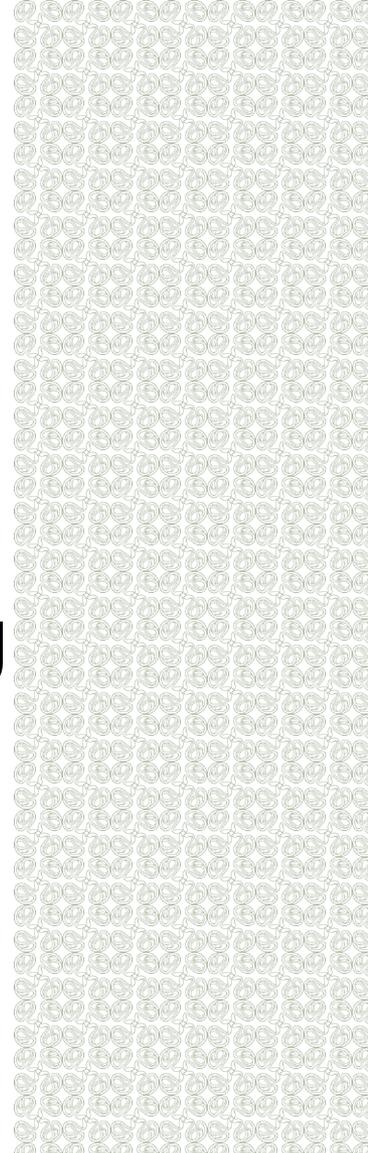




Sports-Related Concussions in Youth

Improving the Science, Changing
the Culture

INSTITUTE OF MEDICINE *AND*
NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES



Project Sponsors

Centers for Disease Control and Prevention

CDC Foundation with support from the National Football League

Department of Defense

Department of Education

Health Resources and Services Administration

National Athletic Trainers' Association (NATA) Research and Education Foundation

National Institutes of Health

- National Institute of Child Health and Human Development
- National Institute of Mental Health
- National Institute of Neurological Disorders and Stroke



Statement of Task

- Review literature on concussions in youth, including in military personnel and their dependents, related to
 - the causes and consequences of concussions
 - the current state of the art on diagnosis and management
 - the effectiveness of protective equipment and sports regulations for prevention of injury
- Recommend actions that can be taken by research funding agencies, legislatures, schools, military organizations, young athletes and their parents, and other stakeholders to improve what is known about concussions, improve the diagnosis and management of these injuries, and to reduce their occurrence.

Committee's Approach

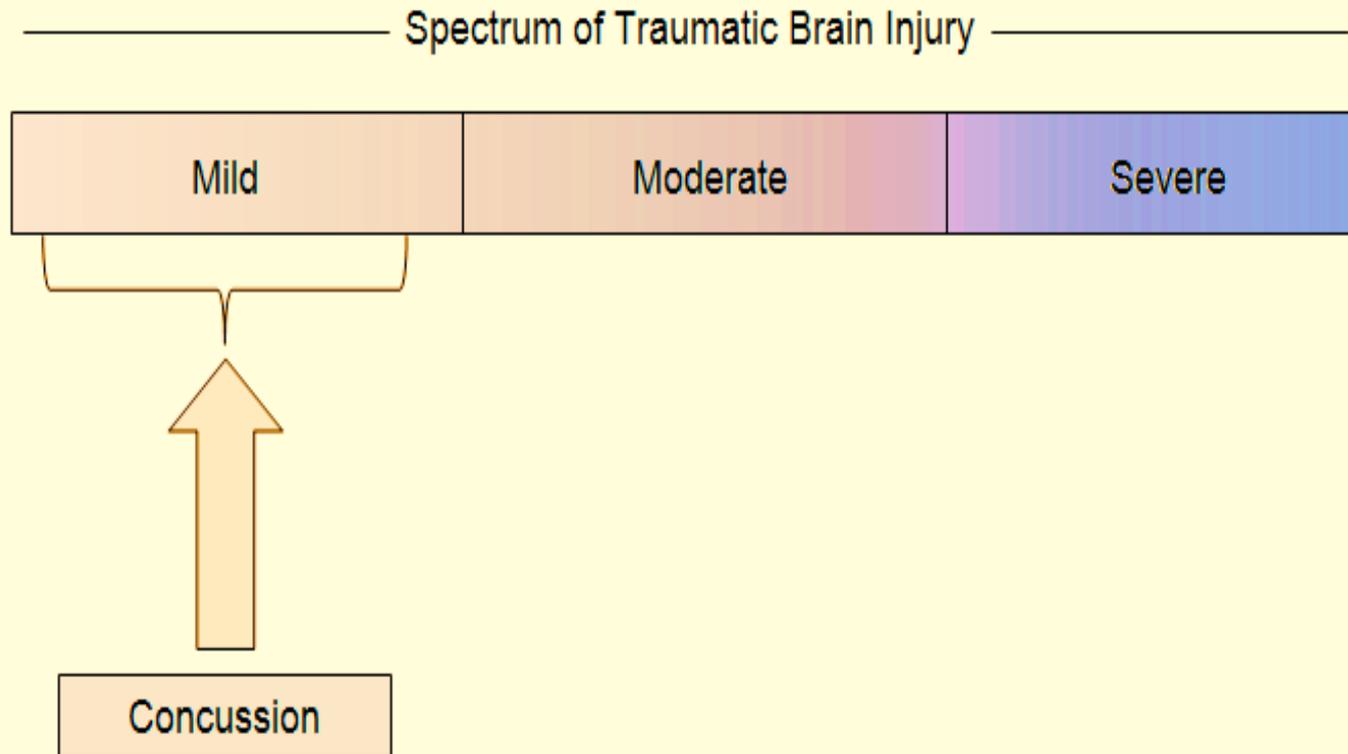
- Reviewed scientific literature and previous reports from the Institute of Medicine and National Research Council
- Reviewed current consensus and position statements relevant to diagnosis and management of concussions
- Held two public workshops
- Focused on youth ages 5 to approximately 21 years
- Took a broad view of sports, defining it as any sort of vigorous physical activity that does not involve motorized vehicles.

Concussion Definition

Concussion is a brain injury induced by biomechanical forces, that may or may not include loss of consciousness, and typically results in a rapid onset of short-lived impairment of neurological function with no abnormalities visible on standard structural neuroimaging studies.

Source: McCrory et al., 2013. Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012.

Relationship of Concussion to the Spectrum of TBI



Epidemiology

- There are limited data on the incidence of sports- and recreation-related concussion among youth at different ages.
- Early studies indicated higher rates of reported concussion among college athletes than among high school athletes.
- Recent data indicate higher reported concussion rates among high school athletes in some sports—football, men’s lacrosse and soccer, and baseball.
- Rates of reported concussions tend to be higher
 - in competition than in practice,
 - for females than for males in comparable sports, and
 - in certain sports.



Some Sports with Higher Reported Concussion Rates

Men	Women
Ice Hockey	Soccer
Football	Lacrosse
Lacrosse	Basketball
Wrestling	Ice Hockey (college)
Soccer	

Surveillance

- There is a lack of data on sports-related concussions in individuals younger than high-school age and for youth who participate in club sports and competitive and recreational sports outside of an academic setting.
- Data captured on sports and recreation-related concussions do not routinely include race and ethnicity.
- There are no published data on the incidence of reported concussions during basic training for military recruits.

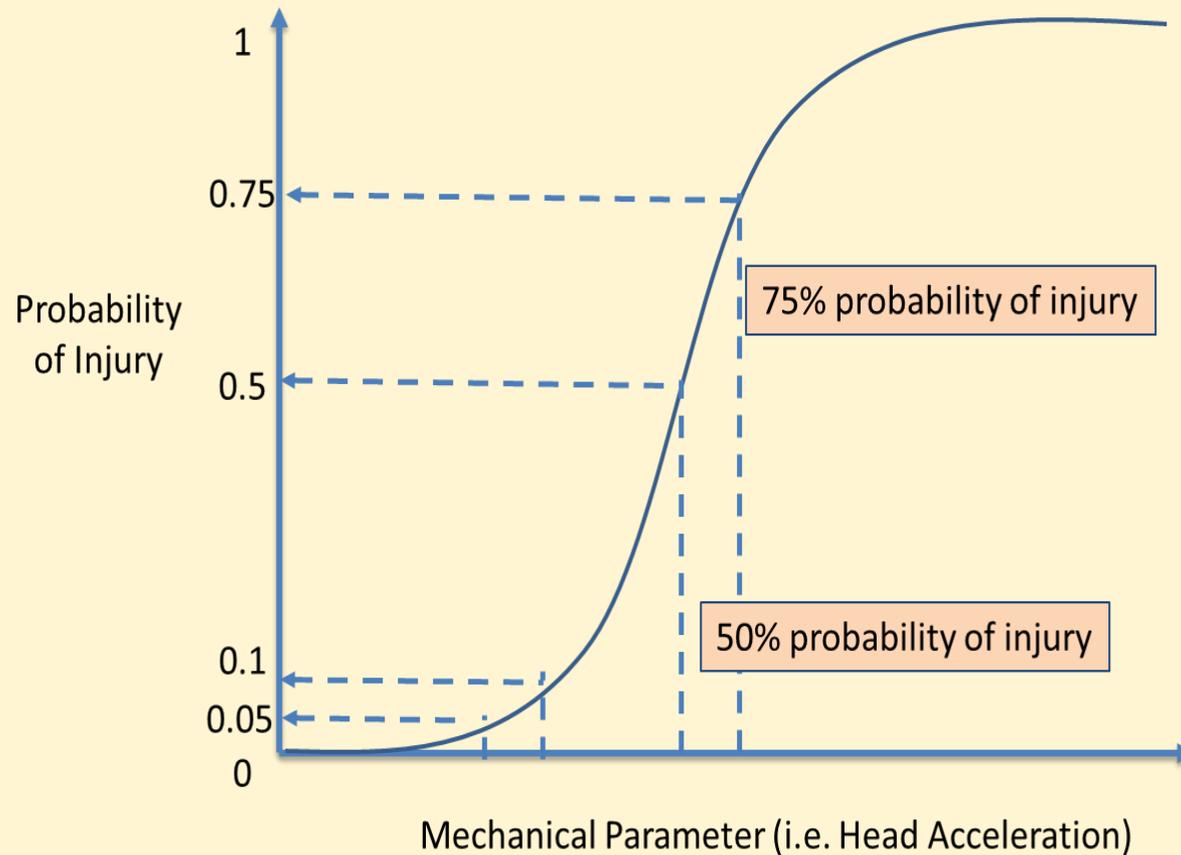
Surveillance

Recommendation 1. The Centers for Disease Control and Prevention should establish and oversee a national surveillance system to accurately determine the incidence of sports-related concussions, including those in youth ages 5 to 21. The surveillance data collected should include demographic information, pre-existing conditions, concussion history, the use of protective equipment and impact monitoring devices, and the qualifications of personnel making the concussion diagnosis.

Neuroscience and Biomechanics

- Normal changes during brain development may influence susceptibility to and prognosis following concussion in youth.
- Research primarily involving animals and people with more severe head injury indicates that there are a series of physiological changes in the brain following head injury. Little research has been conducted specifically on changes in the brain following concussions in youth.
- Existing studies of head injury biomechanics have limited applicability to youth and thus are inadequate to define the direction- and age-related thresholds for linear and rotational acceleration specifically associated with concussions in youth.
- The degree to which threshold for injury is modified by the number of and time interval between head impacts and concussions is also unknown.

Injury Risk Curve



Diagnosis and Management

- There are no objective markers for concussion diagnosis, prognosis, and recovery.
- Performance on neuropsychological tests can be influenced by many factors.
- The brain is more susceptible to injury while it is recovering.
- Existing management guidelines are based on expert consensus with limited empirical evidence.
- There are no randomized clinical trials testing the effectiveness of psychosocial or pharmacological treatments for youth with post-concussive symptoms and prolonged recovery.

Diagnosis and Management

Recommendation 2. The National Institutes of Health and the Department of Defense should support research to (1) establish objective, sensitive, and specific metrics and markers of concussion diagnosis, prognosis, and recovery in youth and (2) inform the creation of age-specific, evidence-based guidelines for the management of short- and long-term sequelae of concussion in youth.

Short- and Long-Term Consequences

- People who have had a concussion may be at risk for more severe subsequent concussions and may take longer to recover. The length of time between concussions may be an important factor.
- There currently are no data to evaluate the relationship between concussions and risk of suicide in young athletes.
- More data are needed to determine whether repetitive head impacts and multiple concussions sustained in youth increases the risk for later conditions such as chronic traumatic encephalopathy (CTE) or Alzheimer's disease.

Short- and Long-term Consequences

Recommendation 3. The National Institutes of Health and the Department of Defense should conduct controlled, longitudinal, large-scale studies to assess short- and long-term cognitive, emotional, behavioral, neurobiological, and neuropathological consequences of concussions and repetitive head impacts over the life span.

Age-Appropriate Rules and Standards

- Although additional research across a variety of sports is needed, there is some evidence that enforcement of rules and fair play policies contributes to reductions in the incidence of sports-related injuries, including concussions, in youth sports.
- While fewer impacts are likely better, the specification of a 'hit count' threshold above which concussion risk is increased is without scientific basis.

Age-Appropriate Rules and Standards

Recommendation 4. The National Collegiate Athletic Association, in conjunction with the National Federation of State High School Associations, national governing bodies for youth sports, and youth sport organizations, should undertake an evaluation of the effectiveness of age-appropriate techniques, rules, and playing and practice standards in reducing sports-related concussions and sequelae. The Department of Defense should conduct equivalent research for sports and physical training, including combatives, at military service academies and for military personnel.

Biomechanics and Protective Equipment

- There is little evidence that current helmet designs reduce concussion risk in youth athletes, and no evidence that mouthguards or facial protection (e.g., facemasks worn in ice hockey) reduce concussion risk in youth athletes.
- Protective devices do reduce the risk for other sports-related injuries, such as skull fractures (helmets) and injuries to the eyes, face, mouth, and teeth, and their use should be promoted for this reason.
- Current testing standards for protective equipment do not incorporate measures of both linear and rotational acceleration and therefore do not comprehensively evaluate a device's ability to mitigate concussion risk.

Biomechanics, Equipment, and Safety Standards

Recommendation 5. The National Institutes of Health and the Department of Defense should fund research on age- and sex-related biomechanical determinants of injury risk for concussion in youth, including how injury thresholds are modified by the number of and time interval between head impacts and concussions. These data are critical for informing the development of rules of play, effective protective equipment and equipment safety standards, impact-monitoring systems, and athletic and military training programs.

Culture Change

- Awareness of sports-related concussions increasing
- Continues to be a culture among athletes and military personnel, as well as coaches, parents, and athletic trainers, that can interfere with both the self-reporting of concussion symptoms and compliance with appropriate concussion management plans.
- The committee heard testimony and there is emerging research indicating that youth may choose not to report possible concussions to avoid letting down their teammates, coaches, schools, and parents.

Culture Change

Recommendation 6. The National Collegiate Athletic Association and the National Federation of State High School Associations, in conjunction with the Centers for Disease Control and Prevention, the Health Resources and Services Administration, the National Athletic Trainers' Association, and the Department of Education, should develop, implement, and evaluate the effectiveness of large-scale efforts to increase knowledge about concussions and change the culture surrounding concussions among elementary school through college-aged youth and their parents, coaches, sports officials, educators, athletic trainers, and health care professionals. The Department of Defense should conduct equivalent research for military personnel and their families.

Response to Report

- National Athletic Trainers' Association established an Inter-Association Task Force to address Recommendation 6 (culture change).
- Concussion Education and Awareness Act of 2014 (H.R. 3954) introduced January 28, 2014 in response to the report.
 - Directs HHS and DoD Secretaries to conduct systemic research on the prevention, surveillance, and treatment of concussion in youth.
 - Would establish a Concussion Research Commission under the HHS Secretary.

Committee Membership

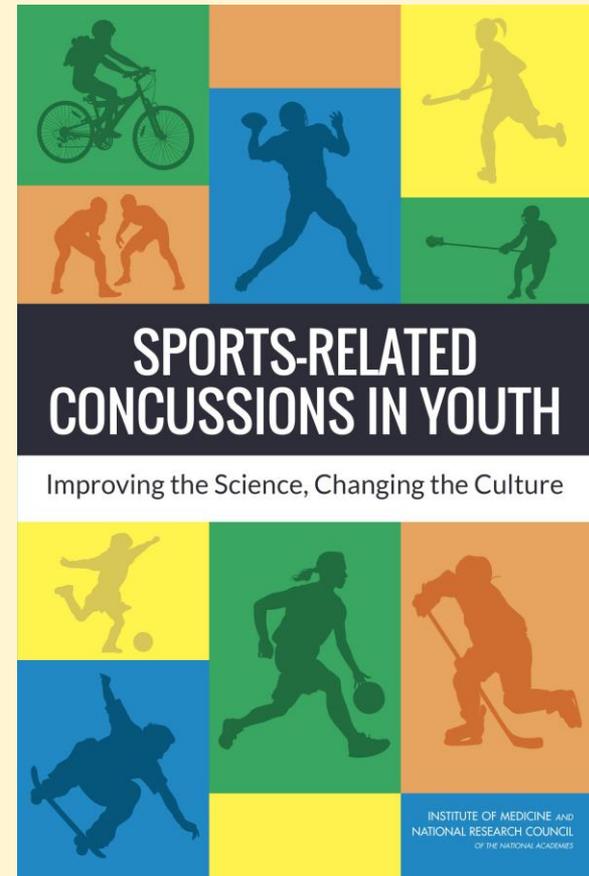
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