Table 11

Results of Paired t-tests excluding baseline scores that were not "At-Risk" or higher

Baseline Measure	BASC Comparison Scale	N	t	p
BRIEF GEC				
	Externalizing	47	-1.04	0.31
	Internalizing	49	-0.91	0.37
	Behavioral Symptoms	46	-0.65	0.51
	Adaptive Functioning	46	0.11	0.91
BASC Externalizing				
	Externalizing	32	0.93	0.36
	Internalizing	34	-1.24	0.22
	Behavioral Symptoms	31	-0.20	0.84
	Adaptive Functioning	31	1.01	0.32
BASC Internalizing				
	Externalizing	34	-0.90	0.38
	Internalizing	34	2.63	0.01
	Behavioral Symptoms	33	-0.06	0.95
	Adaptive Functioning	33	0.81	0.42
BASC Behavioral Symptoms				
	Externalizing	42	-0.56	0.58
	Internalizing	44	-0.84	0.40
	Behavioral Symptoms	41	-0.46	0.65
	Adaptive Functioning	41	1.16	0.25
BASC Adaptive Functioning				
	Externalizing	39	-1.38	0.17
	Internalizing	42	-1.36	0.18
	Behavioral Symptoms	39	-0.75	0.46
	Adaptive Functioning	39	-1.72	0.09

**At-Risk Range defined as a T-Score of >59 for Externalizing, Internalizing, and Behavioral Symptoms Indices and a T-Score of <41 for the Adaptive Functioning Index.*

GEC = Global Executive Composite.

All paired t-tests were calculated by subtracting the follow-up score from the baseline score.

Table 12

Correlations between baseline Global Executive Composite from the BRIEF and change scores from the BASC

	Change in Externalizing Symptoms	Change in Internalizing Symptoms	Change in Behavioral Symptoms	Change in Adaptive Functioning
Pearson *r*	0.14	0.11	0.10	-0.04
p-value	0.27	0.39	0.47	0.75

Table 13

Correlations between time since evaluation (in days) and change scores from the BASC

	Change in Externalizing Symptoms	Change in Internalizing Symptoms	Change in Behavioral Symptoms	Change in Adaptive Functioning
Pearson *r*	0.11	0.17	0.19	-0.36
p-value	0.37	0.14	0.12	0.002

Table 14

Results of one-way ANOVAs to determine differences in change scores on the BASC and diagnostic classification

	Congenital M (SD)	Epilepsy M (SD)	Medical M (SD)	TBI M (SD)	F	*p*
Externalizing Symptoms	-1.12 (11.87)	-3.8 (9.85)	3.8 (8.47)	-3.83 (9.67)	0.96	0.43
Internalizing Symptoms	-1 (10.57)	-2.5 (4.2)	4.4 (7.77)	0.65 (11.52)	0.48	0.75
Behavioral Symptoms	-1.56 (10.76)	-2.9 (10.93)	2 (6.12)	-2.04 (8.93)	0.22	0.93
Adaptive Functioning	1.09 (9.68)	1 (8.62)	2.2 (7.22)	0.61 (5.96)	0.21	0.93

Table 15

Themes and sample responses to the question, "What part of the evaluation did you find most useful?"

Theme	N
Learning about strengths and weaknesses (SW)	12 (13%)
Understanding my child (U)	31 (35%)
Diagnosis (D)	17 (44%)
Recommendations (Rec)	22 (25%)
Feedback (F)	8 (9%)
Report (Rep)	9 (10%)
Sample Responses	Theme Code
"Finding out what was going on"	U
"Learning about abilities and weaknesses"	SW
"Styles of learning"	SW
"Different ideas to help her learn best"	Rec
"Handouts given that explain X diagnosis"	U, Rec
"The one-on-one time with Dr. X"	F
"Asking questions"	F
"Feedback from the doctor in a very straightforward and empathic way."	F
"Explanation of what to expect over time"	U
"Mainly validation about what I felt like he was experiencing and how I could help."	U, Rec
"The diagnosis section"	D
"Where she struggled and what we needed to do to help her."	U, Rec
"Report"	Rep
"Explanation of the child's condition and recommendations"	U, Rec
"Seeing where my son struggles"	SW
"Insight into how she thinks and responds"	U

Table 16

Sample responses to "What part of the evaluation did you find least useful?"

"The actual testing procedures used. It was confusing to read the report."

"Still feeling helpless and not getting immediate help."

"Some of the recommendations"

"It was all useful, but now I'm wanting more specific help. The school hasn't really known how to do errorless learning so I feel like the biggest recommendation hasn't been fully recognized."

"Test scores"

"No real answers to his behaviors"

"I feel there were a lot of things missed, but perhaps the child was too young at the time."

"The schools don't want to use recommendations without months of their own evaluations and their own recommended interventions."

"I didn't read most of the book recommendations."

"Some recommendations have created more behavior issues."

"I didn't know how to get others to buy into what we found and getting school's support has been really frustrating"

"The report didn't tell us much that we already didn't know about our child"

"I wish more time would have been spent talking about how [symptoms] are affecting his/her emotional and physical well-being"

"From the time we got the appointment, until the time we were able to get [the evaluation] was many months."

"It would have been helpful to have had the report much sooner."

Note: This list was not exhaustive but was thought to represent the breadth of comments. There were no common themes detected throughout these comments. Only 37 participants responded to this question with answers other than "Nothing" or "It was all useful."