



# Medical College of Wisconsin Researchers Tackle Concussions From All Angles

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The national dialogue on traumatic brain injury has reached significant amplitude with the public platform of professional sports raising awareness, the experiences of soldiers over a decade of war reinforcing the implications, and the medical community rising with innovative efforts to improve diagnosis and care.

Of the estimated 3.8 million traumatic brain injuries (TBI) sustained each year in the United States, more than 75% are considered concussions, frequently termed mild TBI. Increasingly common among adult and youth athletes in impact sports, concussion also is recognized as an all-too-frequent, combat-associated wound of the conflicts in the Middle East. Combined with civilian risk from unintentional and intentional injury, concussions are a serious public health problem.

Acute symptoms manifest as a disturbance in cognition, and individuals can experience post-concussion syndrome, of which headaches and protracted symptoms are characteristic. Over the long term, concussions can yield even more devastating health concerns, including depression, cognitive impairment, dementia, and chronic traumatic encephalopathy.

As the nature of the injury suggests and the variety of projects at the Medical College of Wisconsin (MCW) demonstrates, better under-

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Dr Kerschner is dean of the medical school and executive vice president of the Medical College of Wisconsin.

standing of mild TBI requires a multidisciplinary approach. Concussion research led by MCW faculty includes expertise in neurosurgery, neurology, pediatrics, orthopaedic surgery, psychiatry and behavioral medicine, physical medicine and rehabilitation, emergency medicine, and primary care.

We are learning that how a concussion is sustained may affect its health consequences. Neurosurgery researchers Frank A. Pintar, PhD,

deficits, neuromotor deficits, anxiety-related behavior and aggression, adhedonic behavior, brain edema, and brain tissue pathology over a 4-year period. It is anticipated that better understanding the pathophysiology of these causative mechanisms will influence treatment and rehabilitation methodology.

Neuropsychologist Michael McCrea, PhD, is leading an additional area of innovative research in mild TBI as his team aims to deter-

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and Brian Stemper, PhD, are funded by the Veterans Administration to study the differences in outcomes in concussions caused by blunt trauma, common in automobile collisions, versus those that are blast-induced, which have multiplied dramatically for military troops with the proliferation of improvised explosive devices.

The team is utilizing a rat model of injury, and their research suggests that although blast TBI and blunt TBI have similar acute outcomes, their chronic outcomes may be different. The researchers will conduct post-injury assessments of amnesia, spatial learning

mine which of four common screening tools is the most valid and reliable for assessing concussion and recovery. Dr McCrea is a member of the NFL Head, Neck and Spine Committee, and was part of the Concussion in Sports Group responsible for the 2008 Zurich international consensus statement on concussion in sport that led to new standards in sports-related concussion management.

Funded by a US Department of Defense grant, Dr McCrea's team intends to collect baseline tests on 2,100 Milwaukee area high school and college athletes. If and when any of these athletes sustains a concussion, the research

team performs an immediate assessment plus several follow-up exams, enabling comparison of the 4 tests. The goal is to identify the optimal tool for measuring the injury's effect and for guiding clinical decisions about a patient's readiness to return to activity. While benefiting the public good, the results will hopefully transfer to military applications as well, helping determine a soldier's fitness to return to duty.

Assessing recovery is critical for making return-to-play decisions following sports-related concussion, and the stakes are even higher in the still-developing brains of children and adolescents. Neuropsychologist Thomas A. Hammeke, PhD, is using functional imaging to better understand functional abnormalities and recovery mechanisms associated with the acute and subacute stages of concussions in high school athletes.

His team's recent study revealed changes in brain activation patterns that correlate strongly with changes in self-reported post-concussive symptoms and neurocognitive performance. This was marked by underactivation in the right hemisphere attentional networks within 24 hours of injury, followed by hyperactivation 7 weeks after injury, suggesting neurocognitive functions can recover enough for an individual to achieve normal performance with compensatory cognitive operations. As such, functional MRI may be an accurate imaging biomarker for documenting the transition from acute to subacute stages of recovery and for assessing the efficacy of interventions.

Interventions for concussion may be as straightforward as inactivity. Pediatric emergency medicine physician Danny Thomas, MD, along with Dr Hammeke and neuropsychologist Jennifer Apps, PhD, recently finished enrolling patients in a study funded by the MCW Injury Research Center examining the effect of rest on recovery from pediatric concussion. It will compare 5 days of strict rest to the current standard of care, which is a slow return to school and activity. Results are expected this summer.

As research begins to answer our many questions about concussions, we are able to create and update clinical guidelines and policy

to more effectively treat and limit injury. In 2012, pediatric primary care sports medicine specialist Kevin Walter, MD, with Dr Apps, published the first book of its kind to summarize research and provide guidelines for understanding diagnosis, management and outcomes of concussions in children and adolescents.

Dr Walter's expertise on the topic is well-known around the state, where he is a vigorous advocate for young athletes. As a member of the Wisconsin Interscholastic Activities Association's (WIAA) Sports Medicine Advisory Committee, Dr Walter worked closely with peers, legislators, community leaders and the WIAA to craft legislation mandating that players age 19 and younger who suffer a possible concussion are not allowed to return to play until they are cleared by a health care professional trained in concussion evaluation and management. The "Sidelined for Safety Act" was signed into Wisconsin law on April 2, 2012.

Dr Walter—who was just appointed to the Institute of Medicine of the National Academies' Committee on Sports-Related Concussions in Youth—Dr McCrea, Dr Apps and other clinical colleagues have made baseline concussion testing accessible for young athletes statewide. Recommended by the American Academy of Pediatrics, baseline testing allows clinicians to compare brain function before and after injury, resulting in better care, return-to-play decisions and outcomes.

Such efforts are part of MCW's integrated concussion program, which is built on partnerships connecting Froedtert, The Medical College of Wisconsin, Children's Hospital of Wisconsin and the Zablocki VA Medical Center. The program demonstrates our commitment to advancing the clinical care of concussion to benefit people throughout Wisconsin and beyond.

Awareness about concussions has probably never been higher. It is the responsibility of physicians and medical researchers to make sure momentum translates into progress on the diagnosis, treatment and outcomes of mild traumatic brain injuries.

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