

# Supporting Resources

Use the links below to jump to a specific resource.

## **5 Types of Concussion and Two Modifying Factors Infographic and Fact Sheet**

Information on the types of clinical trajectories of concussion

## **A Fact Sheet for School Nurses**

CDC's fact sheet specific to school nurses

## **CDC Online Training for Healthcare Providers**

Earn free CME, CNE, and CEU credits

## **Research Summary and References**

Summary of research provided in training and references

## **Changes to Watch for Over Time**



Brain Links is supported by the Administration for Community Living (ACL) of the U.S. Department of Health and Human Services under Grant No. 90TBSG0051-01-00 and in part by the TN Department of Health, Traumatic Brain Injury Program.

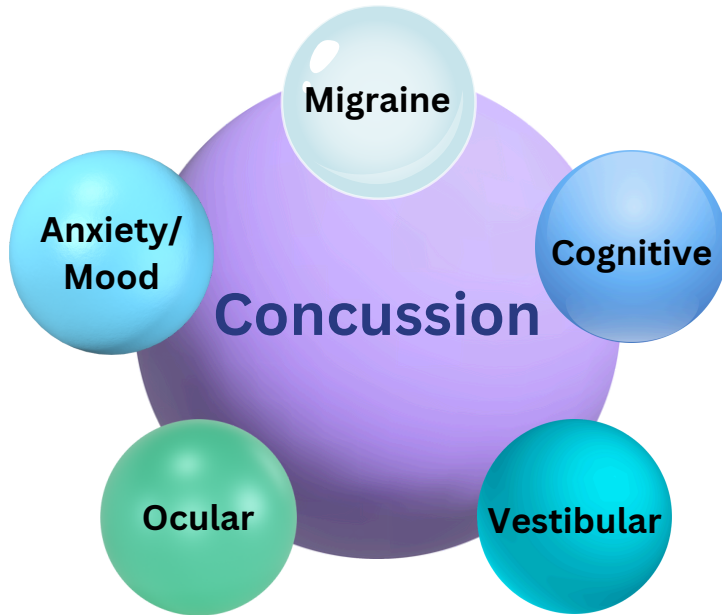
# 5 TYPES OF CONCUSSION

with 2 Modifying Factors

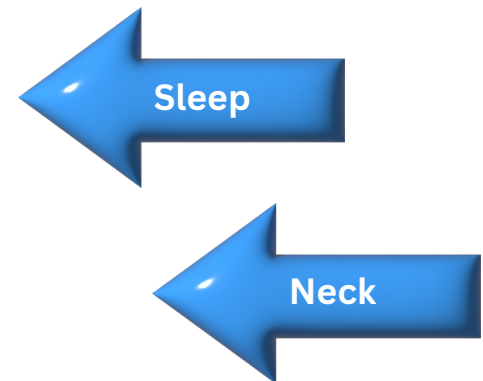


“Concussions are characterized by diverse symptoms and impairments in function resulting in different clinical profiles and recovery trajectories.”

## 5 Concussion Types



## 2 Modifying Factors



## CONCUSSION FACTS

- Symptoms will be broad and generalized during the first week following a concussion and will generally include symptoms like headache and fatigue.
- After the first week, if symptoms persist, they will tend to fall into one of the 5 clinical trajectories.
- There could be more than one trajectory type present.
- Specific trajectory and outcome depends on several factors:
  - Direction of force (linear vs. rotational)
  - Location of impact
  - Amount of force involved
  - Pre-injury risk factors

## ACTIVE TREATMENT

Research is showing that active, specialized treatment - focused on specific symptoms - helps the brain recover from injury. These treatments include:

- |  |  |
|--|--|
| ▪ Neuropsychology                      | ▪ Neurosurgery                                 |
| ▪ Vestibular Physical Therapy          | ▪ Neuroradiology                               |
| ▪ Exertional Physical Therapy          | ▪ Chiropractic                                 |
| ▪ Physical Medicine and Rehabilitation | ▪ Cognitive Therapy/ Speech Language Pathology |
| ▪ Neuro-optometry/ Neuro-ophthalmology |  |
| ▪ Orthopedist                          |  |

## RISK FACTORS (which may delay recovery)

- |                                |   |
|--------------------------------|---|
| • History of prior concussions | • Migraine history                                      |
| • Motion sickness              | • Gender (female)                                       |
| • Visual problems              | • Age (younger children tend to take longer to recover) |
| • Learning or attention issues |   |

# CONCUSSION CLINICAL TRAJECTORIES

A model for understanding assessment, treatment and rehabilitation.

## COGNITIVE

“Cognitive difficulties include decreased concentration, increased distractibility, difficulty learning/retaining new information or decreased multitasking abilities. Sometimes accompanied by increased fatigue as the day progresses.”



## VESTIBULAR

“Impairments of the vestibular system - the balance center of the brain - affects one’s ability to interpret motion, coordinate head and eye movements, or stabilize vision upon head movement.”



## OCULAR

“Ocular dysfunction occurs when the movement of the eyes in tandem, or binocular movement, is affected. This may result in difficulties bringing the eyes together, or moving one’s eyes to track motion.”



## POST-TRAUMATIC MIGRAINE

“Post-traumatic migraine symptoms include headaches, nausea, and/or sensitivity to light or noise.”



## ANXIETY/MOOD

“This occurs when someone has a hard time turning his or her thoughts off, being particularly ruminative, or suffering from excessive worry or concern.”



**TWO MODIFYING FACTORS:** The presence of modifiers impacts the concussion symptoms.

### SLEEP

The sleep modifier involves sleeping more or less than usual and having difficulty falling or staying asleep.

### NECK

The neck modifier includes neck pain, stiffness or difficulty moving the neck.

The information on this infographic is from the University of Pittsburgh Medical Center’s *TREAT Sport-related Concussion Conference* on April 20-21, 2024. It was based on research from: Collins, Kontos, Reynolds, Murawski, et al. KSSTA; 2014. Kontos & Collins, APA Books; 2018. Kontos et al. *Curr Sports Med Rep*; 2019. This *5 Types of Concussion and 2 Modifying Factors* information reflects an update from the original *6 Types of Concussion*.



[@BrainLinksTN](https://www.tndisability.org/brain)



Brain Links is supported by the Administration for Community Living (ACL) of the U.S. Department of Health and Human Services under Grant No. 90TBSG0051-01-00 and in part by the TN Department of Health, Traumatic Brain Injury Program.

July 2024



## A Fact Sheet for School Nurses

**HEADS UP  
SCHOOLS**

### THE FACTS:

- \* All concussions are serious.
- \* Most concussions occur without loss of consciousness.
- \* Recognition and proper response to concussions when they first occur can help aid recovery and prevent further injury, or even death.

To download this fact sheet in Spanish, please visit: [www.cdc.gov/Concussion](http://www.cdc.gov/Concussion).  
Para obtener una copia electrónica de esta hoja de información en español, por favor visite: [www.cdc.gov/Concussion](http://www.cdc.gov/Concussion).

### What is a concussion?

A concussion is a type of brain injury that changes the way the brain normally works. A concussion is caused by a bump, blow, or jolt to the head. Concussions can also occur from a fall or blow to the body that causes the head and brain to move rapidly back and forth. Even what seems to be a mild bump to the head can be serious.

### How can I recognize a concussion?

To help you recognize a concussion, ask the injured student or witnesses of the incident about:

1. Any kind of forceful blow to the head or to the body that resulted in rapid movement of the head.

-and-

2. Any change in the student's behavior, thinking, or physical functioning. (See the signs and symptoms of concussion.)

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
CENTERS FOR DISEASE CONTROL AND PREVENTION





## How can concussions happen in schools?

Children and adolescents are among those at greatest risk for concussion. Concussions can result from a fall, or any time a student's head comes into contact with a hard object, such as the floor, a desk, or another student's head or body. The potential for a concussion is greatest during activities where collisions can occur, such as during physical education (PE) class, playground time, or school-based sports activities.

Students may also get a concussion when doing activities outside of school, but then come to school when symptoms of the concussion are presenting. For example, adolescent drivers are at increased risk for concussion from motor vehicle crashes.

Concussions can have a more serious effect on a young, developing brain and need to be addressed correctly. Proper recognition and response to concussion symptoms in the school environment can prevent further injury and can help with recovery.



# What are the signs and symptoms of concussion?

Students who experience **one or more** of the signs and symptoms listed below after a bump, blow, or jolt to the head or body should be referred to a health care professional experienced in evaluating for concussion.

There is no one single indicator for concussion. Rather, recognizing a concussion requires a symptom assessment. The signs and symptoms of concussion can take time to appear and can become more noticeable during concentration and learning activities in the classroom. For this reason, it is important to watch for changes in how the student is acting or feeling, if symptoms become worse, or if the student just “doesn’t feel right.”

## SIGNS OBSERVED BY SCHOOL NURSES

- Appears dazed or stunned
- Is confused about events
- Answers questions slowly
- Repeats questions
- Can’t recall events *prior* to the hit, bump, or fall
- Can’t recall events *after* the hit, bump, or fall
- Loses consciousness (even briefly)
- Shows behavior or personality changes

## SYMPTOMS REPORTED BY THE STUDENT

### Thinking/Remembering:

- Difficulty thinking clearly
- Difficulty concentrating or remembering
- Feeling more slowed down
- Feeling sluggish, hazy, foggy, or groggy

### Emotional:

- Irritable
- Sad
- More emotional than usual
- Nervous

### Physical:

- Headache or “pressure” in head
- Nausea or vomiting
- Balance problems or dizziness
- Fatigue or feeling tired
- Blurry or double vision
- Sensitivity to light or noise
- Numbness or tingling
- Does not “feel right”

### Sleep\*:

- Drowsy
- Sleeps *less* than usual
- Sleeps *more* than usual
- Has trouble falling asleep

*\*Only ask about sleep symptoms if the injury occurred on a prior day.*



Remember, you can’t see a concussion and some students may not experience or report symptoms until hours or days after the injury. Most young people with a concussion will recover quickly and fully. But for some, concussion signs and symptoms can last for days, weeks, or longer.



## What are concussion danger signs?

In rare cases, a dangerous blood clot may form on the brain in a person with a concussion and crowd the brain against the skull. The student should be taken to an emergency department right away if s/he exhibits any of the following danger signs after a bump, blow, or jolt to the head or body:

- One pupil larger than the other
- Is drowsy or cannot be awakened
- A headache that gets worse and does not go away
- Weakness, numbness, or decreased coordination

- Repeated vomiting or nausea
- Slurred speech
- Convulsions or seizures
- Cannot recognize people or places
- Becomes increasingly confused, restless, or agitated
- Has unusual behavior
- Loses consciousness (even a brief loss of consciousness should be taken seriously)

For more information and tool kits for youth sports coaches and high school coaches, visit [www.cdc.gov/Concussion](http://www.cdc.gov/Concussion).

## What can school nurses and school professionals do?

Below are steps for you to take when a student comes to your office after a bump, blow, or jolt to the head or body.

1. **Observe student for signs and symptoms of concussion for a minimum of 30 minutes.**
2. **Complete the *Concussion Signs and Symptoms Checklist* and monitor students consistently during the observation period.** The form includes an easy-to-use checklist of signs and symptoms that you can look for when the student first arrives at your office, fifteen minutes later, and at the end of 30 minutes, to determine whether any concussion symptoms appear or change.
3. **Notify the student's parent(s) or guardian(s) that their child had an injury to the head.**
  - > If signs or symptoms are present: refer the student right away to a health care professional with experience in evaluating for concussion. Send a copy of the *Concussion Signs and Symptoms Checklist* with the student for the health care professional to review. Students should follow their health care professional's guidance about when they can return to school and to physical activity.

- > If signs or symptoms are not present: the student may return to class, but should not return to sports or recreation activities on the day of the injury. Send a copy of the *Concussion Signs and Symptoms Checklist* with the student for their parent(s) or guardian(s) to review and ask them to continue to observe the student at home for any changes. Explain that signs and symptoms of concussion can take time to appear. Note that if signs or symptoms appear, the student should be seen right away by a health care professional with experience in evaluating for concussion.



Children and teens with a concussion should NEVER return to sports or recreation activities on the same day the injury occurred. They should delay returning to their activities until a health care professional experienced in evaluating for concussion says they are symptom-free and it's OK to return to play. This means, until permitted, not returning to:

- Physical Education (PE) class,
- Sports practices or games, or
- Physical activity at recess.





## What do I need to know about students returning to school after a concussion?

Supporting a student recovering from a concussion requires a collaborative approach among school professionals, health care professionals, parents, and students. All school staff, such as teachers, school nurses, counselors, administrators, speech-language pathologists, coaches, and others should be informed about a returning student's injury and symptoms, as they can assist with the transition process and making accommodations for a student. If symptoms persist, a 504 meeting may be called. Section 504 Plans are implemented when students have a disability (temporary or permanent) that affects their performance in any manner. Services and accommodations for students may include speech-language therapy, environmental



### School Policies:

#### *Students Returning to School after a Concussion*

Check with your school administrators to see if your district or school has a policy in place to help students recovering from a concussion succeed when they return to school. If not, consider working with your school administration to develop such a policy. Policy statements can include the district's or school's commitment to safety, a brief description of concussion, a plan to help students ease back into school life (learning, social activity, etc.), and information on when students can safely return to physical activity following a concussion.

adaptations, curriculum modifications, and behavioral strategies.

Encourage teachers and coaches to monitor students who return to school after a concussion. Students may need to limit activities while they are recovering from a concussion. Exercising or activities that involve a lot of concentration, such as studying, working on the computer, or playing video games, may cause concussion symptoms (such as headache or tiredness) to reappear or get worse. After a concussion, physical and cognitive activities—such as concentration and learning—should be carefully monitored and managed by health and school professionals.

If a student already had a medical condition at the time of the concussion (such as chronic headaches), it may take longer to

recover from the concussion. Anxiety and depression may also make it harder to adjust to the symptoms of a concussion.

School professionals should watch for students who show increased problems paying attention, problems remembering or learning new information, inappropriate or impulsive behavior during class, greater irritability, less ability to cope with stress, or difficulty organizing tasks. Students who return to school after a concussion may need to:

- Take rest breaks as needed,
- Spend fewer hours at school,
- Be given more time to take tests or complete assignments,
- Receive help with schoolwork, and/or
- Reduce time spent on the computer, reading, or writing.

It is normal for a student to feel frustrated, sad, and even angry because s/he cannot return to recreation or sports right away, or cannot keep up with schoolwork. A student may also feel isolated from peers and social networks. Talk with the student about these issues and offer support and encouragement. As the student's symptoms decrease, the extra help or support can be gradually removed.

## What can I do to prevent and prepare for a concussion?

Here are some steps you can take to prevent concussions in school and ensure the best outcome for your students:

**Prepare a concussion action plan.** To ensure that concussions are identified early and managed correctly, have an action plan in place before the start of the school year. This plan can be included in your school or district's concussion policy. You can use the online action plan for sports and recreation activities at: [www.cdc.gov/concussion/response/html](http://www.cdc.gov/concussion/response/html). Be sure that other appropriate school and athletic staff know about the plan and have been trained to use it.

**Educate parents, teachers, coaches, and students about concussion.** Parents, teachers, and coaches know their students well and may be the first to notice when a student is not acting normally. Encourage teachers, coaches, and students to:

- Learn about the potential long-term effects of concussion and the dangers of returning to activity too soon.
- Look out for the signs and symptoms of concussion and send students to see you if they observe any or even suspect that a concussion has occurred.
- View videos about concussion online at: [www.cdc.gov/Concussion](http://www.cdc.gov/Concussion).

**Prevent long-term problems.** A repeat concussion that occurs before the brain recovers from the previous concussion—usually within a short period of time (hours, days, or weeks)—can slow recovery or increase the likelihood of having long-term problems. In rare cases, repeat concussions

can result in edema (brain swelling), permanent brain damage, and even death. Keep students with a known or suspected concussion out of physical activity, sports, or playground activity on the day of the injury and until a health care professional with experience in evaluating for concussion says they are symptom-free and it is OK for the student to return to play.

### Create safe school environments.

The best way to protect students from concussions is to prevent concussions from happening. Make sure your school has policies and procedures to ensure that the environment is a safe, healthy place for students. Talk to all school staff and administrators and encourage them to keep the physical space safe, keep stairs and hallways clear of clutter, secure rugs to the floor, and check the surfaces of all areas where students are physically active, such as playing fields and playgrounds. Playground surfaces should be made of shock-absorbing material, such as hardwood mulch or sand, and maintained to an appropriate depth. Proper supervision of students is also important.



For more detailed information about concussion diagnosis and management, please download *Heads Up: Facts for Physicians about Mild Traumatic Brain Injury* from CDC at: [www.cdc.gov/Concussion](http://www.cdc.gov/Concussion).



### Monitor the health of your student athletes.

Make sure to ask whether an athlete has ever had a concussion and insist that your athletes are medically

evaluated and are in good condition to participate in sports. Keep track of athletes who sustain concussions during the school year. This will help in monitoring injured athletes who participate in multiple sports throughout the school year.

Some schools conduct preseason baseline testing (also known as neurocognitive tests) to assess brain function—learning and memory skills, ability to pay attention or concentrate, and how quickly someone can think and solve problems. If an athlete has a concussion, these tests can be used again during the season to help identify the effects of the injury. Before the first practice, determine whether your school would consider baseline testing.

### Again, remember your concussion ABCs:

- A—Assess the situation
- B—Be alert for signs and symptoms
- C—Contact a health care professional

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
CENTERS FOR DISEASE CONTROL AND PREVENTION



\* For more information on concussion and to order additional materials for school professionals **FREE-OF-CHARGE**, visit: [www.cdc.gov/Concussion](http://www.cdc.gov/Concussion).

# CDC'S ONLINE TRAINING FOR HEALTHCARE PROVIDERS

## HEADS UP

HEADS UP to Healthcare Providers is a free online training developed by CDC and the American Academy of Pediatrics. The goal of the training is to provide an overview of the evidence-based recommendations outlined in the [CDC Pediatric mTBI Guideline](#) and to equip healthcare providers with practical strategies to integrate these recommendations into clinical practice.

## LEARNING OBJECTIVES

This **training** will enable healthcare providers to:

- ★ Learn practical strategies to integrate the latest clinical recommendations into practice. Understand
- ★ the current diagnostic criteria for mTBI and use validated, symptom-based assessment tools to identify them.
- ★ Recognize the key components of a return-to-school process.
- ★ Identify common mental health conditions following mTBI.
- ★ Advise patients and their caregivers on mTBI-related prevention strategies.

With this training, health care providers will get the tools to improve mTBI care and patient outcomes to help children thrive. CMEs are available for AAP members.

## FOLLOW THE URL TO BEGIN

<https://www.cdc.gov/heads-up/hcp/training/index.html>

## CDC Resources for Healthcare Providers

<https://www.cdc.gov/traumatic-brain-injury/hcp/communication-resources/index.html>



Brain Links is supported by the Administration for Community Living (ACL) of the U.S. Department of Health and Human Services under Grant No. 90TBSG0024-01-00 and in part by the TN Department of Health, Traumatic Brain Injury Program.



# Research Summary and References

## Support for the Toolkit

### TOOLKIT

This toolkit, and specifically the *Concussion Management Protocol*, were developed based on the research summarized below. The research supports educating practitioners (rationale for the [Reference](#) section), properly evaluating, monitoring and referring patients (rationale for the [In-Office](#) section) and properly educating those with mTBI/ TBI (rational for the [Send-Home](#) sections).

### CHILDREN:

#### Healthcare providers outside hospitals are on the front lines:

Most (82%) of those 0 to 17 years will seek initial care with their primary care physician (Arbogast, et al., 2016). Since most of our incidence data comes from Emergency Department's (ED's), we are significantly underestimating the extent of the TBI issue (Study included over 8,000 patients).

#### The very young are frequently not diagnosed or treated:

The newest pediatric mTBI guidelines recommend using an age-appropriate validated concussion scale (Lumba-Brown, et al., 2018), but one does not exist yet that focuses on children five and under. We must look for additional signs in children five years and under. For this age range, parents endorse the typical symptoms from the ACE, but in answer to an open-ended question, 82% also reported additional symptoms (Suskauer, et al., 2018), including:

- ✱ Appetite changes
- ✱ Behavioral dysregulation
- ✱ Decreased engagement
- ✱ Disrupted sleep
- ✱ Bladder incontinence (Enuresis)
- ✱ Increased dependence
- ✱ Stomachaches

The study also concluded that it is important to monitor behavior dysregulation over time. At first, parents saw disengagement, and then behavior dysregulation emerged and persisted. Behavioral dysregulation was among most commonly reported symptoms and was still present at the time of the evaluation (over one month post).

#### Children with TBI may develop or have ongoing concerns and should be monitored (for years):

They are more likely to have a variety of health/academic issues compared to those with no TBI (Haarbauer-Krupa, Lee, et al., 2018). The highest prevalence are:

- ✱ Learning disorders
- ✱ ADD/ADHD
- ✱ Speech Language problems
- ✱ Developmental delay
- ✱ Anxiety
- ✱ Bone, joint or muscle problems

Children with mild (Taylor, 2015) and moderate and severe (Schwartz, 2003) injuries are more at risk for persistent behavior problems. The risk rises with severity of the mTBI and younger age at injury. Even in children whose injuries were significant enough to show skull or brain tissue damage on imaging, only one-fourth received any rehabilitations services afterward and only one-fourth received a neuropsychological assessment. None of the children received early intervention or special education preschool services after their TBI (Haarbauer-Krupa, Lundine, et al., 2018). This study concludes:

- ✱ Healthcare providers should provide information to parents on what to watch for and long term implications.

- ✧ Healthcare providers should make appropriate referrals at the time of diagnosis.
- ✧ Referral to rehabilitation can help with transition to preschool.

Another study (Niedzwecki, et al., 2018) concluded that even though children did not receive inpatient care, some will still benefit from rehabilitation for subsequent problems, including memory and learning issues (that were not pre-existing).

This study also found that medical issues at the time of injury, like elevations or depressions of Intra-cranial pressure (ICP), unstable blood pressure, unstable oxygenation, delayed nutrition or seizures, can impact the child's IQ at 12 months.

- ✧ The study's recommendation for trauma treatment is that rehab services be included early in the continuum – this would include consultation early in the ICU or acute care settings and referrals to an outpatient concussion clinic.

In the first year after injury, a substantial portion of children with moderate or severe TBI have unmet or unrecognized healthcare needs, with cognitive services being most frequent among these. Because of this finding, the authors recommended that cognition be screened in the primary care setting (Slomine, et al., 2006).

#### *Reason for unmet needs:*

- ✧ Lack of a physician's recommendation or referral
- ✧ Failure of parent follow-up
- ✧ Not provided in the school settings
- ✧ Cost

Children with all levels of impairment had educational needs, while those with less severe injuries were at greater risk of being underserved (Kingery, et al., 2017).

Earlier age at time of injury produces more functional impairment (Taylor, et al., 2015). The more severe the injury and the younger age at injury, the greater the need for monitoring and follow up (Anderson, Catroppa, Dudgeon, 2006; Anderson, Catroppa, Haritou, 2006).

### **On the first visit, provide educational materials, accommodations for return to school and recommend a follow up visit (at which time appropriate referrals can be made):**

- ✧ Many children did not even visit a healthcare provider in the year following their injury (Slomine, et al., 2006).

### **Ongoing family support is important:**

Family support is important because those with family dysfunction/poor coping, the child had greater dysfunction (Schwartz, 2003; Anderson, Catroppa, Dudgeon, et al., 2006; Taylor, 2008).

Families also reported needing information, emotional support and access to community-based services (Jones, 2017).

### **Schools need the support/recommendations of healthcare providers:**

Teachers are not adequately trained to identify brain injuries and issues related to them (Davies, et al., 2013).

On specialized testing, children with TBI tend to show specific patterns of deficit that will not be revealed through standard special education testing. A neuropsychological evaluation will pick up these patterns. In a study of mild complicated TBI (with orthopedic controls), children who were injured before age 6 and were about 5 years post injury were tested. Both groups were within normal limits on most cognitive, language and reading measures; but they had some differences in verbal IQ, receptive

language and reading comprehension. The biggest differences were in pragmatic language (which leads to social issues), story retell, and word fluency (Haarbauer-Krupa, King, et al., 2019).

Schools will not provide all of what a child needs (Niedzwecki, 2018). Schools are only required to provide those services that directly relate to academics.

The gap in academic achievement widens over time (compared with non-injured classmates) (Ewing-Cobbs, 2006; Farmer, 1997; Taylor & Yeates, 2002; Todis & Glang, 2008; Todis, Glang, Bullis, et al., 2011; Wagner, et al., 2006). So, if children with TBI do not qualify for services at first, they should be referred again if they continue to have difficulties.

“Children who receive systematic transition services a part of their medical care are more likely to be identified for specialized support services at school, such as speech therapy (Haarbauer-Krupa, Ciccio, et al., 2017).

Use of the ACE tools (screening tool and Care Plan) “increased patient follow-up and improved recall of and adherence to ED discharge recommendations (Zuckerbraun, 2014).”

### **Pediatric Guideline:**

*Also see the CDC Pediatric Guideline (Lumba-Brown, et al., 2018) on mTBI in this toolkit for 19 sets of recommendations, with these [5 key take away points](#):*

1. Do not routinely image pediatric patients to diagnose mTBI.
2. Use validated, age-appropriate symptom scales to diagnose mTBI.
3. Assess risk factors for prolonged recovery, including history of mTBI or other brain injury, severe symptom presentation immediately after the injury, and personal characteristics and family history (such as learning difficulties and family and social stressors).
4. Provide patients and their parents with instructions on returning to activity customized to their symptoms.
5. Counsel patients and their parents/caregivers to return gradually to non-sports activities after no more than 2-3 days of rest.

### **Consequences of brain injury for all ages:**

Once a person has one brain injury, the risk for another increases, and the risk increases with each subsequent injury. A person with a brain injury is also more likely to be incarcerated (or involved with the criminal justice system) (Farrer & Hedges, 2011; Shiroma, et al., 2012; Williams, et al., 2010; Im, et al., 2014), to have psychiatric issues ((McCarthy, et al., 2006; Kaponen, et al., 2002; Zgaljardic, et al., 2015), to be involved with substance abuse (Kreutzer, et al., 1996), and to be socially isolated (Morton & Wehman, 1995; Hawthorne, et al., 2009). Long-term psychiatric disorders are associated with greater risk for substance abuse (Zgaljardic, et al., 2015). Prior TBI has been identified as a potential contributing factor to domestic violence (Romero-Martinez & Moya-Albiol, 2013). Not surprisingly, TBI is found in female victims of domestic violence (Corrigan, et al., 2001).

## **ADULTS**

### **Follow up and education are important:**

Findings from a study (Seabury, et al., 2018) of follow-up care that was provided to people at 11 Level 1 trauma centers across the country:

- ✱ Less than half received TBI educational material at discharge or saw a health care practitioner within 3 months after injury.
- ✱ Only 27% were called by 2 weeks.
- ✱ Follow-up care varied by site, from 19% to 72%.

- ✳ For those with a positive CT scan, over one-third had not seen a medical practitioner for follow-up.
- ✳ Even among those with 3 or more moderate to severe post-concussive symptoms, only about half saw a medical practitioner within 3 months.
  - Of those that did, 80% reported that it was helpful. The majority saw a general practitioner and 38% saw a neurologist. Only 15% reported visiting a clinic specializing in TBI care.

### A few conclusions from the paper:

- ✳ “Failure to follow-up with patients could have adverse consequences, as simply providing educational materials to patients with mTBI is associated with improved outcomes.”<sup>35</sup>
- ✳ “Our findings reveal the consequences that may result from the absence of systems of follow-up care for patients with mTBI and concussion. They also highlight an apparent lack of appreciation by many clinicians of the substantial symptom and life burdens experienced by a significant proportion of patients with injuries labeled mild.”

Use of the ACE tools (screening tool and Care Plan) “increased patient follow-up and improved recall of and adherence to ED discharge recommendations (5-21 year olds) (Zuckerbraun, 2014).”

### Unmet Needs:

Poor psychosocial health was reported by a substantial portion in a study at one year post injury TBI may cause decades lasting vulnerability to psychiatric illness in some individuals. They were most susceptible to depression, delusional disorders and personality disturbances. This study highlights the importance of psychiatric follow up even decades (30 years) later (Kaponen, et al., 2002). Heinemann found unmet needs at 7 years. The most prevalent were improving memory and problem solving, increasing income and improving job skills (Heinemann, et al., 2002).

[Also see the Updated Mild Traumatic Brain Injury Guideline for Adults in this toolkit.](#)

### Model of 6 types of concussion and active treatments (pediatric and adult):

There is now a great body of evidence supporting the 6 types of concussion and the active treatments for each type. A good resource to start with is *Concussion: A Clinical Profile Approach to Assessment and Treatment* by Kontos and Collins (2018) and *A comprehensive, targeted approach to the clinical care of athletes following sport-related concussion* (Collins, et al., 2013).

### References

- Anderson, V. A., Catroppa, C., Dudgeon, P., Morse, S. A., Haritou, F., & Rosenfeld, J. V. (2006). Understanding predictors of functional recovery and outcome 30 months following early childhood head injury. *Neuropsychology*, 20(1), 42-57. doi:10.1037/0894-4105.20.1.42
- Anderson, V., Godfrey, C., Rosenfeld, J.V., & Catroppa, C., Predictors of Cognitive Function and Recovery 10 Years After Traumatic Brain Injury in Young Children. (2012). *Pediatrics*, 129(2). doi:10.1542/peds.2011-0311d
- Arbogast, K. B., Curry, A. E., Pfeiffer, M. R., Zonfrillo, M. R., Haarbauer-Krupa, J., Breiding, M. J., . . . Master, C. L. (2016). Point of Health Care Entry for Youth With Concussion Within a Large Pediatric Care Network. *JAMA Pediatrics*, 170(7). doi:10.1001/jamapediatrics.2016.0294
- Collins, M. W., Kontos, A. P., Reynolds, E., Murawski, C. D., & Fu, F. H. (2013). A comprehensive, targeted approach to the clinical care of athletes following sport-related concussion. *Knee Surgery, Sports Traumatology, Arthroscopy*, 22(2), 235-246. doi:10.1007/s00167-013-2791-6
- Corrigan, J. D., Wolfe, M., Mysiw, W. J., Jackson, R. D., & Bogner, J. A. (2001). Early identification of mild traumatic brain injury in female victims of domestic violence. *Clinical Journal of Womens Health*, 01(4), 184-190. doi:10.1053/cjwh.2001.27867



- Davies, S. C., Fox, E. E., Glang, A., et al. Traumatic Brain Injury and Teacher Training: A Gap in Educator Preparation. (2013). Counselor Education and Human Services Faculty Publications. 25. [http://ecommons.udayton.edu/edc\\_fac\\_pub/25](http://ecommons.udayton.edu/edc_fac_pub/25)
- Ewing-Cobbs, L., Prasad, M. R., Kramer, L., Cox, C. S., Baumgartner, J., Fletcher, S., et al. (2006). Late intellectual and academic outcomes following traumatic brain injury sustained during early childhood. *Journal of Neurosurgery: Pediatrics*, 105(4), 287-296. doi:10.3171/ped.2006.105.4.287
- Farmer, J. E., & Johnson-Gerard, M. (1997). Misconceptions about traumatic brain injury among educators and rehabilitation staff: A comparative study. *Rehabilitation Psychology*, 42(4), 273-286. doi:10.1037//0090-5550.42.4.273
- Farrer, T. J., & Hedges, D. W. (2011). Prevalence of traumatic brain injury in incarcerated groups compared to the general population: A meta-analysis. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 35(2), 390-394. doi:10.1016/j.pnpbp.2011.01.007
- Haarbauer-Krupa, J., King, T. Z., Wise, J., Gillam, S., Trapani, J., Weissman, B., & Depompei, R. (2019). Early Elementary School Outcome in Children With a History of Traumatic Brain Injury Before Age 6 Years. *Journal of Head Trauma Rehabilitation*, 34(2), 111-121. doi:10.1097/htr.000000000000041
- Haarbauer-Krupa, J., Lee, A. H., Bitsko, R. H., Zhang, X., & Kresnow-Sedacca, M. (2018). Prevalence of Parent-Reported Traumatic Brain Injury in Children and Associated Health Conditions. *JAMA Pediatrics*, 172(11), 1078. doi:10.1001/jamapediatrics.2018.2740
- Haarbauer-Krupa, J., Lundine, J. P., Depompei, R., & King, T. Z. (2018). Rehabilitation and school services following traumatic brain injury in young children. *NeuroRehabilitation*, 42(3), 259-267. doi:10.3233/nre-172410
- Hawthorne G, Gruen RL, Kaye AH. Traumatic brain injury and long-term quality of life: findings from an Australian study. *J Neurotrauma*. 2009;26:1623–33. doi: 10.1089/neu.2008.0735
- Heinemann, A. W., Sokol, K., Garvin, L., & Bode, R. K. (2002). Measuring unmet needs and services among persons with traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*, 83(8), 1052-1059. doi:10.1053/apmr.2002.3428
- Im, B., Hada, E., Smith, M., & Gertisch, H. (2014). The Relationship between TBI and incarceration rates. Spotlight on Disability Newsletter, Dec 2014 retrieved from <https://www.apa.org/pi/disability/resources/publications/newsletter/2014/12/incarceration>.
- Jones, S., Davis, N., & Tyson, S. F. (2017). A scoping review of the needs of children and other family members after a child's traumatic injury. *Clinical Rehabilitation*, 32(4), 501-511. doi:10.1177/0269215517736672
- Kaponen, S., Taiminen, T., Portin, R., et al. (2002). Axis I and II psychiatric disorders after traumatic brain injury a 30 year follow-up study. *Am J Psychiatry*, Aug; 159(8): 1315-21.
- Kontos, A. P., & Collins, M. W. (2018). Concussion: A clinical profile approach to assessment and treatment. Washington, DC: American Psychological Association.
- Kreutzer, J. S., Witol, A. D., & Marwitz, J. H. (1996). Alcohol and Drug Use Among Young Persons with Traumatic Brain Injury. *Journal of Learning Disabilities*, 29(6), 643-651. doi:10.1177/002221949602900608
- Lumba-Brown, A., Yeates, K.O., Sarmiento, K., et al. Centers for Disease Control and Prevention guideline on the diagnosis and management of mild traumatic brain injury among children [published online September 4, 2018]. *JAMA Pediatr*. doi:10.1001/jamapediatrics.2018.2853
- Mccarthy, M. L., Dikmen, S. S., Langlois, J. A., Selassie, A. W., Gu, J. K., & Horner, M. D. (2006). Self-Reported Psychosocial Health Among Adults With Traumatic Brain Injury. *Archives of Physical Medicine and Rehabilitation*, 87(7), 953-961. doi:10.1016/j.apmr.2006.03.007
- Morton, M. V., & Wehman, P. (1995). Psychosocial and emotional sequelae of individuals with traumatic brain injury: A literature review and recommendations. *Brain Injury*, 9(1), 81-92. doi:10.3109/02699059509004574
- Niedzwecki, C. M., Rogers, A. T., & Fallat, M. E. (2018). Using Rehabilitation along the Pediatric Trauma Continuum as a Strategy to Define Outcomes in Traumatic Brain Injury. *Clinical Pediatric Emergency Medicine*, 19(3), 260-271. doi:10.1016/j.cpem.2018.08.005

- Romero-Martinez, A., Moya-Albiol, L., Neuropsychology of perpetrators of domestic violence: the role of traumatic brain injury and alcohol abuse and/or dependence. (2013). *Revista de Neurologica*, Dec; 57(11): 515-522.
- Schwartz, L. (2003). Long-Term Behavior Problems Following Pediatric Traumatic Brain Injury: Prevalence, Predictors, and Correlates. *Journal of Pediatric Psychology*, 28(4), 251-263. doi:10.1093/jpepsy/jsg013
- Seabury, S.A., Gaudette, E., Goldman, A. J., et al. (2018). Assessment of Follow-up Care After Emergency Department Presentation for Mild Traumatic Brain Injury and Concussion: Result from the TRACK-TBI Study. *JAMA Network Open*. 208;1(1) doi:10.1001/jamanetworkopen.2018.0210
- Shiroma, E. J., Ferguson, P. L., & Pickelsimer, E. E. (2012). Prevalence of Traumatic Brain Injury in an Offender Population. *Journal of Head Trauma Rehabilitation*, 27(3). doi:10.1097/htr.0b013e3182571c14
- Slomine, B. S., McCarthy, M.L., Ding, R., et al. (2006). Health Care Utilization and Needs After Pediatric Traumatic Brain Injury. *Pediatrics*, 117(4). doi:10.1542/peds.2005-1892
- Suskauer, S. J., Rane, S., Reesman, J., & Slomine, B. S. (2018). Caregiver-report of symptoms following traumatic brain injury in a small clinical sample of preschool-aged children. *Journal of Pediatric Rehabilitation Medicine*, 11(1), 7-14. doi:10.3233/prm-160424
- Taylor, H. G., Swartwout, M. D., Yeates, K. O., Walz, N. C., Stancin, T., & Wade, S. L. (2008). Traumatic brain injury in young children: Postacute effects on cognitive and school readiness skills. *Journal of the International Neuropsychological Society*, 14(5), 734-745. doi:10.1017/s1355617708081150
- Taylor, H.G., Orchinik, L.J., Minich, N., et al. (2015). Symptoms of Persistent Behavior Problems in Children with Mild Traumatic Brain Injury. *J Head Trauma Rehabil*. Sep-Oct;30(5):302-10. doi:10.1097/HTR.0000000000000106
- Taylor, H.G., Yeates, K. O., Wade, S.L., et al. (2002). A prospective study of short- and long-term outcomes after traumatic brain injury in children: Behavior and achievement. *Neuropsychology*, 16(1) 15-27.
- Todis, B., & Glang, A. (2008). Redefining Success. *Journal of Head Trauma Rehabilitation*, 23(4), 252-263. doi:10.1097/01.htr.0000327257.84622.bc
- Todis, B., Glang, A., Bullis, M., Ettel, D., & Hood, D. (2011). Longitudinal Investigation of the Post-High School Transition Experiences of Adolescents With Traumatic Brain Injury. *Journal of Head Trauma Rehabilitation*, 26(2), 138-149. doi:10.1097/htr.0b013e3181e5a87a
- Updated Mild Traumatic Brain Injury Guideline for Adults, retrieved from [https://www.cdc.gov/traumaticbraininjury/mtbi\\_guideline.html](https://www.cdc.gov/traumaticbraininjury/mtbi_guideline.html)
- Wagner, M., Newman, L., Cameto, R., Levine, P., and Garza, N. (2006). An Overview of Findings From Wave 2 of the National Longitudinal Transition Study-2 (NLT2). (NCSE 2006-3004). Menlo Park, CA: SRI International.
- Williams, W. H., Mewse, A. J., Tonks, J., Mills, S., Burgess, C. N., & Cordan, G. (2010). Traumatic brain injury in a prison population: Prevalence and risk for re-offending. *Brain Injury*, 24(10), 1184-1188. doi:10.3109/02699052.2010.495697
- Zgaljardic DJ, Seale GS, Schaefer LA, Temple RO, Foreman J, Elliott TR. Psychiatric disease and post-acute traumatic brain injury. *J Neurotrauma*. 2015;32:1911–25. doi: 10.1089/neu.2014.3569
- Zuckerbraun NS, Atabaki, S, Collins, MW, Thomas D, Gioia GA. Use of modified acute concussion evaluation tools in the emergency department. *Pediatrics*, 133(4). doi: 10.1542/peds.2013-2600d

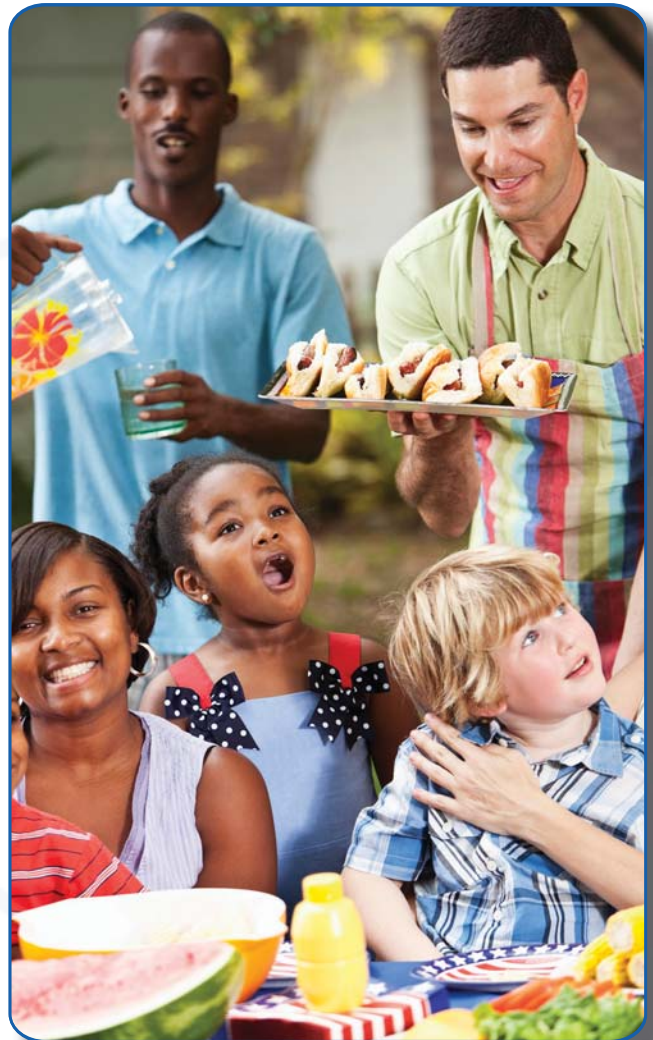


[www.tndisability.org/brain](http://www.tndisability.org/brain)

# TRAUMATIC BRAIN INJURY/ CONCUSSION

## THINGS TO WATCH FOR OVER TIME:

- ☐ Headaches
- ☐ Changes in sleep patterns
- ☐ Fatigue
- ☐ Changes in vision
- ☐ Balance, coordination changes, dizziness
- ☐ Mood swings, gets mad easily
- ☐ Changes in personality
- ☐ Not feeling like themselves
- ☐ Trouble with attention and thinking
- ☐ Memory problems, especially short term
- ☐ Depression/Anxiety
- ☐ Difficulty handling stress
- ☐ Innapropriate behavior
- ☐ Grades dropping, falling behind in class
- ☐ Changes in work performance



# Thank You!

---

## We're here to help

Our mission is to bring together professionals to recognize the far-reaching and unique nature of brain injury and to improve services for survivors. If we can help you, please feel free to reach out!



### Contact us:

[tbi@tndisability.org](mailto:tbi@tndisability.org)

### Check out our website:

[www.tndisability.org/brain](http://www.tndisability.org/brain)

### Follow us on social media:



## We want to hear from you!



Complete our short survey to let us know how we're doing.

