Psychosocial functioning following Moderate-to-Severe Pediatric Traumatic Brain Injury: Recommended Outcome Instruments for Research and Remediation Studies

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Published as:

Wearne, T., Anderson, V., Catroppa, C., Morgan, A., Ponsford, J., Tate, R.L., Ownsworth, T., Togher, L., Fleming, J., Douglas, J., Sigmundsdottir, L., Francis, H., Honan, C. & McDonald, S. Psychosocial functioning following Moderate-to-Severe Pediatric Traumatic Brain Injury: Recommended Outcome Instruments for Research and Remediation Studies Neuropsychological Rehabilitation 1-15. doi:10.1080/09602011.2018.1531768

Abstract

Background: Psychosocial functioning is compromised following pediatric traumatic brain injury (TBI), with the past few decades witnessing a proliferation of research examining the effect of childhood brain insult on a range of psychosocial outcomes. This paper describes the systematic recommendation of outcome instruments to address psychosocial functioning following pediatric TBI.

Procedure: A total of 65 instruments across 11 psychosocial areas (i.e. Global Outcome, Communication, Social Cognition, Behavioural and Executive Function, Other Neuropsychological Functioning, Psychological Status, TBI-related Symptoms, Activities and Participation, Support and Relationships, Sense of Self, and Health-Related Quality of Life) were reviewed using various assessment methods, including working groups, literature searches, comparisons with selection guidelines, and international expert opinion. Each measure was reviewed for its usefulness across early recovery, intervention, and outcome related studies.

Results: 34 instruments were recommended and classified according to the World Health Organization's International Classification of Functioning, Disability and Health taxonomy and categorized by psychosocial area.

Conclusion: This compilation provides a common framework to guide the activities of clinicians and researchers in psychosocial rehabilitation. It is anticipated that these will foster a multidisciplinary approach to psychosocial dysfunction to enhance the evaluation, prediction, and improvement of functional outcomes for those with pediatric TBI.

Keywords: traumatic brain injury, pediatric, psychosocial, outcome assessment, outcome instuments, remediation, research, recommendations

Traumatic Brain Injury (TBI) is a leading cause of disability in children and adolescents (Catroppa, Godfrey, Rosenfeld, Hearps, & Anderson, 2012; Thurman, 2016), with an accumulating body of evidence highlighting that pediatric TBI is concomittant with an array of physical, cognitive, emotional, psychiatric, linguistic, and behavioral problems (Anderson, Spencer-Smith, & Wood, 2011; Bloom et al., 2001; Kraus et al., 2007; Li & Liu, 2013; Morgan, Masterton, Pigdon, Connelly, & Liegeois, 2013). Unlike brain injury during adulthood, childhood brain insult occurs during periods of significant reorganization of neural networks (Anderson, Spencer-Smith, et al., 2011) and the development of cognitive function, language, relationships, and social skills (Beauchamp & Anderson, 2010). As such, childhood TBI can significantly disrupt the natural development and maturation of neural connections and social functions that are needed to reach developmental milestones, to acquire new skills, and to become competent social beings. Furthermore, the extent and pervasiveness of these difficulties may not be evident until years after injury when these skills are expected to manifest (Wells, Minnes, & Phillips, 2009).

Psychosocial functioning refers to the social, physical and mental factors associated with how an individual interacts and functions with their environment. Difficulties with psychosocial functioning are perhaps some of the most disabling outcomes of pediatric TBI (Ryan et al., 2016). Parents, teachers and carers often report impairments in social functioning as a cause of persistent distress (Catroppa, Anderson, Morse, Haritou, & Rosenfeld, 2008; Catroppa et al., 2012; Chapman et al., 2010; Li & Liu, 2013) and psychosocial difficulties can lead to significant declines in academic performance (Ewing-Cobbs et al., 2004), number and quality of peer relationships (Bohnert, Parker, & Warschausky, 1997), community integration (Chevignard, Brooks, & Truelle, 2010), social competence (Ganesalingam et al., 2011), self-esteem (Conoley & Sheridan, 1996), and quality of life (Anderson, Brown, Newitt, & Hoile, 2011; Di Battista, Soo, Catroppa, & Anderson, 2012; Stancin et al., 2002). Furthermore,

studies have shown that psychosocial problems from pediatric TBI are long-lasting and persist into adulthood (McLellan & McKinlay, 2013; Scott et al., 2015).

Given the potential negative impact of pediatric brain injury on psychosocial functioning, continued research in this area is paramount to understand how these difficulties develop and persist throughout recovery and to determine their effects on the social mileu of survivors. Such understanding would also provide a strong theoretical and empirical foundation for the development of remediation techniques that circumvent the deleterious effects of pediatric TBI. Currently, however, factors underlying social difficulties are poorly understood and interventions that target psychosocial outcomes are limited. A significant impediment to research is the lack of uniform instruments across studies, which renders it difficult to draw reliable and firm conclusions and hinders the quality of evidence for interventions targeting psychosocial functioning. Furthermore, specifically in the context of pediatric TBI, many instruments are not validated for pediatric samples, are not developmentally appropraite nor have age-specific normative data available. In light of the limited remediation options for psychosocial dysfunction following TBI, together with the fragmented nature of research in this field, the 'Moving Ahead' Centre of Research Excellence (CRE) was established (McDonald et al., 2012). One of the main aims of the Moving Ahead CRE was to develop a coherent framework for activities addressing psychosocial difficulties following TBI. A major objective of this framework included the evaluation of and recommendations for the use of outcome instruments for psychosocial research and remediation across the lifespan.

The United States (US) Interagency Common Data Elements (CDE) project previously established recommendations for outcome instruments for TBI research with adult (Wilde et al., 2010) and pediatric populations (McCauley et al., 2012). As an extension to these recommendations, the Moving Ahead CRE published a list of recommended outcomes

for use with adults with moderate-to-severe TBI (Honan et al., 2017). These expanded on the CDE project by 1) focusing on instruments specifically related to psychosocial functioning, 2) categorizing instruments according to the taxonomy of the International Classification of Functioning, Disability and Health (ICF) (World Health Organisation, 2001; World Health Organization, 2013), and 3) assessing whether each instrument was sensitive to change. A detailed rationale behind this approach can be found elsewhere (Honan et al., 2017). Here, we provide our follow-up recommendations for research and remediation related to psychosocial function specifically focussing on moderate-to-severe pediatric TBI. Assessment of both pediatric and adult instruments is central to the assessment of psychosocial functioning, as social outcomes and functional changes over time are likely to vary depending on the age at the time of the assessment and the developmental stage at which the insult was acquired (Anderson, Northam, Hendy & Wrennall, 2011). This project was conducted in conjunction with our adult recommendations and facilitated by the Moving Ahead CRE outcome measures working group and three project managers. The working group included 12 experienced clinicians and expert researchers in TBI in the fields of clinical psychology, neuropsychology, occupational therapy, and speech pathology.

Method

Here we summarize the process for selection and critique of the outcome instruments for use in pediatric psychosocial research following TBI (see Figure 1 for schematic summary). A detailed description of this approach can be found in the original paper on the development of outcome instruments in adult TBI populations (Honan et al. 2017).

Psychosocial Area Selection

Consistent with the areas selected for outcome instruments for adults with TBI (Honan et al., 2017), 11 functional areas were identified as relevant to psychosocial research following pediatric TBI. These were chosen according to the original CDE workgroup recommendations (https://commondataelements.ninds.nih.gov/tbi.aspx) and further assessed by the current working group regarding their appropriateness for psychosocial research. Names and definitions of areas were adjusted to reflect the descriptions typically employed in psychosocial literature (e.g. 'Activities and Participation' in place of 'Social Role Participation and Social Competence') and a new area (Sense of Self) was introduced to reflect issues relating to 'the self' and identity, a construct which is routinely assessed within the psychosocial context. The final psychosocial areas were: (1) Global Outcome, (2) Communication, (3) Social Cognition, (4) Behavioral and Executive Function, (5) Other Neuropsychological Functioning, (6) Psychological Status, (7) TBI-Related Symptoms, (8) Activities and Participation, (9) Support and Relationships, (10) Sense of Self, and (11) Health-related Quality of Life (QoL). Descriptions of these psychosocial areas are provided elsewhere (Honan et al., 2017). It should be noted that neuropsychological constructs are not usual targets of psychosocial remediation. However, cognitive abilities, such as executive functioning and memory, are important requisites for everyday activities and social role participation, and are very sensitive to effects of TBI. Consequently, the assessment of neuropsychological indices is an important adjunct in the examination of the relationship between TBI and psychosocial dysfunction and has been included as an additional psychosocial domain in both our adult (Honan et al., 2017) and pediatric recommendations.

ICF Classification

Outcomes were differentiated by ICF classifications (a full list can be found at http://www.who.int/classifications/icf/en/) in accordance with the 'construct intent' approach

as outlined by Tate, Godbee, and Sigmundsdottir (2013) and our adult TBI recommendations (Honan et al., 2017). Factoring in the intended purpose of the instrument (as documented in the original development of the instrument), each outcome was classified by adopting a 'best fit' approach and instruments that satisfied criteria for multiple ICF classifications were given several codes (e.g., Table 2). Two researchers with knowledge of the ICF taxonomy (RT and LS) independently allocated ICF rubrics using the above approach and disagreements were resolved by consensus.

Outcome Instrument Selection

The working group initially recommended 29 instruments for use in psychosocial research following pediatric TBI (Figure 1). Consistent with the approach used for adult TBI psychosocial instruments (Honan et al., 2017), these were summarized based on their intended purpose, psychosocial area, ICF codes, administration features (e.g., clinician rated or self-report), psychometric properties related to TBI, and strengths and weaknesses (see Supplementary Tables s1a-s1j). They were assessed for their suitability for research relating to *early recovery*, *intervention* and *outcome* studies. *Early recovery* refers to studies conducted in inpatient settings up to approximately 3 months post injury, *intervention* studies assess the effectiveness of treatments/interventions, and *outcome* studies examine psychosocial functioning following the acute phase of recovery. They were then placed into one of four tiers of recommendations (i.e. *Core*, *Basic*, *Supplemental* or *Emerging*), consistent with the TBI CDE v.2 recommendations. An overview of the specific guidelines used to determine the selection and classification of instruments for the current paper can be found in our adult measures paper (Honan et al., 2017) and in Table 1. *Core* refers to instruments that are well established within the domain of psychosocial functioning and are applicable to all study types across the spectrum of moderate-to-severe pediatric TBI. *Basic* refers to well-

established instruments that are only relevant to a specific study type. *Supplemental* refers to instruments that are relevant depending on the scope and aims of the specific study. *Emerging* refers to newer instruments that are yet to be shown to be psychometrically and clinically superior to currently available tools.

A survey was anonymously distributed amongst the working group to assess the frequency with which the nominated instruments were used on a 4-point scale from 'Never' to 'Always'. Three instruments were rejected, as they did not fit within the psychosocial areas (total = 26). One or two reviewers with expertise in a specific psychosocial area (e.g. Social Cognition) reviewed all nominated instruments within that area against a pre-established set of criteria. These criteria were taken from the guidelines established from the CDE process and were expanded to assess: the use of the instrument in psychosocial research, availability of international normative data, flexibility of formats, ease of use across multiple studies, ability to document recovery or response to treatment, and ability to predict longer-term outcomes. The same reviewers identified gaps in the assessment of psychosocial functioning and sourced an additional 33 instruments via literature searches using psychosocial keywords (e.g. theory of mind) across a number of academic databases (e.g. PsycINFO and PubMed). The working group met monthly via teleconference to develop, assess, and discuss the list of recommended instruments. At this point, the suitability of individual instruments across study types, their tier of recommendation, and their sensitivity to change were agreed upon via consensus. Lastly, a full-day workshop with the entire working group was convened to review and finalize the recommendations prior to expert review.

Table 1 here

An international Expert Advisory Board (EAB) was established to review and provide feedback on the final list of recommendations. The EAB consisted of 10 internationally renowned researchers within psychosocial research across Australia, Canada, the United States, and Sweden. They were asked to provide written reports on the instruments within their areas of expertise (one or two EAB reviewers per psychosocial area) and to comment on the tier of recommendation across study types. A total of 59 instruments were reviewed by the EAB and consisted of three Global Outcome instruments. For the ICF Body and Mental Functions (b) domain, nine Communication, four Social Cognition, seven Behavioral and Executive Function, nine Other Neuropsychological Functioning, six Psychological Status, and two TBI-Related Symptoms instruments were reviewed. Within ICF Activities/Participation (d) and Environmental Factors (e) domains, eleven Activities and Participation and three Support and Relationships were considered, respectively. Two Sense of Self instruments within the Personal Factors domain were considered along with three Health-Related Quality of Life instruments, which is not considered within the current ICF taxonomy (Supplementary Table s2). The EAB recommended an additional six instruments to be considered for inclusion in the final list of recommendations. The feedback was discussed at monthly working group meetings and the final list was created and endorsed by the group. Several instruments were identified as satisfying inclusion criteria across several psychosocial areas. During these instances, a 'best fit' approach was used to identify the psychosocial area that best encapsulated the intention of the measure.

Results

In total, 34 instruments were recommended for psychosocial research and remediation studies following pediatric TBI. These are summarized in Table 2 and are organized by ICF codes

and psychosocial areas. Short descriptions of each measure are provided in the supplementary materials along with tables detailing the type of study, level of recommendation, basic psychometric properties, and strengths and weaknesses for each instrument (Tables s1a to s1j). Full descriptions of these instruments, including administration procedures, type of measure (e.g. self-report), age-range, detailed psychometric properties, along with advantages and weaknesses of their use, can be downloaded from the CRE website (www.movingahead.com.au).

Table 2 here

Global Outcomes

No measure was endorsed in this area.

Body Functions (b); Mental Functions (b1)

Communication

Six instruments in the Communication area were recommended. The Clinical Evaluation of Language Fundamentals V (CELF-V) (Wiig, Semel, & Secord, 2013) was recommended as a Basic measure across intervention and outcome study types but was also Not Recommended for early recovery studies. The Comprehensive Assessment of Spoken Language Psycholinguistic (CASL) (Carrow-Woolfolk, 1999), The Word Test 2 (TWT-2)/ Word Test 3 (Bowers, Huisingh, & LoGiudice, 2004), The FAVRES – Student Version (MacDonald & Johnson, 2005), Oral and Written Language Scales – Second Editions (OWLS-II) (Carrow-Woolfolkd, 2011), and Test of Integrated Language and Literacy Skills (TILLS) (Nelson,

Plante, Helm-Estabrooks, & Hotz, 2015) were recommended as Supplemental instruments across intervention and outcome study types but Not Recommended for early recovery studies.

Social Cognition

Five instruments were recommended for the Social Cognition area. The Interpersonal Negotiation Strategy (INS) (Yeates, Schultz, & Selman, 1990), and the Social Cognition subscale of the developmental NEuroPSYchological Assessment (NEPSY) (Korkman, Kirk, & Kemp, 1998) were recommended as Supplemental instruments across all study types. The Social Language Development Test (SLDT) (Bowers, Huisingh, & LoGiudice, 2008) was recommended as a Supplemental instrument for intervention and outcome studies but was not recommended for early recovery. Socio-Moral Reasoning (So-Moral) (Dooley, Beauchamp, & Anderson, 2012) and the Paediatric Evaluation of Emotions, Relationships, and Socialisation (PEERS/PEERS-Questionnaire) (Muscara, Catroppa, Beauchamp, & Anderson, 2012; Thompson et al., 2018) were recommended as Emerging outcome instruments across all study types.

Behavioral and Executive Function

Four instruments for the Behavioral and Executive Function were recommended. The Child Behavior Checklist (CBCL) (Achenbach & Edelbrock, 1991), specifically the Social Competence Scale, was recommended as a Supplemental instrument across early recovery and intervention studies and a Basic measure for outcome studies. The Behavior Assessment System for Children – Third Edition (BASC- 3) (Reynolds & Kamphaus, 2004), Behavior Rating Inventory of Executive Function – Children's Version (BRIEF-C) (Gioia, Isquith, Guy, & Kenworthy, 2000) and the Vineland Adaptive Behavior Scales – III (VABS) (Sparrow, Balla, & Cicchetti, 2005) were all recommended as Supplemental instruments across all study types.

Other Neuropsychological Functioning

Five instruments assessing other neuropsychological functioning related to psychosocial research were recommended. These included the Stories subtest of the Children's Memory Scale (CMS) (Cohen, 1997), the Comprehensive Trail Making Test (CTMT) (Reynolds, 2002), Verbal Fluency tasks (e.g. FAS) (Spreen & Benton, 1977) and the Wechsler Intelligence Scale for Children- 5th Edition (WISC-V) (Wechsler, 2014). All these tools were recommended as Supplemental instruments across all study types. The Contingency Naming Test (CNT) (Anderson, Anderson, Northam, & Taylor, 2000) was recommended as an Emerging measure across all study types.

Psychological Status

Three instruments were recommended for the Psychological Status area. The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) was recommended as a Core measure across all study types while the Children's Depression Scale (CDS) (Lang & Tisher, 1983) and the Spence Children's Anxiety Scale (SCAS) (Spence, 1998) were recommended as Supplemental instruments across all study types in this area.

TBI-Related Symptoms

The Fatigue Subscale of the Pediatric Quality of Life Inventory (PEDS-QL) (Varni, Seid, & Rode, 1999) was recommended as a Supplemental instrument across all study types within the TBI-Related Symptoms area.

Activities/Participation (d)

Activities and Participation

Five instruments were recommended for the Activities and Participation area. The Pediatric Evaluation of Disability Inventory – Computer Adaptive Test (PEDI-CAT) (Haley, 1992) and the Social Skills Improvement System (SSIS) Rating Scales (Gresham & Elliott, 2008) were

all recommended as Supplemental instruments across all study types. The Child and Adolescent Scale of Participation (CASP) (Bedell, 2011) and the Social Subscale of the Pediatric Quality of Life Inventory (PEDS QL) (Varni et al., 1999) were recommended as Supplemental instruments for intervention and outcome studies only, while the Sydney Psychosocial Reintegration Scale for Children (SPRS-C) (C. Soo et al., 2016) was recommended as an Emerging tool across all study types.

Environmental Factors (e)

Support and Relationships

Four instruments were recommended for the Support and Relationships area. The Family Assessment Device (FAD) (Epstein, Baldwin, & Bishop, 1983) was recommended as a Core measure across all study types. The Family Management Measure (FAMM) (Knafl et al., 2009) was recommended as a Basic measure for intervention studies and a Supplemental instrument for early recovery and outcome studies. The Parent Experience of Child Illness (PECI) (Bonner et al., 2005) and Paediatric Care and Needs Scale (PCANS) (Soo, Tatle, Williams, Waddingham, & Waugh, 2005) were recommended as a Supplemental measure across all study types.

Personal Factors

Sense of Self

The Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965) was recommended as a Supplemental measure across all study types.

Concepts not covered in ICF

Health-related Quality of Life

The Pediatric Quality of Life Inventory (PEDS-QL) (Varni et al., 1999) was recommended as a Core instrument across all study types.

Discussion

Psychosocial functioning is an emerging and important field following pediatric TBI, particularly given the negative outcomes of childhood brain injury on family, social, and educational networks. Here, we have described outcome instruments that are recommended for use in psychosocial research with pediatric samples across early recovery (i.e. 3 months post injury), intervention and outcome-related studies. By recommending instruments for pediatric samples, together with our original list of instruments for use in moderate-to-severe adult TBI (Honan et al., 2017), this paper completes one of the aims of the Moving Ahead CRE by providing recommendations for psychosocial outcome instruments for research across the lifespan. This work provides a comprehensive framework to be implemented within the field that guides and promotes psychosocial rehabilitation, facilitates data pooling across research teams, and allows more reliable and valid research outcomes to be reported in the literature.

Similar to the recommended instruments described for psychosocial research following adult TBI (Honan et al., 2017), the instruments described in this paper do not represent an exhaustive or requisite list that should be implemented across all study types and contexts. In addition, even though we have recommended three instruments as *core* measures (i.e., SDQ, FAD & PEDS-QL), this does not mandate their use in every research study. Rather, *core* means that they are well-validated instruments that are applicable to moderate-to severe pediatric TBI and can be utilized across all study types. We propose, therefore, our list of recommended instruments serve as a basis for pediatric psychosocial studies that are tailored and focused towards the specific research question and psychosocial area being

examined. Furthermore, we believe these instruments complement the original CDE recommendations (McCauley et al., 2012) by specifically targeting instruments for use in encapsulating the psychosocial context. The original list provided by CDE project group should be considered when conducting research related to area not specifically related to psychosocial outcomes (e.g., academics, physical functioning etc.).

We have organized these suggestions within the taxonomy of the ICF by the World Health Organization. However, as noted in our previous publication (Honan et al., 2017), there are additional areas associated with psychosocial research that do not currently fit within the ICF classification system, such as research relating to quality of life. Therefore, other important facets of TBI psychosocial research may have been omitted from the current list of recommended instruments that are important within this field. We have also identified a number of emerging instruments that show potential in their assessment of psychosocial functioning following pediatric TBI. It is anticipated that these will be utilized and further validated to determine their usefulness across all psychosocial research following pediatric TBI. To this end, we have expanded previous recommendations by highlighting where each measure is sensitive to change. In doing so, literature searches were conducted to identify studies where each measure was used to demonstrate treatment and/or intervention effects. It should be noted, however, that even though sensitivity to change may not have been established for specific instruments, this does not necessarily preclude their potential to detect change, and future studies could still use such instruments to demonstrate treatment efficacy.

Unlike our list of adult instruments where we identified The Glasgow Outcomes Scale-Extended (GOS-E) (Teasdale, Pettigrew, Wilson, Murray, & Jennett, 1998) as a core instrument across all study types, we did not provide a global instrument for psychosocial research for pediatric samples in the current paper. There are several reasons for this omission. First, the GOS-E is not routinely used in pediatric samples, and while we would

like to provide consistency in the use of global instruments across the lifespan, its lack of clinical utility with this population negated the recommendation of this measure as a core instrument. Second, the international expert advisory panel did not endorse other instruments that are routinely used in clinical practice, such as the Pediatric Glasgow Coma Scale (GCS) (Reilly, Simpson, Sprod, & Thomas, 1988). The GCS is routinely used in medical contexts to examine physical indices of coma and injury rather than psychosocial functioning. Consequently, we did not have a global measure of psychosocial functioning that could be used across different study types following pediatric TBI. Clearly, there is scope for the development and validation of new global instruments to fill this gap in pediatric assessment.

Summary and Conclusion

The current paper provides recommendations regarding the use of various instruments for the assessment and evaluation of psychosocial outcomes following moderate-to-severe pediatric TBI. These recommendations evaluate the usefulness of each instrument for early recovery, intervention and long-term outcome measurement. We anticipate that these recommendations will enable comparisons to be easily drawn across published studies, foster collaborations between research teams and that data can be pooled to enable research with larger pediatric TBI samples. Additionally, it is anticipated that these instruments will foster a multidisciplinary approach to psychosocial dysfunction to enhance the evaluation and prediction of outcomes. Combined with the adult instruments recommended previously, this list completes a common framework for measuring outcomes and allows all clinicians and researchers working within the traumatic brain injury field to ‘Move Ahead’ with psychosocial rehabilitation so that we can ultimately improve therapeutic and functional outcomes for those with TBI.

Funding

The Moving Ahead Centre for Research Excellence is funded by the National Health and Medical Research Council (NHMRC) for the period 2012-2017.

Acknowledgements

We would like to thank Francesca Hill, Crystal Yau, and Melinda Drew for their invaluable administrative assistance for this project. We would like to express our sincere thanks to the following postdoctoral research fellows for their time with the preparation of the outcome instrument briefs: Dr Kimberley Docking and Dr Phoebe Kho. We would like to thank the following members of the distinguished Expert Advisory Board for their time in reviewing and providing feedback on the recommendations: Professor Gerry Taylor, Dr Catherine Aaro Jonsson, Professor Gavin Davis, Professor Lyn Tursktra, Professor Jeffrey Max, Dr Harvey Levin, Professor Keith Yates, Associate Professor Miriam Beauchamp, Ms Jane Galvin, and Dr Ingrid van't Hooft**.**

Author Disclosure Statement

Recommended instruments that are authored by the Moving Ahead Working Group that are available in the public domain include the following (Note: these authors did not contribute to the discussion of the instrument's inclusion in the recommendations):

Robyn Tate – Sydney Psychosocial Rehabilitation Scale for Children and the Paediatric Care and Needs Scale

Cathy Catroppa – Sydney Psychosocial Rehabilitation Scale for Children

Vicki Anderson – Sydney Psychosocial Rehabilitation Scale for Children and the Paediatric Evaluation of Emotions, Relationships, and Socialisation

Skye McDonald – the Paediatric Evaluation of Emotions, Relationships, and Socialisation

Figure 1. Schematic representation of methodology employed

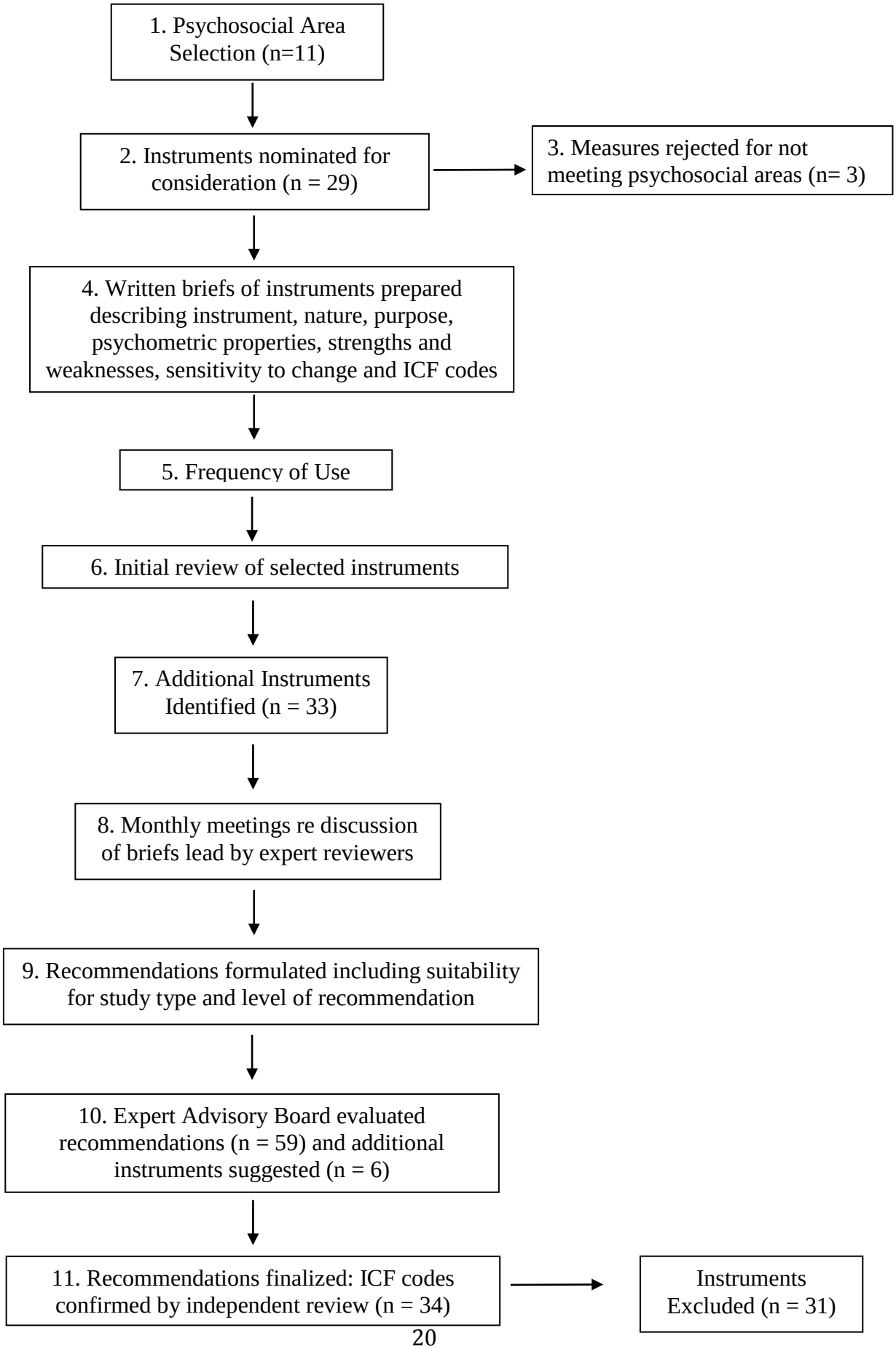

Table 1. Psychosocial Outcome Measure Instrument Selection Guidelines

Guidelines
1. Sufficient representation in scientific literature and/or widespread use in psychosocial research of moderate-to-severe pediatric TBI and across studies examining ‘early recovery’, ‘intervention’ and/or ‘outcome’.
2. Evidence of sound psychometric properties relevant to moderate-to-severe pediatric TBI populations
3. Well-established normative/comparison data and international normative/comparison data
4. Applicability across a range of severity, functional levels, and developmental levels
5. Availability in the public domain
6. Ease of administration (i.e., minimal complexity in administration and scoring.
7. Brevity
8. Continuity with US-based TBI Common Data elements instruments where possible.

Table 2. Recommended Instruments by ICF domain and psychosocial area

Instrument	ICF Codes	Study Type R	I	O	Δ
ICF - Body Functions (b)					
Communication					
Clinical Evaluation of Language Fundamentals (CELF-V)	d310-349, b167, b144, b166, d170	N	B	B	N
Comprehensive Assessment of Spoken Language Psycholinguistic (CASL)	d310, d330, b167	N	S	S	N
The Word Test 2 (TWT-2) (adolescents) and TWT-3 (children)	b167	N	S	S	N
The FAVRES - Student Version (SFAVRES)	b164, b167, d310-349, d175, d177	N	S	S	N
Oral and Written Language Scales - Second Edition (OWLS-II)	b167, d310-349, d166, d170	N	S	S	Y
Test of Integrated Language and Literacy Skills (TILLS)	b167, b144, d310-349, d166, d170	N	S	S	N
Social Cognition					
Interpersonal Negotiation Strategy (INS)	d710-d729, d175	S	N	N	N
NEPSY Social Cognition	d3150, d310, d710-729, b122	S	S	S	N
Social Language Development Test (SLDT)	d130, d330, d710-129	N	S	S	N
Socio-Moral Reasoning (So-Moral)	d720, d7203, b122	E	E	E	N
PEERS/PEERS-Q	d710-729, d310-349	E	E	E	N
Behavioral and Executive Function					
Child Behavior Checklist (CBCL); Social Competence Scale	d710-729, d730-779, b152, d810-839, d910, d920	S	S	B	Y
Behavior Assessment System for Children (BASC-3)	d710-729, b1304, b152	S	S	S	N
Behavior Rating Inventory of Executive Function (BRIEF-C)	d710-729, b164, b130	S	S	S	N
Vineland Adaptive Behavior Scales (VABS) - II	B130, d310, d330, d166, d170, d240, d710-729, d910, d920, d5, d6, d4	S	S	S	Y
Other Neuropsychological Functioning					
Children's Memory Scale (CMS): Stories subtest	b144	S	S	S	N/A
Comprehensive Trail Making Test	b164, b140	S	S	S	N/A
Verbal Fluency (FAS)	b164	S	S	S	N/A
Wechsler Intelligence Scale for Children (5th Edition): PSI/WMI	b140-189	S	S	S	N/A
Contingency Naming Test (CNT)	b164	E	E	E	N/A
Psychological Status					
Strengths and Difficulties Questionnaire (SDQ)	b152, b130, d710-729	C	C	C	Y
Children's Depression Scale (CDS)	b152	S	S	S	Y
Spence Children's Anxiety Scale (SCAS)	b152	S	S	S	Y
TBI-related Symptoms					
Pediatric Quality of Life Inventory (PEDS QL); Fatigue[a] Scale	b134, b130	S	S	S	Y
ICF - Activities/Participation (d)					
Activities and Participation					
Child and Adolescent Scale of Participation (CASP)	d910, d920, d810-839, d710-729, d6, d3, d4, d5	N	S	S	Y
Pediatric Evaluation of Disability Inventory - Computer	d710-729, e3, d4,	S	S	S	Y

Adaptive Test (PEDI-CAT)	d5, d6				
Pediatric Quality of Life Inventory (PEDS QL); Social Subscale[a]	d710-729	N	S	S	Y
Social Skills Improvement System (SSIS) Rating Scales	d710-729, d810-830, b130	S	S	S	Y
Sydney Psychosocial Reintegration Scale - Children (SPRS-C)	d920, d810-839, 710-729, d6, d4, d5, d3	E	E	E	Y
ICF - Environmental Factors (e)					
Support and Relationships					
Family Assessment Device (FAD)	N/A	C	C	C	Y
Family Management Measure (FAMM)	d310, e410	S	B	S	N
Parent Experience of Child Illness (PECI)	N/A	S	S	S	Y
Paediatrics Care and Needs Scale (PCANS)	d710-729, d910, d920, d810-839, e1, e3, e5, d4, d5, d6	S	S	S	Y
ICF - Personal Factors					
Sense of Self					
Rosenberg Self-Esteem Scale (RSES)	b1266	S	S	S	N
Concepts not covered in ICF					
Health-Related Quality of Life					
Pediatric Quality of Life Inventory (PEDS QL)	N/A	C	C	C	Y

ICF = International Classification of Functioning, Disability and Health, R = Early Recovery, I = Intervention Studies, O = Outcome studies, C = Core, B = Basic, S = Supplemental, E =Emerging, Δ = Sensitivity to Change, Y = Yes, N = Not enough evidence, N/A = not available.

[a] Quality of life Instruments are classified as 'N/A' because it is not a concept covered by the ICF but here it is being used to document severity.

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Brief Description of Recommended Outcome Instruments for Use in Psychosocial Research for Pediatric Samples

Supplemental Paper to

"Psychosocial functioning following Moderate-to-Severe Pediatric Traumatic Brain Injury: Recommended Outcome Instruments for Research and Remediation studies"

The recommended instruments are smmarised in both Table 1 (within the main manuscript) and s1a to s1k (presented at the end of this document). In total, 34 instruments were recommended (a full listing of other instruments considered is shown in Table s2). Brief descriptions of each recommended instrument are provided below. The information is organized according to the taxonomy of the World Health Organization's International Classification of Functioning (WHO) and areas of psychosocial functioning.

Body Functions (b): Mental Functions (b1)

Communication

The Comprehensive Assessment of Spoken Language (CASL) (Carrow-Woolfolk, 1999) is an individually and orally administered language assessment battery for children and adolescents aged from ages 3 to 21. It consists of 14 tests that examine comprehension, expression, and retrieval of language tests examining: Lexical/Semantics, Syntax, Supralinguistics and Pragmatics. Core tests (C) can be used to derive a global language composite score and supplementary tests (S) provide additional diagnostic information and index scores (e.g. Receptive Language Index, Expressive Language Index, Lexical/Semantic Index, Syntactic Index and

Supralinguistic Index). Administration of each individual test is 5 to 10 minutes with the core composite score (General Language Ability Index) taking approximately 45 minutes. The manual provides scoring information, comparison normative data (1,700 examinees across the USA) and interpretation. There is insufficient evidence as to whether the CASL is sensitive to change.

The Clinical Evaluation of Language Fundamentals – 5 (CELF-V) (Wiig, Semel, & Secord, 2013) is an individually administered tool for the identification, diagnosis, and follow-up evaluation of language deficits in individuals aged from 5 years to 21:11 years. It comprises 18 tests that examine Receptive Language, Expressive Language, Pagmatics, Language Structure, and Language Content. The test can be used to derive a Core Language Score. It is available in both traditional and digital forms. Normative data are based on 3,250 English speaking 5-12 year olds from 47 states of the USA. Administration of the Core Language score is 45 minutes. One RCT that used the CELF to assess treatment effects found no change (Phillips et al., 2016) so sensitivity to change is not established.

The Word Test 2 (TWT-2) (Bowers, Huisingh, LoGiudice, & Orman, 2005) and Word Test 3 (TWT-3) (Bowers, Huisingh, LoGiudice, & Orman, 2014) are objective measures of a child's language competency as assessed by their ability to express vocabulary and understand semantics. TWT-3 is a recent version available in Elementary (ages 6 - 11) while the older TWT-2 has the Adolescent version (ages 12 to 17). Each version consists of six subtests that assess Associations, Synonyms, Semantic Absurdities, Antonyms, Definitions, and Flexible Word Use. Each subtest consists of 15 items. Administration time for each form of the test is approximately 30 minutes. Normative data based on 1,302 children and 1,692 adolescents from the USA are available. Information regarding sensitivity to change is not available.

The Functional Assessment of Verbal Reasoning and Executive Strategies (FAVRES) Student Version (MacDonald & Johnson, 2005) assesses ability to implement strategies when providing written and oral responses, complex comprehension, and the use of verbal reasoning for pediatric patients aged between 12 and 19 years of age. It consists of tasks that represent real-life scenarios and scoring can be used to differentiate between reasoning subscales that examine 1) getting the facts; 2) eliminating irrelevant material; 3) weighting facts; 4) flexibility; 5) predicting consequences, and 6) a total reasoning score. Administration time is approximately 50 minutes. Comparative data based on 182 typically developing adolescent (12-19 years of age) is available (MacDonald, 2016). Sensitivity to change has not been established.

The Oral and Written Language Scales – Second Edition (OWLS-II) (Carrow-Woolfolkd, 2011) is an assessment of oral and written language for pediatrics aged 3 to 21 years of age. It aims to identify language disorders, design intervention targets, and monitor progress. The assessment consists of four scales: Listening Comprehension, Oral Expression, Reading Comprehension, and Written Expression, with each scale assessing four linguistic structures: semantic/lexical, syntax, pragmatics and supralinguistics. Each scale can be administered in isolation and each scale administration time ranges from 10 to 30 minutes. Scores can be combined to produce five Composites: Oral Language, Written Language, Receptive Processing, Expressive Processing, and Overall Language Processing. Scoring can be completed manually or with a computer-scoring program. Normative data is available based on 2,123 examinees aged 3-21 years from the USA. The OWLS Listening Comprehension task has been shown to be sensitive to the effects of treatment (Phillips et al., 2016).

The Test of Integrated Language and Literacy Skills (TILLS) (Nelson, Plante,

Helm-Estabrooks, & Hotz, 2015) is a measure of language and literacy skills for children aged 6 to 18 years. It can be used to identify language and literacy disorders, strengths and weaknesses, and document language and literacy over time. There are 15 subtests that are differentiated into two dimensions of language (Sound/Word and Sentence/Discourse Level) and subtests are divided across language modalities (e.g. Listening, Speaking, Reading, Writing and Memory). There is also an informer rating scale that can be used to identify perceptions of the student's strengths and needs. The subtests of the TILLS can be administered in isolation, in combination or its entirety. The full administration takes approximately 90 minutes while core subtests take approximately 25 to 45 minutes. Normative data based on 1,262 US students with typical language development is available. Sensitivity to change has not been established.

Social Cognition

The Interpersonal Negotiation Strategy (INS) (Yeates, Schultz, & Selman, 1990) is a semi-structured interview for ages 6 to 16 years old. It assesses social problem solving via the presentation of social conflict scenarios and participants are asked to solve the issue by 1) defining the problem, 2) generating alternative strategies, 3) selecting a specific strategy and, 4) evaluating outcome. Responses are scored on a scale from 1 to 4 (impulsive = 1 point, unilateral = 2 points, reciprocal = 3 points, or collaborative = 4 points). An average score is obtained from the four problems. Higher scores indicate better interpersonal negotiation strategies. Administration time is approximately 30 minutes. Some research studies have provided comparative data on small numbers of typically developing children (e.g. Hanten et al., 2011; Keith Owen Yeates, Lynn Hickey Schultz, & Robert Selman, 1991. There is insufficient evidence

available of sensitivity to change.

The Social Language Development Test (SLDT) (Bowers, Huisingh, & LoGiudice, 2008) is a standardized assessment of social language-based skill development and evaluates language via responses to peer-based situations. It can be used to differentiate typically developed children from those with autism and language learning disorder. It is available in two versions for Elementary (6 – 11 years) and Adolescent (12 – 17 years) ages. The Elementary version consists of four subtests including Making Inferences, Interpersonal Negotiations, Multiple Interpretations, and Supporting Peers. The Adolescent form consists of five subtests including Making Inferences, Interpreting Social Language, Problem Solving, Social Interpretation, and Interpreting Ironic Statements. Administration time is approximately 45 minutes. Normative data is available based on 1,104 children and 834 adolescents from the USA. Information regarding sensitivity to change is not available.

The developmental NEuroPSYchological Assessment-Second Edition (NEPSY-II) Social Perception Domain (Korkman, Kirk, & Kemp, 2007) is designed to assess two main abilities: affect recognition and the ability to understand other's perspectives and points of view (Theory of Mind: ToM). Administration time is approximately 5-7 mins (Affect recognition) and 10-13 minutes (ToM). Normative data is based upon 1,200 children through to adolescents based in the USA. While there is evidence that the NEPSY attention subtest is sensitive to treatment effects (Saard, Kaldoja, Bachmann, Pertens, & Kolk, 2017), there is insufficient evidence that the Social Perception subtests detect change.

The So-Moral (Dooley, Beauchamp, & Anderson, 2012) task is an assessment of moral reasoning by presenting moral dilemmas that reflect social situations likely to have been experienced by young people. Dilemmas are presented as a series of

photographs followed by a dichotomous question tapping moral decision-making. It is available in computer and hard copy forms. Administration time is approximately 15 minutes. There is some comparative data available (Chiasson, Vera-Estay, Lalonde, Dooley, & Beauchamp, 2017). There is insufficient evidence as to whether So-Moral detects change.

The Pediatric Evaluation of Emotions Relationships and Socialization (PEERS®) is a direct, interactive (photo and video based), individually administered assessment of social skills delivered via iPad designed for children from 5 to 13 years. Twelve subtests tap three social domains: attention/executive skills; social cognition and social communication. As part of the PEERS, the Peers-Q (previously the DASC) (Muscara, Catroppa, Beauchamp, & Anderson, 2012) is a parent report measure (145 questions) that assesses social competence and the quality of relationships of children and adolescents between the ages of 5 and 18 years. Six scales assess 1) relationships and prosocial behavior, 2) social communication and information processing, 3) coping skills, resilience, emotional control and antisocial behaviors, 4) temperament and personality, 5) self and internal factors, and 6) social environment and non-injury related factors. Each item is scored on a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree. Administration time for the entire battery is approximately 45 minutes. Normative data based on 724 Australian children is currently being compiled. This is a new measure with no evidence of sensitivity to treatment.

Behavioral and Executive Function

The Behaviour Assessment System for Children – Third edition (BASC-3) (Reynolds & Kamphaus, 2015) is a set of rating scales to assess adaptive behavior and emotional functioning. The Self-Report of Personality (SRP) provides insight into a

child's thoughts and feelings. It is available for children (ages 8 to 11), adolescents (ages 12 to 21) and college students (ages 18 to 25) and takes approximately 30 minutes to complete. The Teacher Rating Scales (TRS) measures adaptive and problem behaviors in the preschool or school setting across preschool (ages 2 to 5), child (ages 6 to 11), and adolescent years (ages 12 to 21), taking approximately 10 to 20 minutes to complete. The Parent Rating Scales (PRS) measures both adaptive and problem behaviors in the community and home similarly to the Teacher Scales. Validity and response set indexes help judge the quality of completed SRP, TRS and PRS forms. Norms are based on samples of 1700 (TRS), 1800 (PRS) and 1500 (SRP) children through to young adults from the USA. There is insufficient evidence to establish whether the BASC scales are sensitive to change.

The Behaviour Rating Inventory of Executive Function (BRIEF) (Gioia, Isquith, Guy, & Kenworthy, 2000) is a rating scale used to assess behavior and executive functioning for children aged 5 to 18:11 years. It is available in parent and teacher forms to assess executive function and behavior in school and home contexts. Both forms consist of 86 items that yield eight clinical scales including Inhibition, Shifting, Emotional Control, Initiation, Working Memory, Planning and Organization, Monitoring, and Organization of Materials. These scores can be used to generate global indexes of Behavioral Regulation Index and Metacognition, which together form a Global Executive Composite. There are also two validity scales (Inconsistency & Negativity). A self-report version is also available for children aged 11 to 22 years of age. Administration time is approximately 10 minutes. Normative data is based on 1419 parent and 750 teacher responses regarding participants in the USA. There is insufficient evidence as to whether the BRIEF is sensitive to change.

The Child Behaviour Checklist: Social Competence Scale (Achenbach & Edelbrock, 1991) is designed to obtain data from parents on behavioral / emotional problems and competencies for children aged 6 to 18 years of age. Twenty items assess competence (activities, social interactions, school performance) yielding subscores and a total competence score. 118 items assess problem behaviors providing scores on empirically based syndromes, i.e. Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problem, Thought Problems, Attention Problems, Rule-Breaking Behavior, Aggressive Behavior, and the extent to which the child's profile is indicative of Internalising or Externalising behaviors. Profiles can also be scored to reflect DSM-oriented scales. Administration time is approximately 15 minutes. Normative data is based on 4,994 children aged 6 to 18 based in 40 states of the USA, the district of Columbia, UK and one state of Australia. The CBCL has been shown to change with treatment (Pastore et al., 2011).

The Vineland-II Adaptive Behaviour Scales (VABS-II) (Sparrow, Balla, & Cicchetti, 2005) is a measure of adaptive behaviors for children from preschool to 18 years of age and assesses the ability to learn new everyday skills, cope with environmental changes and demonstrate independence. It provides an overview of five broad domains, including Communication, Daily Living, Socialization, Motor Skills and Maladaptive Behaviour (Optional). Caregiver rating scale and interview are also available but the rating scale is recommended. A different version of the scale is available for children under 6 years of age. Administration time is 20 to 60 minutes. Normative data are based on a total sample size of 3,000 children from the USA: 200 per year group through 11 years, 200 in each of three age groups for ages 12 through 18 years. The (original) VABS Social behavior scale showed improvement following CBT in children with a TBI (Pastore et al., 2011).

Neuropsychological Functioning

The Children's Memory Scale: Stories subtest (Cohen, 1997) is a measure for immediate and delayed auditory/verbal memory for children aged 5 through 16 years of age. The examiner reads a short story whereby the respondent recounts as many details as possible both immediately and after a 25 to 30 minute delay. Scores are converted to standard scores (M = 10, SD = 3). Administration time is approximately 5 minutes. Normative data is based on 1,000 US children.

The Contingency Naming Test (CNT) (Anderson, Anderson, Northam, & Taylor, 2000)(available from www.assbi.com.au) is a test for the assessment of executive functioning for children between 7 and 16 years old. It specifically examines concentration, cognitive flexibility and working memory by asking children to name a series of shapes (circle, triangle, square) by their form and colour depending on the specific rule of the item. It consists of four trials of increasing difficulty that are applied to a stimulus set of 9 practice items and 27 test items. The respondent is given 5 trials to learning a specific rule. Scoring consists of response time, errors and self-correction. Administration time is approximately 15 to 20 minutes. Comparative data is based on 381 healthy Australian (N=250), Canadian (N =42) and American (N=89) children aged 7 upwards (Anderson, Anderson, Northam, & Taylor, 2000).

The Comprehensive Trail Making Test (CTMT) (Reynolds, 2002) is a measure of processing speed, resistance to distraction, inhibition, task switching and cognitive flexibility. It has five trials. Trial 1 contains 25-circled numbers (1 – 25) that are to be connected by a line in ascending order. Trial 2 is similar but has distracter circles that are empty. In Trial 3 numbers 1 through 25 must be connected while ignoring distracter circles that are either empty or contain irrelevant line drawings. In Trial 4 numbers 1

through 20 must be connected whereby half are presented as numerals and half in text (e.g. 'nine'). In Trial 5, numbers (1 – 13) and letters (A – L) must be connected in alternating sequence while ignoring empty distracters. Administration time is approximately 15 - 20 minutes. The normative data is based on 1,664 individuals from 8-75 years of age, with a subset of 557 children aged 8 to 18 reported separately (Kahn, Riccio, & Reynolds, 2012).

Verbal Fluency (FAS) is a subtest of the Neurosensory Center Comprehensive Examination for Aphasia (Spreen & Benton, 1977) and assesses phonemic verbal fluency by asking the respondent to produce words that begin with a specific letter (i.e. F, A or S) within 1 minute. This is then repeated for the remaining two letters. It is a test of spontaneous word production, idea retrieval, self-initiation, strategy formation and response monitoring. Scoring represents the total number of words produced for all three letters and compared with normative data. Administration time is approximately 5 minutes. Normative data for English speaking children is available from a number of sources, e.g. (Anderson, Lajoie, Bell, 1997; Anderson, Anderson, Northam, Jacobs, & Catroppa, 2001) as well as for Spanish speaking children (Matute, Rosselli, Ardila, & Morales, 2004) . Meta-norms have been published for children and adults of varying ages, levels of education, ethnic diversity, and geographical diversity (Loonstra, Tarlow, & Sellers, 2001; Strauss et al., 2006).

The Wechsler Intelligence Scale for Children – 5th Edition (WISC-V) (Wechsler, 2014) is an individual administered intelligence test of children aged between 6 to 16 years of age. It comprises of short subtests that can be used to assess a variety of cognitive abilities and are scored to generate standard scores (M=10, SD =3). Subtests can be used to generate indexes of cognitive domains, including the Verbal Comprehension Index, Visual Spatial Index, Fluid Reasoning Index, Working Memory

Index (WMI), and Processing Speed Index (PSI). These can be combined to generate a Full Scale IQ (formerly known as an intelligence quotient or IQ score) to represent a child's overall intellectual ability. The PSI (derived from two subtests: Coding and Symbol Search) and WMI (derived from Digit Span and Picture Span) are recommended as outcome measures. Full administration of the WISC-V takes approximately 48 to 65 minutes. Norms are based on 2,200 children aged 6:0–16:11 stratified to match current U.S. census data.

Psychological Status

The Children's Depression Scale (CDS) (Lang & Tisher, 1983) is a questionnaire used for the assessment of symptoms of depression for children aged between 9 to 16 years of age. It is available in both self-report and parent/teacher/health practitioner versions. The self-report consists of 66 items presented on color-coded cards with responses ranging from 'Very Wrong' to 'Very Right'. There are two main subscales, the Depressive scale (48 items) and Positive Scale (18 items). The Depressive subscale and be further divided into Affective Response, Social Problems, Self-Esteem, Preoccupation with Sickness and Death, Guilt, and Miscellaneous Depressive Items. The Positive Scale can be further divided into Pleasure and Enjoyment, and Miscellaneous Positive Items. Administration time for the self-report is approximately 5 to 10 minutes. Normative data is available in the manual that was standardized on 1266 students through grades 2 to 8. The CDS appears to be sensitive to treatment effects (Kaslow & Thompson, 1998).

The Spence Children's Anxiety Scale (SCAS) (Spence, 1998) is a self-report questionnaire for the assessment of anxiety symptoms in children aged 8 to 15 years old. It was designed to be consistent with the diagnostic criteria for anxiety disorders

within the DSM-IV. It is a 44-item questionnaire where children are asked to rate the degree to which they experience specific symptoms on a 4-point scale from ‘never’ to ‘always’. It is divided into six domains of anxiety, including Generalized Anxiety, Panic/Agoraphobia, Social Phobia, Separation Anxiety, Obsessive Compulsive Disorder, and Physical Injury Fears. Six items are positively phased to reduce negative response bias. A parent version is also available. Administration time is approximately 10 minutes. Normative data is available based on a large community sample of 4,916 children aged 8 to 15 years of age in Australia. Different normative data is available for older (12-15 years of age) compared to younger age range (8-11 years). Previous studies have shown that the SCAS is sensitive to change (Barrett & Turner, 2001; Barrett, Farrell, Ollendick, & Dadds, 2006; Barrett, Lock, & Farrell, 2005).

The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) is a behavioral screening tool for children aged between 3 through 16 years of age. It consists of 25 items that are used to derive five subscales associated with conduct problems, hyperactivity-inattention, emotional symptoms, peer problems, and prosocial behavior. These can also be used to generate a total difficulties score. Ten items are considered strengths and 14 items are consisted difficulties, while one item is considered neutral. It is available in parent, teacher and self-report (aged 11 through 16) forms. Administration time is approximately 5 to 10 minutes. An extended version is also available to examine distress, social impairment, burden, and chronicity of problems. Normative data is available for several countries on the questionnaire website. Sensitivity to change seems to have been established (Mason, Chmelka, & Thompson, 2012).

TBI-Related Symptoms

The Multidimensional Fatigue Scale of the Pediatric Quality of Life (PedsQL) Inventory (Varni, Seid, & Rode, 1999) assesses general and specific symptoms associated with fatigue in pediatrics older than 2 years of age. The scale consists of 18 items and the respondent is asked to rate how much of a problem each item has been for them over the past month using a 5-point Likert scale where 0 = 'never a problem' to 4= 'almost always a problem'. Versions exist for toddlers (2 – 4 years of age), young children (5 – 7 years of age), children (8 – 12 years of age) and adolescents (13 to 18 years of age). Three subscales can be derived examining General Fatigue, Sleep/Rest Fatigue and Cognitive Fatigue (6 items each). Items are reversed scores such that higher scores indicate fewer symptoms of fatigue. Self-report and parent forms are available. Administration takes approximately 5 minutes. It was developed on 339 families with 220 self-reports and 334 reports from parents. One study showed changes to fatigue using the scale for children receiving chemotherapy (Yeh et al., 2008).

Activities/Participation (d)

Activities and Participation

The Child and Adolescent Scale of Participation (CASP) (Bedell, 2004) is a guardian derived measure used to examine participation in home, school, and community settings for school aged children older than 5 years of age. It consists of 20-items that address activities associated with social settings, leisure, school, independence, and activities of daily living. Each item is rated on a 4-point scale ranging from 'unable' to 'full participation'. Scores can be used to four different subscales, including Home Participation, Community Participation, School Participation, and Home and Community Living Activities. Activities that are not expected for a respondent's age (e.g. work) can be answered with 'Not Applicable'.

Administration time is approximately 10 minutes. It was initially developed on 60 parents/guardians of children with acquired brain injury (Bedell, 2004), with a follow-up study on 313 parents/guardians from children across a range of disabling conditions and countries (Bedell, 2009) There is some evidence that the CASP is sensitive to change (Rivara et al., 2012)

The Paediatric Care and Needs Scale (PCANS) Version 2 (Soo, Tatle, Williams, Waddingham, & Waugh, 2005) examines the support needs for young people with acquired brain injury aged 5 to 15 years of age. It consists of 105 items that assess the type, extent and support needed across 13 functional domains, including: high level needs; personal hygiene; bathing/dressing; food preparation; shopping; home activities; health, safety and medication use; money management; everyday devices; transport and outdoor surfaces; interpersonal relationships; leisure recreation and play; and, school. Normative data is available to classify each item as: independence as expected (IND), emerging (EM) or not as expected (NE). There are 4 version of the scale depending on the age of the respondent (A: 5 – 7 years; B: 8-11 years; C: 12-14 years; and D: 15 years), with the number of items administered across each version of the scale varying according to whether independence is expected or emerging for each item. Administration time is approximately 10-15 minutes. Normative data is available from 300 parents of typically developing children. The PCANS level of support need scores decreased from inpatient discharge over a 6-month period (Soo et al., 2010).

The Pediatric Evaluation of Disability Inventory – Computer Adaptive Test (PEDI-CAT) (Haley, 1992) is a computerized clinical assessment for pediatric samples aged between 1 to 21 years. It examines functional and daily life skills that should be acquired throughout infancy, childhood, and adolescence. It consists of 276 activities across four domains of functioning, including Daily Activities, Mobility,

Social/Cognitive, and Responsibility. For the Daily Activities, Mobility and Social/Cognitive domains, a child's ability is rated on a 4-point scale ranging from 'Unable' to 'Easy' while the Responsibility domain is answered of a 5-point scale ranging from 'Caregiver has FULL responsibility' to 'Child takes FULL responsibility without supervision or guidance'. All respondents begin with the same item in each domain and their response dictates which item will appear next (a harder or easier item). Parents, teachers and clinicians that are familiar with the child can also fill out the inventory. There are two version of the inventory. The "precision" version is the quickest form and consists of 10 to 15 items per domain while the 'comprehensive' CAT consists of 30 items per domain. Administration time is approximately 10 minutes. Normative data was collected from 2205 parents and 703 children with disabilities. All scores are presented as percentiles and scaled scores. Sensitivity to change appears to have been established (Fragala-Pinkham, Dumas, Lombard, & O'Brien, 2016).

The Social Subscale of the PEDS QL (Varni et al., 1999) examines social functioning and how long children get along with others. It is used for children older than 2 years of age and is available in parent/guardian and self-report forms (ages < 8 years old). The subscale consists of five items and each item is rated using a 5-point Likert scale where 0 = 'never a problem' to 4 = 'almost always a problem'. Versions exist for toddlers (2 – 4 years; parent/guardian report only), young children (5 to 7 years; parent/guardian report), children (8 to 12 years; guardian or self-report) and adolescents (13 to 18 years). Administration time is approximately 5 minutes. It was developed on 339 families with 220 self-reports and 334 reports from parents. There is some evidence for improved psychosocial functioning scores (the social subscale contributes to this index) between admission and 2 to 8 weeks following discharge for

those with chronic illness (Desai et al., 2014).

The Sydney Psychosocial Reintegration Scale for Children (SPRS-C) (Soo et al., 2016) is a measure of psychosocial functioning and participation for children aged between 5 and 16 years of age. The scale has been adapted from the adult version (Tate et al, 1999) and is appropriate for child self-report or for parents who are able to complete the scale on their child's behalf. The SPRS-C consists of 12 items that examine school/leisure (occupational activities), interpersonal relationships, and living skills (social skills and home living). Items are rated on a 5-point scale from 'very poor' to 'very good'. Higher scores indicate better psychosocial outcome. Administration time is approximately 10 minutes. Normative data for the SPRS-C have been collected for the parent version of Form B in approximately 200 children aged between 5 and 14 years in Melbourne Australia (Soo et al., 2016). Sensitivity to change for the SPRS-C has not yet been established.

The Social Skills Improvement System (SSIS) (Gresham & Elliott, 2008) is a rating scale used to evaluate social skills, problem behaviors, and academic competence in children age 3 to 18 years of age. It involves rating scales from multiple sources including parents, teachers, and self-report (8 to 18 years of age). Each form consists of approximately 140 items. In the self-report version, the respondent indicates how true each item is on a 4-point scale ranging from 'not true' to 'very true'. For the parent and teacher forms, the frequency of various behaviors is reported on a 4-point scale from 'never' to 'almost always'. The Social Skills domain consists of 46 items that assess communication, cooperation, assertion, responsibility, empathy, engagement, and self-control. The Competing Problem Behaviour subscale consists of 38 items that examine externalizing, bullying, hyperactivity/inattention, internalizing and autism spectrum. The Academic Competence domain in the teacher version assesses reading,

math, motivation, parental support, and general cognitive functioning. Each version of the scale takes approximately 10 to 25 minutes to complete. A large normative sample is available based on 4700 students (aged 3 through 18), 385 teachers, and 2,800 parents. Sensitivity to change has been established cross a number of intervention and program evaluation studies (Kim, Doh, Hong, & Choi, 2011; Laugeson, Frankel, Gantman, Dillon, & Mogil, 2012).

Environmental Factors (e)

Support Relationships

The Family Assessment Device (FAD) (Epstein, Baldwin, & Bishop, 1983) is a family assessment based on the McMaster Model of Family Functioning (MMFF). It is a 53-item screening instrument used to assess six different dimensions of family functioning, including Problem Solving, Communication, Roles, Affective Responsiveness, Affective Involvement, and Behavior Control. These can be combined to produce a General Functioning index to assess the overall health of the family. Administration time is approximately 15 to 20 minutes. The FAD has been used to examine the efficacy of various medical and psychiatric disorders with sensitivity to change established (Staccini, Tomba, Grandi, & Keitner, 2015).

The Family Management Measure (FAMM) (Knafl et al., 2009) measures how families manage and care for a child with a chronic illness in their everyday lives. The measure consists of 53 items that assess different dimensions of family management of the condition, including Child's Daily Life, Condition Management Ability, Condition Management Effort, Family Life Difficulty, and View of Condition Impact. Each item is scored on a 5-point Likert scales ranging from 'strongly disagree' to 'strongly agree'. Administration time is approximately 10 minutes. It was developed on a sample of 579

parents from 417 families of children with a range of conditions (Knafl et al, 2009). Sensitivity to change has not been established.

The Parent Experience of Child Illness (PECI) (Bonner et al., 2005) assesses parental adjustment to caring for a child with a chronic illness. It is a 25-item measure that consists of four subscales examining Guilt and Worry, Unresolved Sorrow and Anger, Long-term Uncertainty, and Emotional Resources. Parents are asked to determine how well each item describes their thoughts and feelings over the previous month. Each item is rated on a 5-point scale from 'Never' to 'Always'. Administration time is approximately 5 to 10 minutes. It was developed in 149 parents of patients diagnosed with brain tumour. Scores on the PECI declined following an amended treatment protocol of acceptance and commitment therapy for parents of children with a life-threatening illness (Burke et al., 2014)

Personal Factors

Sense of Self

The Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965) is a 10-item scale that measures the respondent's state self-esteem. The respondent reads each statement and rates how much they agree with each on a 4-point scale from 'strongly disagree' to 'strongly agree'. Higher scores indicate greater self-esteem and scores below 25 are reportedly indicative of clinically low self-esteem in TBI (Anson & Ponsford, 2006). Administration time is approximately 5 minutes. It was originally developed on 5024 high school students from New York State. There is no evidence that the RSES responds to intervention.

Concepts not covered in ICF

Health Related Quality of Life

The Pediatric Quality of Life Inventory (PEDS QL) (Varni et al., 1999) is a global measure of quality of life for children whereas the scale described in the activities and participation section specifically focused on the social functioning subscale. The PEDS QL can be used for pediatrics older than 2 years of age. It consists of 23 items that assess various aspects of Physical, Emotional, Social and School Functioning. A Psychosocial Health Summary Score can be calculated from 15 items across the Emotional, Social and School Functioning subscales. The PEDS QL is available in parent/guardian and self-report forms. Each item is rated using a 5-point scale where 0 = ‘never a problem’ to 4 = ‘almost always a problem’. Versions exist for toddlers (2 to 4; parent/guardian report only), young children (5 to 7 years), children (8 to 12 years) and adolescents (13 to 18 years). Administration time is approximately 5 minutes. Inventory was developed on 291 pediatric patients with cancer and their parents and was later trialed on 963 children and 1629 parents. Longitudinal changes in self and proxy-parent report due to intervention has been documented (Varni et al., 2002).

Table s1a.

Recommendations for Communication Instruments

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Comprehensive Assessment of Spoken Language Psycholinguistic (CASL)	d310, d330, b167	N	S	S	N	RELIABILITY: *IC*: α > .90 for all Indexes except Receptive (.85-.90) *Test-retest:* .65-.95 (subtests); .92-.93 (Composites); .88 -.96 (Indexes). VALIDITY: *Construct*: Inter-correlation coefficients low to mod (.30-.79) suggesting both independence of subtests and interdependence to support validity of Composite and Index scores. Shows developmental progression. *Convergent:* Correlates with the TOLD-P3 (Hoffman, Loeb, Brandel, & Gillam, 2011), everyday communication behavior (Vinelands) (Reichow, Salamack, Paul, Volkmar, & Klin, 2008), other tests of language (TACL-R, OWLS™, PPVT™-III, EVT™) and cognition (K-BIT™)(Carrow-Woolfolk, 1999).	No reading or writing required. Uses verbal responses or pointing. Ideal for measuring delayed language, oral language disorders, dyslexia, and aphasia. Can administer only the subtests required. Core tests measure representative aspects of each language category for six age bands. Supplementary tests provide additional diagnostic information to yield assessment data for quantitative (profile) and qualitative (clinical) analyses.	Norm/standardisation is not contemporary (1996–1997). Independent research with children with specific language impairment yields different factor structure to manual (based on typically developing children) (Hoffman et al., 2011).
Clinical Evaluation of Language Fundamentals V (CELF-V)	d310-349, b167, b144, b166, d170	N	B	B	N	RELIABILITY**:** *Split-half*: .60-.99 (subtests); .92 -.97 (indices). *Test-retest* (7-46 days): .56-.93 (subtests), .86-.92(composites). *IRR:*.91-.99. VALIDITY: *Construct*: Inter-correlations low to moderate: .19-.65 (subtests) reflecting different content as well as overlap. Composites inter-correlate: .72-.92. *Convergent:* CELF-5 indices correlate with CELF-4 (.82-.92), Peabody Picture Vocabulary-4 (.68-.80) and Expressive Vocabulary Test-2 (.65-.78). *Sensitivity and specificity*: .97 for both with cut-off score of 80.	Reports standard scores, percentile ranks, and growth scale values for Pragmatics Profile. Can select one of six interactive tasks to rate authentic conversational behavior using Pragmatics Activities Checklist. Targeted assessment of written language.	Cannot be re-administered frequently (less than 12 months).

The Word Test 3 (TWT-3) for children and TWT-2 for adolescents	b164, b167, d310-349, d175, d177	N	S	S	N	TWT-3 (children): RELIABILITY: *IC (KR20):* .94. *test-retest: .91, SEM= 4.10 (total test); IRR* = 93% (total test); VALIDITY: test (all subtests and total scores) discriminates children with typical language development from children with language disorders at all age levels. No consistent differences in racial performance. TWT-2 (adolescents): RELIABILITY: *IC (KR20):* .89. *SEM= 5.50 (total test);* VALIDITY: Subtests and total scores discriminate TD adolescents from those with language disorders at all age levels. Correlations between tasks: .89-.93 across all age levels.	Useful if really delving into language e.g. outcomes related to language following TBI. Adolescent version normed on 1,692 people. No consistent differences in racial performance.	TWT-2 for adolescents has not yet been updated.
The FAVRES - Student Version (SFAVRES)	b167, d310-349, d166, d170	N	S	S	N	RELIABILITY: *IC:* Reasoning Subskills (across 4 subtests): α = .85. *IRR*: Accuracy: .98; Rationale: .74; Time: .99; *Test-retest* (10 participants 14-38 days apart): Accuracy: .58; Rationale: .60; Time, .65. VALIDITY: *Construct*: Adolescents with ABI scores < TD peers (MacDonald, 2016; Newsome et al., 2010). Reasoning score increases with age in TD adolescents (MacDonald, 2016). IC for Accuracy (0.50) and Rationale (.61) lower than Reasoning suggests the subtests all assess Reasoning plus separable skills. *Sensitivity and Specificity:* Combined Accuracy and Rationale Scores: .85	Can administer individual targeted subtests alone; Assesses higher level cognitive linguistic skills not captured by other standardized tests; Good accessibility & availability. Developed specifically for brain injury population.	Long administration time (20 min per subtest) Interpretation can be difficult for novice clinicians. Requires skill to complete observations and to guide intervention. Minimal chance to look at natural discourse. Observing the client complete written sections is time-consuming and can make the client uncomfortable. Requires a number of printed resources. Print can be problematic for clients with visual impairments.

Oral and Written Language Scales - Second Editions (OWLS-II)	b167, b144, d310-349, d166, d170	N	S	S	Y	RELIABILITY: *IC:* .73- .94 (median of .85) for scales; *Alternate forms:* .67 to .96 (median of .78). *IRR:* ICC =.93-.96. VALIDITY: OWLS-II scales can differentiate between TD individuals and those with speech, language and other clinical disorders.	OWLS-II has a parallel form that allows retesting on all scales after a brief interval. Form B, which can be used with children 5 years onwards, can be used to monitor language development over time.
Test of Integrated Language and Literacy Skills (TILLS)	b1, d1, d3	N	S	S	Y	RELIABILITY: *IC* (omega coefficient): .95-.99 (subtests); *Test-retest*: (ICC): .79-.98 (subtests). *IRR*: .86 to 1.0 (subtests) (Mailend, Plante, Anderson, Applegate, & Nelson, 2016). VALIDITY: *Construct:* Exploratory factor analysis indicates two latent factors—sound/word structure knowledge and sentence/ discourse knowledge, supporting the theoretical basis of the test. *Sensitivity .83-.97 and Specificity*: .81-1.00 across ages.	TILLS provides information on diagnostic accuracy (sensitivity and specificity) for every age at which the test is normed. The assessment may be used to detect changes in performance at intervals of 6 months or longer.

Notes: ICF = International Classification of Functioning, Disability and Health, R = Early Recovery, I = Intervention Studies, O = Outcome studies, C = Core, B = Basic, S = Supplemental, E =Emerging, Δ = Sensitivity to Change, Y = Yes, N = Not enough evidence, N/A = not available, TD = typically developing; ABI = acquired brain injury; IC = Internal consistency; IRR = Inter-rater reliability; ICC = Intra-class correlations; α = co-efficient alpha; US/USA = United States of America, mod = moderate, TBI = traumatic brain injury, TOLD-P3= Test of Language Development – Primary 3rd edition (Newcomer & Hammill, 1997), TACL-R= Test for Auditory Comprehension of Language – Revised (Haynes, 1990), PPVT-3 = Peabody Picture Vocabulary Test 3rd Edition (Dunn & Dunn, 1997), EVT-2 = Expressive Vocabulary Test 2nd edition (Williams, 1997), K-BIT = Kaufman Brief Intelligence Test (Kaufman & Kaufman, 2004)

Table s1b.

Recommendations for Social Cognition Instruments

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Interpersonal Negotiation Strategy (INS)	d710-d729, d175	S	N	N	N	RELIABILITY: *Test-retest (*4-months): .69. (Yeates, Schultz, & Selman, 1991). *IRR:* .74-.87 (.89 for INS-Thought total score) (Keith O. Yeates et al., 1991); .89-.98 (Gerri Hanten et al., 2008). VALIDITY: *Construct:* TD children use higher-level problem-solving with children vs adults, or familiar vs unfamiliar participants (Adalbjarnardottir & Selman, 1989;Yeates et al., 1991). Slower responses and increased memory load predict better INS scores (Hanten et al., 2008). *Concurrent*: INS performed better by TD children than those with ABI (Hanten et al., 2008). INS level correlated to ratings of adaptive functioning in TD adolescents (Beardslee, Schultz, & Selman, 1987), better psychosocial adaptation in children 'at risk' (Beardslee et al., 1987; Leadbeater, Hellner, Allen, & Aber, 1989) and parent ratings of the CBCL in children with ABI (Janusz, Kirkwood, Yeates, & Taylor, 2002).	Based on a conceptual model; research with the INS has been conducted in children and adolescents with ABI.	Difficult to administer and score: training is required; Interview is lengthy and there is a lack of normative data.

Social Language Development Test (SLDT)	b167	N	S	S	N	RELIABILITY: *IC*: Elementary: α: .77-.92 (subtests); .94 (SLD Index): Adolescent version α: .76-.86 (subtests); .95 (SLD Index); *test-retest* for total test .79 (Elementary); .82 (Adolescent). VALIDITY: tests differentiate students with language disorders and Autism Spectrum Disorders (ASD) from those with normal language development. *Sensitivity/specificity* of SLD Index cut-off score of 90 =.82 and .86 respectively (Elementary); .71 and .96 (Adolescent).	Comprehensive and ecologically valid assessment of pragmatics with child (elementary) and adolescent versions with norms.	
NEPSY Social Cognition	d130, d330, d710-129	S	S	S	Y	RELIABILITY: *IC*: for most subtests was adequate to high (α = .21-.91). *Test-retest* (165 children: 12 -51 days) using decision consistency methods suggested moderate to high stability. *IRR:* .93-.99%. VALIDITY: convergent: The battery overall shows predicted associations with many instruments including the WISC-IV, CMS, D-KEFS. The Social cognition battery (ToM subtest) correlates with the DANVA and the Strange Stores (ToM) test (McKown, Allen, Russo-Ponsaran, & Johnson, 2013). The Affect Recognition subtest negatively correlates with conduct and externalising scales of the DSMD) (Korkman et al, 2007).	Subtests designed for children aged 3 to 16 and normed on a single, well stratified sample providing age-related quantitative and qualitative patterns in cognitive performance. Norms allow flexibility in subtest selection and administration order. The NEPSY-II is designed to help identify cognitive deficits related to disorders that are typically first diagnosed in childhood and that may limit a child's academic success.	Not much research has been done in the TBI or ABI context, mostly in autism.
PEERS/PEERS-Q	d3150, d310, d710-729, b122	E	E	E	N	PEERS: Psychometric data expected 2018; PEERS Q (DASC): Validity: correlates with subscores of the Adaptive Behavior Assessment System (second edition (ABAS-II) (Muscara, Catroppa, Beauchamp, & Anderson, 2010).	Electronic (available as an app); Engaging for children and adolescents; Specifically designed for use in child TBI.	Still under development. Normative data (724 Australian children and adolescents) due mid 2018.

Socio-Moral Reasoning (So-Moral)	d720, d7203, b122	E	E	E	N	RELIABILITY: *IRR:* Cronbach's alpha: .83-.94 (Dooley, Beauchamp, & Anderson, 2010). VALIDITY: *Construct*: Scores increase linearly with developmental age from childhood to late adolescence (Chiasson et al., 2017). Negative emotions to socioemotional dilemmas correlated with empathy (IECA) and prosocial behavior (SEQ-C) and positive emotions negatively correlated likewise. Level of moral maturity correlated with empathy and negatively correlated with aggressive behaviors (FAS) and oppositional defiant symptoms (CBCL) (Dooley et al., 2010). Adolescents with TBI had lower levels of moral maturity than TD adolescents and this was correlated to low empathy (Beauchamp, Dooley, & Anderson, 2013).	Engaging for children and adolescents; Has normative data; Computer based (and now part of the PEERS) as well as hard copy; Addresses an area that does not have sensitive measurement tools for this population.	An emerging measure, not yet widely used.

Notes: ICF = International Classification of Functioning, Disability and Health, R = Early Recovery, I = Intervention Studies, O = Outcome studies, C = Core, B = Basic, S = Supplemental, E =Emerging, Δ = Sensitivity to Change, Y = Yes, N = Not enough evidence, N/A = not available, TD = typically developing; ABI = acquired brain injury; ASD = Autism Spectrum Disorder, ADHD = Attention deficit hyperactivity disorder, LD = Learning disorder; IC = Internal consistency; IRR = Inter-rater reliability; ICC = Intra-class correlations; α = co-efficient alpha., WISC-IV= Wechsler Intelligence Scale for Children - Fourth Edition (Weschler, 2003), CMS = Children's Memory Scale (Cohen, 1997); D-KEFS = Delis-Kaplan Executive Function System (D-KEFS) (Delis, Kaplan, & Kramer, 2001); DANVA = Diagnostic Analysis of Nonverbal Accuracy (Nowicki, 2010); DMDS = Devereux Scales of Mental Disorders (Naglieri, LeBuffe, & Pfeiffer, 1994); CBCL = Child Behaviour Checklist (now known as the AESBA) (Achenbach & Rescorla, 2001); IECA = Index of Empathy for Children and Adolescents (IECA: Bryant, 1982); SEQ-C = Social-Emotional Questionnaire for Children (Wall, Huw Williams, Morris, & Bramham, 2011); FAS= Form of Aggression Scale (Little, Brauner, Jones, Nock, & Hawley, 2003); ToM = Theory of Mind

Table s1c.

Recommendations for Behaviour and Executive Function Instruments

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Behavior Assessment System for Children -3rd Edition (BASC-3)	d710-729, b1304, b152	S	S	S	N	RELIABILITY: *IC (α)*: Across age groups: TRS: .86-90; PRS: 84-.89; SRP: 81-.85. *Test-retest* (7-70 days): all summary scales >.90; clinical scales: .75-.94. VALIDITY: Convergent: correlates highly with BASC-2 (all rs for summary scales > .96, clinical scales: .82-.99; BASC-2), PRS correlated with CBCL on all relevant scales (Bour, Hakman, Murphy, Myers, & Sidebottom, 2010); *Concurrent*: BASC-2 TRS differentiates TD children from those with a TBI (Thaler, Mayfield, Reynolds, Hadland, & Allen, 2012).	20 year research history; Closely modelled on predecessor; Assesses array of behavioral problems; Can be rapidly completed; Theoretically driven; Covers dimensions of behavior relevant to TBI; Has scales assessing response bias and adaptive functioning. Has been used in TBI research.	Interpretation is moderately difficult based on clinician experience.
Behavior Rating Inventory of Executive Function (BRIEF)	d710-729, b164, b130	S	S	S	N	RELIABILITY: *IC:*α = .80-.98) (Gioia, Isquith, Guy, & Kenworthy, 2010); *Test-retest (2 weeks)* Parent:.81, Teacher:.87. VALIDITY: *Convergent/ Divergent:* Parent and Teacher forms correlate moderately (.32-.34); high correlations with similar constructs in BASC (McCandless & L, 2007) and CBCL (Gioia, Isquith, Guy, & Kenworthy, 1996) and lower with dissimilar. *Concurrent*: TD children outperform those with ADHD on Metacognitive Index (McCandless & L, 2007) and those with frontal lobe lesions on the Behaviour Regulation and Metacognition Index (Anderson, Anderson, Northam, Jacobs, & Mikiewicz, 2002).	Theoretically coherent and psychometrically sound; sensitive to developmental changes; High ecological validity; sufficiently broad to serve as a screen while also comprehensive in content; useful in targeting treatment.	Data must be viewed in the context of a complete evaluation; high scores do not indicate a disorder of executive function rather than a high level of dysfunction in a specific domain of executive functions. Need to consider high scores on the Inconsistency scale.

Child Behaviour Checklist (CBCL); Social Competence Scale	d710-729, d730-779, b152, d810-839, d910, d920	S	S	B	Y	RELIABILITY: *IC:* α = 63-.79 (competence); .78-.97(problems); *Test-retest (8 days): .82*-.93 (competence); .82-.94 (problems); *IRR (*ICC): = .90 (competence); .96 (problems). VALIDITY: *Convergent:* Problem scores correlate with relevant BASC scores (Achenbach & Rescorla, 2001) and with scale measuring emotion and cognition after TBI (Rasquin et al., 2011); *Concurrent:* Children with deviant scores 15 times more likely to be referred to mental health services; (Achenbach & Rescorla, 2001); children with severe TBI showed worsening social competence over time (Tlustos et al., 2016). Problem scores corresponds to psychiatric history in children presenting with mild TBI (Donders & DeWit, 2017).	Commonly used clinically; Used in many seminal child TBI studies; CBCL is identified as a core measure in the NIH common data elements review; It has wide age range 2-21 years; Excellent psychometric properties and multiple relevant subscales and summary scores;	Expensive; Dimensional not diagnostic.
Vineland-II Adaptive Behaviour Scales (VABS-II)	B130, d310, d330, d166, d170, d240, d710-729, d910, d920, d5, d6, d4	S	S	S	Y	RELIABILITY: *IC (Split-half):*.84-.93 across ages (Communication); .86 -.91 (Daily Living Skills); .84-.93. (Socialization); .77-.90 (Motor Skills) .85-.91 (Maladaptive Behaviour). *Test-retest* (13-34 days):.74-.98. *IRR:*.59-.85; VALIDITY: *Construct:* Correlations within a domain larger than those between. *Convergent:* VABC-II correlates with VABC across domain/ subdomains and with similar scores on the BASC-2; overall score correlates with that from the ABAS-II; *Divergent:* No correlation with WISC-III or WAIS-III. *Concurrent:* Clinical groups with cognitive delay score two standard deviations below non-clinical groups on composite score. Scores (VABC) associated with length of coma in children with TBI (Recla et al., 2013).	Useful for intellectual and developmental disabilities; updated with new norms, expanded age range, and improved items; Useful for diagnosis, qualification for special programs, progress reporting, program and treatment planning, and research; offers semi-structured interview focuses discussion and gathers in-depth information as well as convenient rating forms; multi-informant format useful to assess individuals from diverse cultural backgrounds.	Administrative format only suitable for 18 or younger except in cases of older individuals who social functioning abilities already identified as below developmental expectations. Parent rating form can be confusing for parents. Interview format time consuming.

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Table s1d.

Recommendations for Other Neuropsychological Functioning Instruments

Instrument	ICF	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Children's Memory Scale (CMS): Story Recall	b144	S	S	S		RELIABILITY: *IC* (split-half) .69-.79 (Immediate) .71-81 (delayed) across ages: *Test-retest: (stability co-efficient): .71*-.85. *IRR (ICC): .98-.99.* VALIDITY: *Convergent (for* Verbal Immediate and Delayed Indices): correlate with language, cognition, academic achievement (CELF-3, WISCIII, WCST, CCT, OLSAT) and similar verbal learning tests (WMS-III, WRAML, CVLT-C) (Cohen, 1997). *Concurrent:* Discriminates TD children from those with brain/ developmental disorders.	Large normative base of 1,000. Extensive clinical validation studies for special groups; has been compared to WISC–IV, WISC–III, and WPPSI–R to assist validation; excellent psychometric properties. Designed to target left temporal lobe functioning.	The Story subtest is analogous to the WMS-III subtest. Consequently, CMS is often considered to be a downward age extension of the WMS-III leading to concerns about the appropriateness of using subtests developed from adult models to understand cognitive functioning in children.
Comprehensive Trail Making Test	b164	S	S	S		RELIABILITY: *IC:* α >.70 all age groups. *Test–retest* (1 week): .70 -.78. *IRR:*.96–.98 (Gray, 2006). VALIDITY: *Construct:* 2 factors: Simple (Trials 1-3) and Complex (Trials 3-5) (Riccio, Kahn, Yoon, Reynolds, & Bonura, 2011). *Convergent: Co*rrelates with perceptual organization, processing speed (WISC) and motor speed. *Concurrent:* Discriminates between TD children and those with TBI and predicts GCS scores (Armstrong, Allen, Donahue, & Mayfield, 2008). *Sensitivity/ Specificity*: 77%/90% respectively (Index score of 40) to identify adolescents with TBI (Armstrong et al., 2008).	Easy to administer; No clinical training is necessary; specifically tests processing speed and cognitive flexibility; normative information is available for children aged 11+; has excellent internal, test-retest and interrater reliability; specific research using CTMT in children with TBI; can be used to determine injury severity	Must be purchased; instructions can be confusing and also frustrating for people who lose track. Those with significant cognitively impairment may not be able to complete the task; interpretation required as to which cognitive function is impaired; needs careful observation to accurately score errors. Variation in examiner's reaction time in noticing errors may reduce reliability.

Contingency Naming Test (CNT)	b164, b140	E	E	E	VALIDITY: *Convergent*: CNT (self-corrections) correlated with the BRIEF subscales: working memory, monitoring and planning. (Anderson et al., 2002) *Concurrent: Discriminates* TD *c*hildren from those with brain disorders (Anderson et al., 2000; Anderson et al., 2002) although those with focal frontal lesions performed similarly to TD children (Anderson et al., 2002). Did not differentiate between mild and mod/severe TBI although effect sizes were large (Muscara, Catroppa, & Anderson, 2008).	Freely available	Validity for children with TBI needs to be more strongly established; Reliability also needs to be documented.
Verbal Fluency (FAS)	b164	S	S	S	RELIABILITY: *IC:* total words: α = .83: (Tombaugh, Kozak, & Rees, 1999). *IRR*: .99 (Strauss, Sherman, & Spreen, 2006). *Test-retest:* .70 in adults for both short (one week) and long (5 year) intervals (Strauss et al., 2006). VALIDITY: *Construct:* FAS improves through childhood (Loonstra, Tarlow, & Sellers, 2001; Matute et al., 2004). *Concurrent*: TD Children outperform those with specific language impairment (Henry, Messer, & Nash, 2015) and ABI (V. A. Anderson et al., 2002).	Free: Users may design their own materials; good normative data for children; quick to administer; sensitive to brain disorders; strong psychometric properties; can be used as a stand-alone test.	Low specificity; total scores alone provide limited diagnostic utility; various abilities (e.g. attention, processing speed, episodic memory) underpin performance, so is difficult to attribute impairment to a particular cognitive function; highly influenced by premorbid verbal IQ and neurological deficits.
Working Memory Index (WMI) and Processing Speed Index (PSI) from the Wechsler Intelligence Scale for Children (5th Edition)	b140-189	S	S	S	RELIABILITY: *ICC:* averaged across 11 age groups: WMI (split-half): .92 and PSI (test-retest): .88; *Test-retest* (mean 26 days): WMI = .82; PSI = .83: *IRR*: .97-.99; *IRR*: .97-.99; VALIDITY: *Construct:* Confirmatory Factor Analysis of primary subtests yields the five proposed, non-overlapping factors including the PSI and the WMI. *Convergent/divergent:* PSI and WMI correlate with parallel indices of	WISC–V increases construct coverage without increasing testing time; it efficiently produce all primary index scores; has simplified instructions with reduced vocabulary level, shorter discontinue rules, and refined scoring criteria; explicit links to WIATIII and KTEA-3 (academic	

	the WISCIV, WIPPSIV and WAISIV and with academic achievement (WIATIII, KTEA-3). No correlation with the Vineland-II (adaptive behavior) supports divergent validity. Concurrent: WISC-V indices and overall FSIQ differentiates TD children from those with developmental disorders and ABI in the expected directions.	achievement) enable ability-achievement discrepancy analyses.

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Table s1e.

Recommendations for Psychological Status Instruments

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Children's Depression Scale (CDS)	b152	S	S	S	Y	RELIABILITY: *IC:* α >.82 for both self and alternate (parent/self-report) versions. *Split half:* α > .90 (Bath & Middleton, 1985). *Test-retest*: α = .74 (Tonkin & Hudson, 1981). VALIDITY: *Construct:* Strong support for 'D' factor (56 items > .04) but little or no support for subscale structure (Bath & Middleton, 1985; Rotundo & Hensley, 1985). *Discriminant:* Differs between healthy and clinical samples and depressed and non-depressed. Self-report also differentiates between depressed and sad (Rotundo & Hensley, 1985). May be high false positive rate (approx 25%, (Knight, Hensley, & Waters, 1988). *Convergent:* Correlates with CDI, *r* > .48 (Kazdin, 1987; Knight et al., 1988; Rotundo & Hensley, 1985), IPAT and EPQ (Lang & Tisher, 1978) and BID-revised (Kazdin, 1987).	The scale has a game-like quality that facilitates the children's ability to communicate more fully their experience. It has been extensively used in many countries to research depression in children, and has been translated into several different languages, including Spanish, Italian, Dutch, Japanese, Hindu and Arabic.	Factorial structure and internal consistency have variations in differing juvenile cohorts. The CDS is not perfectly valid, particularly its factor structure. It is possible for test-takers of the CDS to "fake good". It relies heavily on reading ability. It is important to account for and consider additional information about the individual rather than solely using CDS test scores. Can be quite cumbersome to score
Spence Children's Anxiety Scale (SCAS)	b152	S	S	S	Y	RELIABILITY: *IC:* α = .93 for total score, .74 - .82 for most subscale scores (except Physical Injury Fears α = .60). *Test-retest:* α = .60 for the total score over 6 months, but lower for specific subscales (α = .45 - .57), suggesting children's report of anxiety symptoms decrease over time (Spence, 1998; Spence, Barrett, & Turner, 2003). VALIDITY: *Construct:* Item-total correlations for total score and subscales were strong. Strong support for 6 factor model	The SCAS assesses a range of specific anxiety symptoms according to diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV). It was introduced as a new childhood anxiety scale with evidence of adequate reliability and validity for international use in the measurement of childhood	Self-report. Total of 44 items to answer and strong tendency that respondent may miss several items. Therefore, crosschecking is essential. Different normative data should be used for older (12-15 years of age) compared to younger age range (8-11 years) and for boys and girls, as scores tend to decrease with age.

						across international versions (Essau, Muris, & Ederer, 2002; Zhao, Xing, & Wang, 2012). *Convergent:* Correlates with RCMAS (*r* =.75; Spence et al., 2003), Youth Self Report and Columbia Impairment Scale (Essau et al., 2002). *Discriminant:* Discriminates between anxiety children from other disorders.	anxiety symptoms. The scale has already been cross-culturally adapted to many languages, countries, and cultures after its original Australian version was proposed. Examples include German, Dutch, Hellenic Greek, Japanese, Mexican, Arab Syrian, Cypriot Greek, English, Swedish, and Italian. Strong support for 6-factor model across international studies.	
Strengths and Difficulties Questionnaire (SDQ)	b152, b130, d710-729	C	C	C	Y	RELIABILITY: *IC:* average α = .73 across scales and subscales (Goodman, 2001). *Test-retest:* α = .62 for 4 to 6 months. VALIDITY: *Construct:* factor structure has been confirmed across a range of studies. *Convergent:* Correlates with Rutter questionnaire and CBCL (Goodman & Scott, 1999). *Discriminant:* Differs between psychiatric from dental cases on self-report (Goodman, Meltzer, & Bailey, 1998) and parent/teacher version (Goodman & Scott, 1999). Scores about the 90th %ile predict diagnosis of psychiatric disorder (odds ratio or 15.7 for parent scales, 6.2 for youth scales)	Covers an area of social functioning not often covered in other questionnaires, e.g. peer relations and prosocial behavior subscales. Can be downloaded for free. Normative data and versions are available for many countries and languages. Used in research and clinically. Better at detecting inattention and hyperactivity compared to CBCL (Goodman & Scott, 1999).	Not as much research performed on the validity and reliability of the self-report version compared to parent/teacher forms (although studies are available). No categorical scores. Not available for adolescents older than 16 years of age.

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Table s1f.
Recommendations for TBI-related Symptoms domain

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Pediatric Quality of Life Initiative (PEDS QL); Multidimensional Fatigue Scale	b134, b130	S	S	S	Y	RELIABILITY: *IC:* α = .90 for child and parent report. α > .88 for subscales (Varni et al., 1999). VALIDITY: *Construct:* Strong correlations between fatigue scale and PedsQL General score scale (Varni, Limbers, Bryant, & Wilson, 2010). Factor structure has been confirmed across numerous studies. *Divergent:* Distinguishes between healthy children and those with a range of clinical conditions associated with fatigue (rheumatoid arthritis, obesity, cancer). Persistent fatigue indicated by a score of < 65. *Convergent:* Correlates with PedsQL General Score scale and the SF-8 health survey (Varni & Limbers, 2008).	It has a short administration time and can be used across a wide age range. It is available in multiple informant forms. Validated across a range of clinical conditions, with strong divergent validity. Reference data is available for various groups. Available in multiple language forms.	Expensive. Very few studies have used the multidimensional scale over time and in treatment studies to determine its sensitivity to change.

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Table s1g.
Recommendations for Activities and Participation Instruments

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Child and Adolescent Scale of Participation (CASP)	d910, d920, d810-839, d710-729, d6, d3, d4, d5	NR	S	S	Y	RELIABILITY: *IC:* α > .96 and *Test-retest:* > .94. VALIDITY: *Construct:* Factors analyses have confirmed 3 factors. *Discriminant:* Children with disabilities as a group had significantly higher CASP scores than children without disabilities (Bedell, 2009). *Convergent:* Moderate correlations with measures of functional activity performance (*r*=0.51 to 0.75 and the PEDI), extent of child impairment (r=-0.58 to -0.66 on the CAFI) and problems in the physical and social environment (r= -0.43 to -0.57; CASE)(Bedell, 2009).	Ease of administration. Free to download. Has been translated into Spanish, French, German, Hebrew and Mandarin.	Long time for completion. Not always sensitive to TBI, if in the acute stage is confounded by clinician restrictions in moderate-severe cases. No self-report. Psychometric properties may be problematic, as analyses have indicated it may be measuring a unidimensional construct. Has not been assessed for sensitivity to change.
Paediatrics Care and Needs Scale – 2 (PCANS)	d710-729, d910, d920, d810-839, e1, e3, e5, d4, d5, d6	S	S	S	Y	RELIABILITY: *Inter-rater ICC* = .93-.96. *Test-retest*: 1 week: *ICC* = .98 (Soo et al., 2007). VALIDITY: *Divergent:* Low correlations between PCANS and unrelated constructs on the Wee-FIM. *Discriminant:* PCANS extend and intensity scores distinguished between groups identified on the VABS and KOSCHI. *Convergent:* moderate to strong correlations (*r* > .46) for PCANS with VABS, Wee-FIM and KOSCHI with global and subscale scores.	Evidence supporting psychometric properties by the authors	Lack of studies on psychometric properties of PCANS besides that conducted by the authors.

Pediatric Evaluation of Disability Inventory - Computer Adaptive Test (PEDI-CAT)	d710-729, e3, d4, d5, d6	S	S	S	Y	RELIABILITY: *IC:* α as high as .99 (Haley, 1992; Mancini et al., 2016). *Test-retest: ICC > .96* between 7 and 30 days (Dumas et al., 2012). VALIDITY: *Discriminant:* Able to discriminate between children with or without disabilities across all 4 domains (Dumas et al., 2012). *Convergent:* Correlates with VABS-II domain scores ($r > .57$) for children with autism (Kramer, Liljenquist, & Coster, 2016). Correlates with AIMS and the PEDI FS Mobility (Dumas, Fragala-Pinkham, Rosen, Lombard, & Farrell, 2015)	Normative standard scores, provided as age percentiles and T scores, are available for 21 age groups (intervals of one year). Scaled scores are based on data from the normative and disability samples. Each PEDI-CAT domain is self-contained and can be used separately or along with the other domains. Age, gender and mobility device filters prevent irrelevant items from being presented. Items are worded using everyday language and clear examples. Illustrations of Daily Activities and Mobility items are included to facilitate understanding of the item intent. The PEDI-CAT is available for iPads and PCs. Each download includes English and Spanish languages.	Lengthy administration time (60min). Skills are at the lower end of the continuum. Items focused primarily on home-based activities, which creates difficulties for therapists to answer questions without parent input. Original standardisation sample had some sampling error due to a lack of geographical representation and small numbers in each age group, which can affect the validity of interpretations made using norm-referenced scores.
Pediatric Quality of Life Initiative (PEDS QL); Social Subscale	d710-729	NR	S	S	Y	RELIABILITY: *IC:* α = .70 for social subscale self-report, *IC:* α = .59-.75 for parent report (Varni et al., 1999; Vardi et al., 2001) *Test-retest:* VALIDITY: *Construct:* Factors confirmed across multiple studies. *Discriminant:* Differentiates Health participants to chronically ill and acutely ill (Varni et al., 2001). *Convergent:* Negatively correlates with care needed and school missed for self-report. Larger negative correlations between social subscale and care needed, school missed, work missed, work routine impact and work concentration impact for	Normative data available. Multiple languages available, wide age range, parent and child report versions. Used in published child TBI studies. Brief (5 items). Flexible (Designed for use with community, school, and clinical pediatric populations).	Expensive and not likely sensitivity to some aspects of quality of life post-TBI

						proxy-report (Varni et al., 2001). *Divergent:* Small to medium correlations between social subscale and other core and modules (Varni et al., 1999).		
Sydney Psychosocial Reintegration Scale - Children (SPRS-C)	d920, d810-839, 710-729, d6, d4, d5, d3	E	E	E	N	RELIABILITY: *ICC:* subscales α = .65 to .97 between parents and adolescents with TBI. Daily Living Skills was α = .26 (Green, Godfrey, Soo, Anderson, & Catroppa, 2012). VALIDITY: *Discriminant:* Children with ABI and behavioral difficulties have lower scores on the SPRS-C. *Convergent*: Positively correlates with global PedsQL (r = .677) and greater with the Psychosocial Summary subscale of the PedsQL (r = .782) (Soo et al., 2016)	Australian normative data available. Easy to administer. Provides perspectives on functioning from parents, child and informant. Explicitly measures change from pre-injury level. Properties of the adult version are strong.	Lack of studies on psychometric properties of SPRS-C besides that conducted by the authors.
Social Skills Improvement System (SSIS) Rating Scales	d710-729, d810-830, b130	S	S	S	Y	RELIABILITY: *IC*: α > .90s for three subscales for self and teacher versions (Gresham & Elliott, 2008). *Test-retest*: teacher form .81, parent form .70s and .80s, student form .59-.81 for 74 days. VALIDITY: *Content:* Factor structure has been supported and moderate correlations between items (internal structure). *Discriminant*: Able to differentiate between healthy controls and those with autism, ADHD, developmental delay, and intellectual disability. *Convergent*: Moderate to high correlations between the SSIS and the BASC–2, r = .78 to .69 for teacher and parent versions, respectively (Reynolds & Kamphaus, 2004); r = .65 to .44 between SSIS total social skills and socialization on the VABS, Second Edition (Sparrow et al., 2005).	Available across numerous informant versions; The SSIS is a revised version of the SSRS, which has a strong history of use in schools; wide age range 3-18 years and has good psychometric properties.	No data yet regarding profiles expected after TBI. Less research available on newer SSIS than original SSRS. Cost of SSIS quite high compared to other surveys. Few studies have examined the psychometric properties of the SSIS beyond those conducted by the original authors.

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Table s1h.

Recommendations for Support and Relationships Instruments

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Family Assessment Device (FAD)	N/A	C	C	C	Y	RELIABILITY: *IC:* α = .74 to 92 for general functioning index (Staccini et al., 2015), subscales ranging from α = .57 to .83 in nonclinical samples (Kabacoff, Miller, Bishop, Epstein, & Keitner, 1990). *Test-retest*: α = .60 and α = .76 at 12 weeks and 6 months for PTSD, respectively (Evans, Cowlishaw, & Hopwood, 2009). VALIDITY: *Construct:* 6-factor structure has been confirmed using factory analyses (Kabacoff et al., 1990). Correlations between subscales ranging from α = .37 to .67. *Discriminant:* Has been show to differentiate amongst numerous clinical groups using the full scale and 12-item GF scale (for review see Staccini et al., 2015). *Convergent:* Correlates with the Family Adaptability and Cohesion Evaluation Scales II-FACES II (Olson et al., 1989), Satisfaction with Family Life (Beierlein et al., 2017) Conflict Behavior Questionnaire-CBQ (Prinz, Foster, Kent, & O'Leary, 1979), and Family Environment Scale (Wenniger, Hageman, & Arrindell, 1993).	Frequently used in TBI studies; has been used across a range of disorders; Recommended as a CORE measure by NIH CDE working group; The 6 subscales provide a comprehensive interpretation of the family unit; taps areas of family functioning not easily observed; can be used to identify strengths and weaknesses in family unit; easy to complete and score; time to complete and score is reasonable; translated into at least 14 different languages.	Some studies have shown no sensitivity to change; does not have a range of normative data; lack of manual; propose greater ethnic, racial, and socioeconomic variability amongst non-clinical groups; 6 subscales are correlated, meaning that if a problem exists in one domain it will probably other domains.

Family Management Measure (FAMM)	d310, e410	S	B	S	N	RELIABILITY: *IC:* α =.70 or above for all subscales. Similar reliability for father and mothers. *Test-retest*: 2-4 weeks ranging from .71 to .94 (Knafl et al., 2011) VALIDITY: *Construct:* Structure confirmed with exploratory and confirmatory factor analyses. Child's daily life, condition management ability and parental mutuality subscales positively correlate with FSM-II Positive Child functional status and Marlowe-Crowne social desirability, and negatively correlates with the FAD Negative family functioning, and the ECBI Intensity Negative total child adaptation and Problem problematic child adaptation.	Has been translated into several languages. Good tool for looking at parent coping and management in the context of child TBI.	No normative data. As used in clinical group, it has data for various diagnoses.
Parent Experience of Child Illness (PECI)	N/A	S	S	S	Y	RELIABILITY: *IC:* subscales between α =.72 to .89 (Bonner et al., 2006). *Test-retest*: α= .83 to .86 for subscales at a median of 15 days (Bonner, Hardy, Willard, Hutchinson, & Guill, 2008). VALIDITY: *Construct*: Factor loadings have been verified. *Convergent:* Subscales positively correlated with Anticipatory Grief Scale (except Emotional Resources). *Divergent:* Subscales negatively correlate with the Herth Hope Index and the Global Assessment of Functioning (exception of Emotional Resources subscale of the PECI).	Could be useful for measuring treatment outcomes associated with parenting.	No normative data as only relevant to chronic illnesses.

Notes: ICF = International Classification of Functioning, Disability and Health, R = Early Recovery, I = Intervention Studies, O = Outcome studies, C = Core, B = Basic, S = Supplemental, E =Emerging, Δ = Sensitivity to Change, Y = Yes, N = Not enough evidence, N/A = not available, PTST = Post-Traumatic Stress Disorder, GF = Global Functioning, ADHD = Attention Deficit Hyperactive Disorder, % = percent, ABI = acquired brain injury; TBI = Traumatic Brain Injury; IC = Internal consistency, ICC = Intra-class correlations; α = co-efficient alpha, min = minutes

Table s1i.

Recommendations for Sense of Self Instruments

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Rosenberg Self-Esteem Scale (RSES)	b1266	S	S	S	N	RELIABILITY: *IC:* α = .89 in TBI populations (Carroll & Coetzer, 2011). *Test-retest:* α =.86 with two week interval in ABI sample (Cooper-Evans, Alderman, Knight, & Oddy, 2008) and α = .85 in healthy controls (Silber & Tippett, 1965). VALIDITY: *Divergent*: Negatively correlates with depression (*r*= -.669) and with positive view of self, using the HISDS-III (*r*=-.365) (Carroll & Coetzer, 2011).	It is available in the public domain. It is easy to administer. It is widely used, including in TBI.	Does not show any sensitivity to change or response to intervention. It is not a diagnostic aid for psychological issues. Since the concept of self-esteem is one more people are familiar with, the RSES will probably not tell the respondents anything they do not already know

Notes: ICF = International Classification of Functioning, Disability and Health, R = Early Recovery, I = Intervention Studies, O = Outcome studies, C = Core, B = Basic, S = Supplemental, E =Emerging, Δ = Sensitivity to Change, Y = Yes, N = Not enough evidence, N/A = not available, ABI = acquired brain injury; TBI = Traumatic Brain Injury; IC = Internal consistency, ICC = Intra-class correlations; α = co-efficient alpha, HISDS-III = Head Injury Semantic Differential Scale (Tyerman & Humphrey, 1984)

Table s1j.
Recommendations for Health-related Quality of Life (QoL) Instruments

Instrument	ICF Codes	Study Type			Δ	Psychometrics	Strengths	Weaknesses
		R	I	O				
Pediatric Quality of Life Initiative (PEDS-QL)	N/A	C	C	C	Y	RELIABILITY: *IC:* α = .83 for Child Self-Report, α = .86 Parent Proxy-Report. Subscales consistency between α = .70 to .89 (Varni et al., 1999). *Test-retest:* α = .75 to .90 for subscales for individuals with TBI (McCarthy et al., 2005). VALIDITY: *Construct:* Structure has been confirmed across numerous studies and clinical populations. *Discriminant:* Distinguishes between healthy children and children with acute and chronic health conditions; distinguishes disease severity within a chronic health condition *Convergent:* Correlates with version 3.0 (Sand, Kljajić, & Sunnegårdh, 2013). *Predictive:* Shows predictive validity with length of stay, readmissions and ED return visits for hospitalized patients (Desai et al., 2014).	Normative data available. It is the best measure currently to assess QoL in children. It is available in multiple languages. It has been used in child TBI studies. It is a core measure in the CDE recommendations. It is brief, practical and multidimensional. Good psychometric properties. Has been translated into multiple languages. Used extensively and validated across multiple clinical groups.	It is expensive and likely not sensitive to some aspects of quality of life following TBI.

Notes: ICF = International Classification of Functioning, Disability and Health, R = Early Recovery, I = Intervention Studies, O = Outcome studies, C = Core, B = Basic, S = Supplemental, E =Emerging, Δ = Sensitivity to Change, Y = Yes, N = Not enough evidence, N/A = not available, ABI = acquired brain injury; TBI = Traumatic Brain Injury; IC = Internal consistency, α = co-efficient alpha, ED = Emergency department, QoL = Quality of Life, CDE = Common Data Elements

Table s2
Instruments considered for recommendation (recommended instruments are also noted)

Global Outcomes
Glasgow Outcome Scale Extended (GOSE-E) [a]
8-Category version of the Glasgow Outcome Scale (8-GOS)
Glasgow Coma Scale [a]
Pediatric Glasgow Coma Scale (PGCS) [a]

Recommended: None

TOTAL REVIEWED = 4

Communication
Measure of Cognitive Linguistic Abilities (MCLA) [a]
Test of Language Competence – Expanded edition (TLC-E) Level 2 [a]
Test of Pragmatic Language Second Edition (TOPL-2) [a]
The Word Test – Revised [a]
Wiig-Semel Test of Linguistic Concepts (WSTLC) [a]
Mayo Clinic Dysarthria Scale (MCDS)
Psycholinguistic Assessment of Language Processing in Aphasia [a]
La Trobe Communication Questionnaire
Social Language Development Test (SLDT) – Recommended for Social Cognition) [a]
Expressive and Receptive One Word Picture Test 4th Edition (EOWPVT/ROWPVT) [b]
Peabody Picture Vocabulary Test 4th Edition (PPVT) [b]
Preschool Language Scale and Screening Test (PLS-5) [b]

Recommended:
Comprehensive Assessment of Spoken Language Psycholinguistic (CASL) [a]
Clinical Evaluation of Language Fundamentals 5th Edition (CELF-V) [a]
The Word Test 2 (TWT-2) and The Word Test 3 (TWT-3) [a]
Functional Assessment of Verbal Reasoning and Executive Strategies (FAVRES) Student Version [b]
Oral and Written Language Scales Second Edition (OWLS-II) [b]
Test of Integrated Language and Literacy Skills (TILLS) [b]

TOTAL REVIEWED: 18

Social Cognition
Pediatric Evaluation of Disability Inventory – Computer Adaptive Test (PEDI-CAT) – Recommended for Activities and Participation
Social Skills Improvement System (SSIS) – Recommended for Activities and Participation
BrainQuest – Now forms part of PEERS/PEERS-Q battery [a]

Recommended:
Interpersonal Negotiation Strategy (INS) [a]
NEPSY Social Cognition [a]
Social Language Development Test (SLDT)

Socio-Moral Reasoning (So-Moral) [a]
Pediatric Evaluation of Emotions Relationships and Socialization (PEERS)

TOTAL REVIEWED = 8

Behavioural and Executive Function
Adaptive Behaviour Assessment System – 3rd Edition (ABAS – 3) [a]
PEERS/PEER-Q – Recommended for Social Cognition [a]
Social Skills Improvement System (SSIS) – Recommended for Activities and Participation [a]
Developmental Assessment of Social Competence (DASC)

Recommended:
Behavior Assessment System for Children– 3rd Edition (BASC-3) [a]
Behavior Rating Inventory of Executive Function Children's Version (BRIEF-C) [a]
Child Behaviour Checklist (CBCL); Social Competence Scale [a]
Vineland Adaptive Behavior Scales 2nd Edition (VABS II) [a]

TOTAL REVIEWED = 8

Neuropsychological Functioning
Behavior Rating Inventory of Executive Function Children's Version (BRIEF-C) – Recommended for Behavioural and Executive Function [a]
Delis-Kaplan Executive Function System (D-KEFS) [a]
Measure of Cognitive Linguistic Abilities (MCLA) [a]
Vineland Adaptive Behavior Scales 2nd Edition (VABS II) – Recommended for Behavioural and Executive Function [a]

Recommended:
Children's Memory Scale (CMS): Story Recall [a]
Contingency Naming Test (CNT) [a]
Comprehensive Trail Making Test [a]
Verbal Fluency [a]
Wechsler Intelligence Scale for Children 5th Edition (WAIS-V) [a]

TOTAL REVIEWED = 9

Psychological Status
Warwick-Edinburgh Mental Well-being Scale (WEMWBS) [a]
Child Behaviour Checklist (CBCL); Social Competence Scale – Recommended for Behaviour and Executive Function [a]
Adaptive Behaviour Assessment System – III (ABAS 3) [a]

Recommended:
Children's Depression Scale (CDS) [a]
Spence Children's Anxiety Scale (SCAS) [a]
Strengths and Difficulties Questionnaire (SDQ) [a]

TOTAL REVIEWED = 6

TBI-Related Symptoms
Pediatric Daytime Sleepiness Scale (PDSS) [a]

Recommended:
Pediatric Quality of Life Initiative (PEDS QL); Multidimensional Fatigue Scale [a]

TOTAL REVIEWED = 2

Activities and Participation

Strengths and Difficulties Questionnaire (SDQ); Relations and Prosocial Behaviour Subscales – Recommended in Psychological Status [a]
Pediatric Evaluation of Disability Inventory (PEDI); Social Functioning Scale – Replaced by PEDI-CAT [a]
Children's Assessment of Participation and Enjoyment & Activity of Children (CAPE) [a]
Adaptive Behaviour Assessment System - III (ABAS-III) [a]
PEERS/PEERS-Q – Recommended in Social Cognition [a]
Child Behaviour Checklist (CBCL); Social Competence Scale (Recommended in Behaviour and Executive Function) [a]
Developmental Assessment of Social Competence (DASC)

Recommended:
Child and Adolescent Scale of Participation (CASP) [a]
Paediatric Care and Needs Scale (PCANS) [a]
Pediatric Evaluation of Disability Inventory - Computer Adaptive Test (PEDI-CAT) [b]
Pediatric Quality of Life Initiative (PEDS QL); Social Subscale [a]
Sydney Psychosocial Reintegration Scale - Children (SPRS-C) [a]
Social Skills Improvement System (SSIS) Rating Scales [a]

TOTAL REVIEWED: 13

Support and Relationships

Recommended:
Family Assessment Device (FAD) [a]
Family Management Measure (FAMM) [a]
Parent Experience of Child Illness (PECI) [a]

TOTAL REVIEWED = 3

Sense of Self

Coopersmith Self-Esteem Inventory (CSEI) [a]

Recommended:
Rosenberg Self-Esteem Scale (RSES) [a]

TOTAL REVIEWED = 2

Concepts not Covered in ICF – Health Related Quality of Life

Assessment of Quality of Life (AQoL) [a]
Child Health Questionnaire (CHQ) [a]

Recommended:
Pediatric Quality of Life Initiative (PEDS QL) [a]

TOTAL REVIEWED = 3

[a] Assessed by the International Advisory Board
[b] Recommended or Substituted by International Reviewer at Review Stage

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