

# Clinically important sport-related traumatic brain injuries in children

Nitaa Eapen<sup>1,2,3</sup>, Gavin A Davis<sup>2,3</sup>, Meredith L Borland<sup>4,5</sup>, Natalie Phillips<sup>6,7</sup>, Ed Oakley<sup>1,2,3</sup>, Stephen Hearps<sup>2</sup>, Amit Kochar<sup>8</sup>, Sarah Dalton<sup>9</sup>, John Cheek<sup>1,2,3</sup>, Jeremy Furyk<sup>10</sup>, Mark D Lyttle<sup>2,11</sup>, Silvia Bressan<sup>2,12</sup>, Louise Crowe<sup>2,3</sup>, Stuart Dalziel<sup>13,14</sup>, Emma Tavender<sup>2,3</sup>, Franz E Babl<sup>1,2,3</sup>

Sports participation by children and adolescents is generally high in Australia and New Zealand,<sup>1,2</sup> and many children sustain head injuries of varying severity during such activities. Concussion has received increasing attention, but less is known about the risk of severe acute intracranial injuries in children with sports-related head injuries.<sup>3</sup>

We therefore investigated the frequency of more serious sports-related head injuries in children seen in hospital emergency departments (EDs). We performed a secondary analysis of data from a large prospective multicentre observational study by the

Paediatric Research in Emergency Departments International Collaborative (PREDICT) of children who presented with head injuries during 2011–2014 to ten EDs in Australia and New Zealand, including those of eight of the nine tertiary children's hospitals in the two countries.<sup>4</sup> We used activity codes to identify patients aged 5–18 years with sports-related head injuries, and assessed the numbers of cases with computed tomography (CT) evidence of traumatic brain injury (TBI) and of clinically important TBI (ciTBI: injury resulting in death, neurosurgery, intubation for more than 24 hours, or hospitalisation for more than 2 days with abnormal CT findings).<sup>5</sup> The ciTBI definition

## Sports-related head injuries and clinically important traumatic brain injuries to 3177 children who presented to ten hospital emergency departments in Australia and New Zealand,\* April 2011 – November 2014

Sport activity	Sport-related head injuries	Clinically important traumatic brain injuries		Hospitalised > 2 days	Intubation > 24 hours	Neurosurgery
		Number	Proportion of injuries			
Bicycle riding	494	20	4.0%	20	6	8
Rugby	414	1	0.2%	1	0	0
Australian football	306	1	0.3%	1	0	1
Football (not specified)	291	1	0.3%	0	0	0
Soccer	258	0	—	0	0	0
Scooter	212	1	0.5%	1	0	1
Skateboarding	183	8	4%	8	2	2
Basketball	141	0	—	0	0	0
Horse riding	113	7	6%	7	1	0
Hockey	90	2	2%	2	0	0
Swimming	79	0	—	0	0	0
Cricket	79	0	—	0	0	0
Diving	65	0	—	0	0	0
Ice skating	60	0	—	0	0	0
Netball	50	0	—	0	0	0
Baseball/softball	40	3	8%	3	0	1
Golf	25	1	4%	1	0	1
Other sports <sup>†</sup>	277	0	—	0	0	0
<b>Total</b>	<b>3177</b>	<b>45</b>	<b>1.4%</b>	<b>44</b>	<b>9</b>	<b>14</b>

\* Royal Children's Hospital, Melbourne; Perth Children's Hospital, Perth; Queensland Children's Hospital (Mater Children's Hospital and Royal Children's Hospital), Brisbane; Women's and Children's Hospital, Adelaide; The Townsville Hospital, Townsville; Children's Hospital at Westmead, Sydney; Monash Children's Hospital, Melbourne; Starship Children's Hospital, Auckland; Kidz First Middlemore Hospital, Auckland. † Sports providing fewer than 50 cases of head injury and no cases of clinically important traumatic brain injury. ♦

<sup>1</sup> Royal Children's Hospital, Melbourne, VIC. <sup>2</sup> Murdoch Children's Research Institute, Melbourne, VIC. <sup>3</sup> University of Melbourne, Melbourne, VIC. <sup>4</sup> Perth Children's Hospital, Perth, WA. <sup>5</sup> University of Western Australia, Perth, WA. <sup>6</sup> Queensland Children's Hospital, Brisbane, QLD. <sup>7</sup> Children's Health Research Centre, University of Queensland, Brisbane, QLD. <sup>8</sup> Women's and Children's Hospital, Adelaide, SA. <sup>9</sup> Children's Hospital at Westmead, Sydney, NSW. <sup>10</sup> The Townsville Hospital, Townsville, QLD. <sup>11</sup> Bristol Royal Hospital for Children, Bristol, United Kingdom. <sup>12</sup> University of Padova, Padova, Italy. <sup>13</sup> Starship Children's Health, Auckland, New Zealand. <sup>14</sup> University of Auckland, Auckland, New Zealand. ✉ [franz.babl@rch.org.au](mailto:franz.babl@rch.org.au) • doi: 10.5694/mja2.50311

encompassed injuries requiring emergency management during the acute phase, as opposed to concussions and injuries without or with only minor CT abnormalities.

The overall study was registered with the Australian New Zealand Clinical Trials Registry (ANZCTR; ACTRN12614000463673); its methodology has been described in detail elsewhere.<sup>4</sup> The study was approved by the Human Research Ethics Committee of the Royal Children's Hospital, Melbourne (reference, 31008A) and by the institutional ethics committees at each participating site. We obtained verbal informed consent from parents and guardians; for life-threatening or fatal injuries, the participating ethics committees granted waivers of consent.

Of 20 137 people who presented with head injuries to the participating EDs, 8857 were aged 5–18 years (44%); 3177 of these young patients (36%) presented with sports-related head injuries, including 2479 boys (78%). A total of 524 patients with sports-related head injuries (16%) underwent CT imaging, and in 64 cases (2.0%) CT evidence of TBI was reported. Fourteen patients underwent neurosurgery and one patient died (bicycle riding) (Box).

Forty-five cases of sports-related head injury (1.4% of such injuries) were classified as ciTBI. Among sports providing more than 40 head injuries, the ciTBI proportions of head injuries were greatest for baseball/softball (3 of 40 head injuries, 8%), horse riding (7 of 113, 6%), skateboarding (8 of 183, 4.4%), and bicycle riding (20 of 494, 4%). The proportions of ciTBI were lower for Australian football (1 of 306, 0.3%) and rugby (1 of 414, 0.2%); no cases of ciTBI were linked with soccer, basketball, cricket, or water sports (Box).

Limitations of our study include the fact that we did not analyse population data, nor could injury numbers be related to sports participation levels. Our data were restricted to sports-related ciTBI in children who presented to EDs, and it is unclear whether our findings can be generalised beyond tertiary children's hospital EDs. We could not differentiate between injuries sustained during organised (game) and recreational activity. Head injuries not meeting our definition of ciTBI, including concussions, were not included, but these less acute injuries also require careful assessment, management, and follow-up.

Sports-related head injuries in children that cause death or require acute interventions are infrequent. The proportion of ciTBI in children who presented to EDs with head injuries was greater for recreational sports (horse riding, bicycle riding, skate boarding) than for the contact sports typically associated with risk of concussion (Australian football, rugby).

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