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## Emergency Department Implementation of the Centers for Disease Control and Prevention Pediatric Mild Traumatic Brain Injury Guideline Recommendations

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#### INTRODUCTION

From 2005 to 2009, children made more than 2 million outpatient visits and almost 3 million emergency department (ED) visits for mild traumatic brain injury.<sup>1</sup> The actual number of mild traumatic brain injury cases is difficult to assess because patients may seek treatment in a variety of medical or school settings, or not at all. However, there is evidence that these numbers are increasing; in 2007, there were 461,000 ED visits for traumatic brain injury among children aged 14 years and younger; by 2013, that number had increased to 642,000.<sup>2,3</sup>

The detection, evaluation, and management of pediatric patients with mild traumatic brain injury is complicated by the lack of standardization and evidenced-based guidance. The short- and potential long-term effects of mild traumatic brain injury can have significant consequences that affect a child's ability to function physically, cognitively, and psychologically.<sup>4–6</sup> Although most pediatric patients no longer experience symptoms within 1 to 3 months, a subset of patients may have protracted symptoms.<sup>7</sup> The ED clinician plays a critical role by recognizing patients with mild traumatic brain injury, conducting and documenting an appropriate focused examination, providing symptom management, guiding preventive measures, and providing sound discharge instructions.

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## DEVELOPMENT OF AN EVIDENCE-BASED GUIDELINE ON PEDIATRIC MILD TRAUMATIC BRAIN INJURY

The Centers for Disease Control and Prevention's (CDC's) recent guideline optimizes and standardizes evidence-based acute clinical care for injured children.<sup>8</sup> This guideline draws on a methodologically rigorous<sup>9</sup> systematic review of a search encompassing more than 34,000 articles spanning 25 years of research.<sup>10</sup> Two public comment periods, one round of external peer review, and 2 rounds of review by academic organizations such as the American College of Emergency Physicians informed the final guideline.

The guideline focused on 6 clinically relevant questions that addressed decisionmaking in the diagnosis of mild traumatic brain injury, prognostic indicators in the pediatric population with mild traumatic brain injury, and management and treatments (Figure 1). Nineteen evidence-based recommendation sets were developed with these 6 questions as a foundation. The clinical questions and guideline recommendations use the term "mild traumatic brain injury." However, in recognition of the heterogeneity of patient presentations, the research reviewed for the guideline encompassed a functional definition of mild traumatic brain injury. The definition used was inclusive of concussive signs or symptoms after direct or indirect head injury, as well as a Glasgow Coma Scale score of 13 to 15, with or without the complication of intracranial injury on neuroimaging, and regardless of the potential to require a hospital admission or neurosurgical intervention.

### CDC RECOMMENDATIONS ON PEDIATRIC MILD TRAUMATIC BRAIN INJURY APPLICABLE TO ED CLINICIANS

Although the CDC guideline is intended for use in a variety of clinical settings and by different categories of health care providers, several strongly supported recommendations are critical for ED clinicians in their practice setting. These recommendations are described below and listed in Figure 2. Broadly, these recommendations encompass diagnosis, prognosis, management and treatment. A modified Grading of Recommendations Assessment, Development and Evaluation methodology was used to assess confidence in the evidence and reflect a strength of recommendation.

#### **Diagnostic Recommendations**

Mild traumatic brain injury in children is a clinical diagnosis that usually does not require neuroimaging in the acute care setting. Computed tomography (CT) imaging should be considered when there is a suspicion of more severe forms of traumatic brain injury. ED clinicians should adhere to recommendations based on validated clinical decision rules that evaluate a variety of risk factors.

Although it is not commonplace for ED clinicians to use postconcussion symptom rating scales, these may be helpful in the diagnosis of traumatic brain injury in children in the ED. These scales can assist ED clinicians with documenting their patients' presenting symptoms and inform symptom-based counseling of children and their families on prognosis.

Ann Emerg Med. Author manuscript; available in PMC 2019 November 01.

#### **Prognostic Recommendations**

Prognostic counseling in regards to a diagnosis made in the ED is a core component of emergency medicine. By using best evidence, the systematic review and metaanalyses identified premorbid history and other risk factors for prolonged recovery that can be easily assessed in the acute care setting. These recommendations are described further in Figure 2. This guideline provides recommendations to counsel children with mild traumatic brain injury, as well as their families, about their likely recovery, but also stresses that everyone's recovery trajectory is unique.

#### Management and Treatment Recommendations

The clinical management and treatment of mild traumatic brain injury in children is grounded in symptom control, which includes establishing a healthy return to cognitive and physical activity. In the acute care setting, children with mild traumatic brain injury and their families need guidance on their next steps in activity reintegration. This guideline provides specific recommendations for ED counseling, including the use of discharge instructions for return to activity, inclusive of school and sports activities.

#### TOOLS TO HELP ED CLINICIANS IMPLEMENT CDC RECOMMENDATIONS

A guideline does not have influence if not implemented into practice. To facilitate implementation, CDC has developed free and publicly available guideline implementation tools applicable to ED management and discharge, available at http://www.cdc.gov/ HEADSUP. These tools range from validated screening tools to assess young patients to discharge instructions and symptombased recovery tips for parents to support their child's recovery (Figure 3).

#### CONCLUSION

The ED clinician plays an important role in the recognition and management of mild traumatic brain injury because he or she may be the first health care provider to evaluate an injured child. The new CDC evidence-based guideline provides strong support for intervention in the ED through a structured framework of recommendations. Key practice-changing features include using validated and age-appropriate postconcussion symptom rating scales to aid in diagnosis and prognosis, and incorporating specific recommendations for counseling at ED discharge. To learn more about the guideline and the methodology for developing it, visit http://www.cdc.gov/HEADSUP.

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Clinical Questions			
1.	For	children	$(\le 18)$

- 1. For children ( $\leq 18$  y) with suspected mTBI, do specific tools compared with a reference standard assist in accurately diagnosing mTBI?
- 2. For children (≤18 y) presenting to the ED (or other acute care setting) with mTBI, how often does routine head imaging identify intracranial injury?
- 3. For children ( $\leq 18$  y) presenting to the ED (or other acute care setting) with mTBI, which features identify patients at risk for important intracranial injury?
- 4. For children ( $\leq 18$  y) with mTBI, what factors identify patients at increased risk for ongoing impairment, more severe symptoms, or delayed recovery (<1 y postinjury)?
- 5. For children ( $\leq 18$  y) with mTBI, which factors identify patients at increased risk of long-term sequelae ( $\geq 1$  y)?
- 6. For children (≤18 y) with mTBI (with ongoing symptoms), which treatments improve mTBI-related outcomes?

#### Figure 1.

Clinical questions contained in the CDC guideline. *mTBI*, Mild traumatic brain injury.

#### Diagnostic Recommendations

- Validated decision rules assessing a combination of risk factors should be used to assess the likelihood of mTBI before CT imaging is obtained.
- mTBI is a clinical diagnosis and is not dependent on head CT imaging or skull radiographs. Additionally, skull radiographs should not be used as a screening tool for intracranial injury.
- In cases of acutely worsening symptoms of headache, especially in the setting of other risk factors, consider emergency neuroimaging to assess for more severe intracranial injuries.
- There is currently not enough evidence to support the routine use of advanced imaging or serum biomarkers.

Prognostic Recommendations

- Age-appropriate, validated, postconcussive symptomrating scales should be used as a component of diagnostic and prognostic evaluation.
- Related premorbid history should be assessed at the initial injury evaluation because recovery might be delayed in those with
  - history of mTBI;
  - increased postconcussive symptoms;
  - preinjury neurologic or psychiatric disorder;
  - learning difficulties;
  - lower cognitive ability; or
  - family and social stressors.
- Although no single factor is strongly predictive of outcome, screen for known risk factors of prolonged recovery (possibly by using validated prediction rules) to aid in providing counseling to patients and families. Prolonged recovery is more common among:
  - Older children/adolescents
  - Hispanic ethnicity
  - Lower socioeconomic status

- More severe presentation of mTBI, including intracranial hemorrhage
- Higher levels of postconcussive symptoms

#### Management and Treatment Recommendations

- ED clinicians should offer nonopioid analgesia to children with headache after acute mTBI, although they should also provide counseling about the risks of chronic analgesic overuse.
- ED clinicians should educate patients who receive a diagnosis of mTBI and their families with:
  - 1. Warning signs for more serious injury and information about when to return to the ED
  - 2. Description of the injury and most commonly expected course of recovery (including that the majority of children recover within 1–3 mo), and stressing that each child's recovery is unique
  - 3. Instructions on how to monitor postconcussive symptoms
  - 4. Information about the need to avoid behaviors that could result in further injuries during recovery
- ED clinicians should provide guidance on the management of cognitive and physical activity/rest that will affect return to play and school, including:
  - 1. More restrictive physical and cognitive activity during the first few days, followed by a gradual return to activity/play that does not significantly exacerbate symptoms
  - 2. Close monitoring of symptom number and severity
  - 3. Follow-up instructions because activity integration cannot be determined from an ED setting and joint medical and school-based teams should address these specifics, including "clearance" for full activity
- ED clinicians should give recommendations for sleep hygiene to facilitate recovery.

#### Figure 2.

Overview of clinical recommendations contained in the CDC guideline.

Lumba-Brown et al.



**Figure 3.** Educational tools for ED clinicians.

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