## Outcome Domain:

Post-Concussive/TBI-Related Symptoms

## Domain Description and Relevance in TBI:

“TBI-related symptoms include somatic (e.g., headaches, visual disturbances), cognitive (e.g., attention and memory difficulties) and emotional (e.g., irritability) symptoms. They are commonly reported after TBI or concussion and may persist in some cases at all levels of TBI severity.” – Wilde et al. 2010

Table CDE Classification by Type of TBI Study and Relevant Population for Recommended Post-Concussive/TBI-Related Symptoms Outcome Measures.

| Outcome Measure Name | Relevant TBI Population | Acute Hospitalized | Moderate/ Severe Rehabilitation | Concussion/ Mild TBI | Epidemiology |
| --- | --- | --- | --- | --- | --- |
| Health and Behavior Inventory (HBI)  | Pediatric  | Supplemental | Supplemental | Basic | Supplemental |
| Neurobehavioral Symptom Inventory (NSI) | Adult  | Supplemental | Supplemental | Supplemental | Supplemental |
| Post-concussion Symptom Inventory (PCSI)  | Pediatric  | Supplemental | Supplemental | Supplemental | Supplemental |
| Rivermead Postconcussive Symptom Questionnaire (RPQ) | Adult  | Supplemental | Supplemental | Basic | Supplemental |

### References

McCauley SR, Wilde EA, Anderson VA, Bedell G, Beers SR, Campbell TF, Chapman SB, Ewing-Cobbs L, Gerring JP, Gioia GA, Levin HS, Michaud LJ, Prasad MR, Swaine BR, Turkstra LS, Wade SL, Yeates KO. Recommendations for the Use of Common Outcome Measures in Pediatric Traumatic Brain Injury Research. J Neurotrauma. 2012 March; 29: 678-705. PubMed PMID: 21644810.

Wilde EA, Whiteneck GG, Bogner J, Bushnik T, Cifu DX, Dikmen S, French L, Giacino JT, Hart T, Malec JF, Millis SR, Novack TA, Sherer M, Tulsky DS, Vanderploeg RD, von Steinbuechel N. Recommendations for the use of common outcome measures in traumatic brain injury research. Arch Phys Med Rehabil. 2010 Nov;91(11):1650-1660.e17. [DOI: 10.1016/j.apmr.2010.06.033]

## Health and Behavior Inventory (HBI)

### DESCRIPTION

The HBI consists of 20 items that measure the frequency of common post-concussive symptoms. There are three versions of the inventory – Child, Parent Current Version and Parent Retrospective Version. The Parent Retrospective Version is used for rating pre-injury symptoms retrospectively.

### PERMISSIBLE VALUES

Symptoms are rated on a 4 point Likert scale from 1=never to 4=often based on frequency over the past week. Scores are summed for a total score, with higher scores indicating more positive health behavior.

### PROCEDURE

Takes approximately 10 minutes to complete.

### COMMENTS

It has been used primarily with 8 to 15-year-old children, but can be adapted to younger children and older adolescents.

### RATIONALE

“The scale has been used to investigate the outcomes of mild to severe TBI, and is sensitive to various markers of injury severity.” – McCauley et al. 2012

### REFERENCES

Ayr, L., Yeates, K., Taylor, H., and Brown, M. (2009). Dimensions of post-concussive symptoms in children with mild traumatic brain injuries. J Int Neuropsychol Soc 15, 19-30.

Fay, T., Yeates, K., Taylor, H., Bangert, B., Dietrich, A., Nuss, K., Rusin, J., and Wright, M. (2010). Cognitive reserve as a moderator of postconcussive symptoms in children with complicated and uncomplicated mild traumatic brain injury. J Int Neuropsychol Soc 16, 94-105.

Hajek, C., Yeates, K., Taylor, H., Bangert, B., Dietrich, A., Nuss, K., Rusin, J., and Wright, M. (in press). Agreement between parents and children on ratings of postconcussive symptoms following mild traumatic brain injury. Child Neuropsychol.

Moran, L., Taylor, H., Rusin, J., Bangert, B., Dietrich, A., Nuss, K., Wright, M., and Yeates, K. (in press). Do post-concussive symptoms discriminate injury severity in pediatric mild traumatic brain injury? J Head Trauma Rehabil.

Taylor, H., Dietrich, A., Nuss, K., Wright, M., Rusin, J., Bangert, B., Minich, N., and Yeates, K. (2010). Post-concussive symptoms in children with mild traumatic brain injury. Neuropsychology 24, 148-159.

## Neurobehavioral Symptom Inventory (NSI)

### DESCRIPTION

The severity of each symptom on the NSI is measured using a 5-item scale (0-none to 4-very severe) that asks patients to indicate the extent to which each symptom has disturbed them in the previous 2 weeks. The NSI total score is the sum of severity ratings of the 22 symptoms. Cluster scores (domains: physical, cognitive, affective, and sensory) were derived.

### PERMISSIBLE VALUES

Raw scores can be calculated for the four domains (Physical, Cognitive, Affective and Sensory) and for the Total Score.

### PROCEDURE

Patient self-report either through 1) written completion of the questionnaire, or 2) in-person or telephone interview with clinician or research associate. Administration time is 5-10 minutes.

### COMMENTS

Adults

### RATIONALE

The NSI is currently being used by the Veteran’s Administration and the Department of Defense as part of a screening for TBI in veterans injured as part of OIF/OEF.

### REFERENCES

Cicerone, K.D., and Kalmar, K. (1995). Persistent Postconcussion Syndrome: The Structure of Subjective Complaints after Mild Traumatic Brain Injury. Journal of Head Trauma Rehabilitation 10(3) 1-17.

## Post-concussion Symptom Inventory (PCSI)

### DESCRIPTION

The PCSI measures physical, cognitive, emotional, and sleep-related TBI symptoms. The self-report forms are for children 5-7 (13 items) and 8-12 (25 items) and 13-18 year olds (26 items). There is also a parent/ teacher form which asks the respondent to rate the extent to which the symptom is observed at home / school. It is important to note that there is a retrospective pre-injury report and a post-injury report of symptoms.

### PERMISSIBLE VALUES

A total symptom score is obtained from the sum of all item scores.

### PROCEDURE

It has three different self-report forms for children of different ages (ages 5-7, 13 items; ages 8-12, 25 items; ages 13-18, 26 items) and one 26-item form for parents and teachers. The 5-7 and 8-12 year old forms are rated on a 3-point scale. The 13-18 and parent/teacher forms use a 7-point scale, where 0= Not a problem, 3= Moderate problem and 7= Severe problem.

### COMMENTS

The inventory is appropriate for children ages 5-18.

### RATIONALE

“The PCSI was selected as a supplemental measure because of its sound psychometric characteristics, promising indications of validity in distinguishing mild TBI from other injuries, applicability to younger children, and availability in the public domain.” -- McCauley et al. 2012

### REFERENCES

Gioia, G., Schneider, J., Vaughan, C., and Isquith, P. (2009). Which symptom assessments and approaches are uniquely appropriate for paediatric concussion? Br J Sports Med 43(Suppl1), i13-i22. Apps, NJ., Walter, KD. (2011). Pediatric and Adolescent Concussion. Springer: New York, NY.

## Rivermead Postconcussive Symptom Questionnaire (RPQ)

### DESCRIPTION

The RPQ is a 16-item self-report measure of the presence and severity of the 16 most commonly reported post-concussive symptoms found in the literature. The scale compares any current symptoms to pre-injury symptom levels to account for potential symptom exacerbation due to TBI.

### PERMISSIBLE VALUES

The range of scores is 0-64. Values for each of the 16 items include 0 (not experienced at all), 1 (no more of a problem than before the injury), 2 (mild problem), 3 (moderate problem), 4 (severe problem). The total score is a summation of symptoms rated as > 2 indicating post-concussion symptoms that represent new symptom onset or an exacerbation of a symptom present pre-injury.

### PROCEDURE

Patient self-report either through 1) written completion of the questionnaire, or 2) in-person or telephone interview with clinician or research associate. Administration time is 5-10 minutes.

### COMMENTS

The RPQ would be most useful in assessing post-concussion symptoms in persons with mild to moderate TBI, but has also been used with more severely injured patients.

### RATIONALE

The RPQ provides a brief assessment of post-concussive symptoms, can be used for diagnostic and severity purposes, and can be used to monitor change in response to treatment. This instrument is available in the public domain and is a widely used measure.

### REFERENCES

King, N.S., Crawford, S., Wenden, F.J., Moss, N.E., & Wade, D.T. (1995). The Rivermead Post Concussion Symptoms Questionnaire: A Measure of Symptoms Commonly Experiences after Head Injury and its Reliability. Journal of Neurology 242: 587-92.