

Heading in soccer

More than a subconcussive event?

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Sports-related concussions are increasingly recognized as a public health problem,^{1,2} not only because of their immediate effects, but in particular because of reported associations with later cognitive decline.³

Less is known about the negative consequences of so-called subconcussive impacts, which occur at forces within the range of those commonly associated with symptoms, but which do not in themselves appear to generate symptoms. Heading in soccer, one of the most popular sports worldwide, may account for the dominant share of subconcussive exposure in sports.

The study by Stewart et al.⁴ in this issue of *Neurology*® aimed to assess whether intentional (i.e., heading) and unintentional (i.e., head to head, head to goalpost) head impacts were associated with CNS symptoms in amateur soccer players. The study included 222 amateur soccer players who completed baseline and serial online 2-week recall questionnaires, covering (1) soccer practice and games; (2) heading and unintentional soccer head impacts; and (3) frequency and severity of CNS symptoms, such as pain, dizziness, and feeling dazed.

Respondents reported a median of 38 headings in soccer practice and games in the 2-week reporting period (interquartile range [IQR] 6–46). The median number of unintentional head impacts in this period was 0.7 (IQR 0–1). A total of 88 players reported 2 or more unintentional impacts. Twenty percent of the players reported CNS symptoms. More frequent headings were associated with CNS symptoms (odds ratio [OR] 3.17, 95% confidence interval [CI] 1.57, 6.37) when controlling for unintentional impacts. Experiencing 2 or more unintentional impacts was more strongly associated with CNS symptoms (OR 6.09, 95% CI 3.33, 11.17) after controlling for heading. The authors conclude that both heading and unintentional head impacts are independently associated with CNS symptoms.

There are several strengths of the study. First, whereas previous studies have generally calculated the combined effects of heading and unintentional

impacts,^{5,6} Stewart et al. were able to delineate the effects of these 2 exposures. Second, in the analysis, effects were adjusted for relevant covariates, including, for example, neck circumference. Third, a large share of research on sports-related concussions has focused on professional athletes, while the large majority of soccer players are amateur recreational league players.^{7,8} The authors acknowledge that they only included adult amateur players in the northeastern United States and that the results cannot be generalized to adolescents and younger children. However, a median of 3 outdoor practices per 2 weeks and 2 outdoor games was reported by study participants, which would be comparable to many amateur soccer players in Europe, both adults and children.

The main limitation of the study is that the exposure and outcome were self-reported, and measured in the same questionnaire. This might result in considerable reporting bias: players with CNS symptoms might be more likely to report more exposure. However, participants had to answer the questions on exposure before questions on outcome and answers could not be changed. In addition, the estimate of total heading was based on a formula containing practice and games and average heading that participants were unable to calculate themselves.

Stewart et al. show that intentional head impacts in soccer, i.e., heading, are associated with concussive symptoms. This suggests, as the authors state, that heading can be more than a subconcussive event. Further research is required to test this hypothesis and to determine if all forms of headings carry similar risks. To date, headings have not received much attention in consensus statements on concussion in sports.⁹ Although the current study does not provide evidence to determine whether there is a long-term consequence of heading, it stresses the need to put heading in soccer on the international research and policy agenda.

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