Concussion research: a public health priority

Head injury is a major public health concern due to the high incidence and the accompanying morbidity and mortality. In the USA, head injuries are a contributing factor to one third (30.5%) of all injury-related deaths and result in 52 000 deaths, 275 000 hospitalisations and 1.4 million emergency department visits each year.[1] While fully 75% of head injuries are classified as mild traumatic brain injury, frequently referred to as 'concussions', these injuries can have serious and prolonged health consequences.[1]

Concussions are caused by a physical blow or jolt to the head resulting in either forces applied directly to the head (eg, a pitcher being struck by a batted ball) or movement of the brain within the skull (eg, anterior–posterior deceleration or rotational forces experienced in motor vehicle crash). Such forces disrupt normal cellular processes in the brain. Concussions are seen in all age, gender and ethnic groups but, because they are commonly sustained during sports and recreational activities, they have frequently been described in children. The estimated incidence of sports-related concussions in the USA ranges from 300 000 to 3.8 million annually.[2] Estimating incidence is difficult because sports-related concussions frequently go undetected due to a lack of recognition of symptoms or intentional underreporting of symptoms.[3 4] Symptoms include physical complaints (eg, headache, fatigue, dizziness, noise intolerance), behavioural changes (eg, mood swings, depression, anxiety, irritability) and cognitive impairment (eg, inability to concentrate, decreased memory). While initial symptoms typically resolve in several days to occasionally several months after the injury,[5–8] in 10–15% these symptoms can persist much longer. Because of the heterogeneity of these injuries and their recovery, as well as the recognition that the length of time until symptoms resolve is more important clinically than the type of symptoms, grading scales and classification schemes have been abandoned.

Of primary concern is determining when it is safe for the concussed patient to return to normal activities. Such activities may include more physically strenuous game play for athletes, but also simply the cognitive exercise of classwork for students or work for adults. Currently accepted guidelines indicate that return should not occur until the concussed patient can accomplish a stepwise progression of increased activity while remaining symptom free.[9] The risks of premature return to activities has been well documented and includes the prolongation of post-concussive symptoms, an increased risk of concussion recurrence and in rare cases, death. These dangers may be even more common in the more vulnerable, younger athletes,[10] in whom even non-contact, exertional activities may be detrimental if re-initiated too quickly.[10 11] A great concern is the risk of second-impact syndrome, a phenomenon that occurs from premature return to sports, when additional (often less severe) contact impacts a brain in a more vulnerable state.[11] In the most dramatic cases, this second impact is believed to result in the rapid onset of increased intercranial pressure, brain stem herniation and death.[12] Despite these concerns, research indicates that at least 15% of high school athletes diagnosed with concussion fail to comply with recommended return-to-play guidelines.[13]

Until recently, the recognition and appropriate treatment of concussions has been lacking. Barriers to optimal care have included a lack of awareness on both the part of the patient (or parent or coach) as well as the clinician, lack of appreciation of the clinical importance of this injury including the potential long-term sequelae, and a lack of resources (both financial and manpower) within communities. Due in large part to injuries to high-profile athletes, public awareness of the short and long-term consequences of concussions has recently been highlighted. This heightened awareness has also spread to the medical community. Concussion awareness has increased across a range of lay and clinical settings in response to the focus on the need to prevent concussion and its health consequences through increased education, an attentiveness towards detection and diagnosis and improved management. One upstream approach is free online 'Heads Up' educational tool kits, developed by the Centers for Disease Control and Prevention to help coaches, parents, athletic trainers and physicians to prevent morbidity and mortality from concussions in youth sports.[14] Another, a joint effort by many organisations including the Centers for Disease Control and Prevention and the National Football League, is a campaign to display posters on concussion in sports in the locker rooms and athletic facilities of sports teams, ranging from the National Football League to schools across the USA.[15] Multipronged approaches integrating physical examination, symptom checklists, balance measurements, neuroimaging innovations, computerised neurocognitive testing, etc, have been developed to aid in the diagnosis of concussion from sports sideline assessments and paediatricians' offices to sports medicine concussion clinics. Equally important is the development of widely accepted guidelines to inform return-to-play recommendations.[9]

As a result of the sheer volume, concussions truly are a public health concern. The responsibility for managing most concussion patients will frequently fall to the certified athletic trainer, parent, or coach working with a primary care physician or paediatrician. However, most frontline clinicians lack specific training in the management of these injuries and the resources (eg, neurocognitive tests) to address patient needs optimally.[16] Therefore ensuring the availability of appropriate resources for physicians to care for these patients is a need yet to be met.

Adequate funding is necessary to support individuals in specialised areas of the injury prevention community who have the expertise to develop new interventions to prevent concussion, technology to diagnose concussion, approaches to treat concussion, and prognostic criteria to enable informed patient management decisions. In addition, research to help prevent, reliably diagnose and better manage these injuries is greatly needed. Unfortunately, because concussion is so often viewed as a sports-related injury, research in this area is woefully underfunded. At the time of writing, for example, only two grant opportunities on Grants.gov, both from the Department of Defense, list concussion as an interest area. The Society for the Advancement of Violence and Injury Research supports the investment of federal research dollars towards the major public health problem of concussion.

Douglas J Wiebe,[1] R Dawn Comstock,[2] Michael L Nance[3]

[1]Department of Biostatistics and Epidemiology, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania, USA; [2]Center for Injury Research and Policy, Nationwide Children's Hospital, Columbus, Ohio, USA; [3]Department of Surgery, The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA

Correspondence to Dr Douglas L Wiebe, Department of Biostatistics and Epidemiology, University of Pennsylvania, School of Medicine, 423 Guardian Drive, Philadelphia, PA 19104-6021, USA; dwiebe@mail.med.upenn.edu

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Jousting—a new extreme sport?

'Is jousting the next extreme sport?' the *New York Times* asks. Apparently some professional jousters believe it could be an arena sport. When a competitor in Florida was hit in the chest, he lay on the ground and did not move for about a minute. Apparently the crowd loved it. 'It was as if someone had sent an electric current through the arena's aluminium bleachers. Men leapt to their feet with their fists in the air. Teenage girls clutched one another's arms. 'I want to see another guy get paralysed,' a boy in front of me squealed, waving a toy sword.'

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