Concussion Guidelines Step 1: Systematic Review of Prevalent Indicators

Supplemental Content 8
Evidence From Single Studies

The information in this section is derived from single studies, and thus is not a part of the Conclusions at this time.

Prevalence of signs and symptoms (Key Questions 1 and 2)

**Signs** Samples from multiple studies reporting signs show a relatively low occurrence of individual signs among subjects sustaining a PCE (See Table, Supplemental Content 10).

**Symptoms** reported immediately after the event, which may be indicators of concussion (based on absolute difference in proportions between PCE and comparator samples of adult athletes) are:\n- headache (75% prevalent)
- dizziness (60% prevalent)
- blurred vision (75% prevalent)
- nausea (54% prevalent)

Supplemental Content 12 lists the 26 studies included in the analysis, and shows how symptoms were reported in each study. Data from one study\(^1\) were reported in a way that could be used in this report; 12 publications reported symptoms as a single composite score, 7 did not report symptoms, and 6 reported symptoms without comparison groups.

Prevalence of deficits in objective measures of neurologic or cognitive function (Key Questions 1 and 2)

**Objective measures** that may be indicators of concussion (based on reported significant differences in group means between PCE and comparator samples) are deficits in:
- concentration, orientation, immediate memory, delayed recall, and a composite of these measures, immediately after injury,\(^2\)
- processing speed within 1 day post-injury,\(^3\)
- verbal memory within 5 days post-injury,\(^4\) and
- memory composite within 7 days post-injury.\(^5\)

Associations between signs/symptoms and objective measures of neurologic/cognitive function (Key Question 3)

**Signs** Limited evidence from single studies about the associations between signs and objective measures of cognitive function show:
- amnesia or observed, documented disorientation lasting more than 5 minutes after injury is correlated with deficits in measures of memory at 36 hours, 4 days, and 7 days post-injury,\(^5\)
- loss of consciousness and/or amnesia at the time of the event is correlated with deficits in concentration, orientation, immediate memory, delayed recall, and a composite of these measures taken immediately after injury,\(^2\) and
• post-traumatic amnesia measured within 24 hours of the event is correlated with deficits in performance on a measure of processing speed taken within 1 day of injury.⁶

**Symptoms** Limited evidence from a single study about the associations between symptoms and objective measures of cognitive and neurologic function shows⁷:

- Self-report of “feeling mentally foggy” is correlated with deficits in measures of reaction time, both measured at 2 days post-injury,
- Self-report of “difficulty concentrating” is correlated with measures of verbal memory, both measured at 2 days post-injury,
- Self-report of having “difficulty remembering” is correlated with deficits in measures of reaction time and verbal memory, all measured at 2 days post-injury, and
- Self-report of having “balance problems” or “dizziness” is correlated with deficits in measures of balance, all measured at 2 days post-injury.

The information about the *association* between signs and symptoms of concussion, and objective measures of concussion, must be understood in light of the relatively low occurrence of most signs or symptoms among individuals sustaining a PCE who subsequently demonstrate post-injury neurologic or cognitive deficits. For example, based on evidence from studies included in this review, the prevalence of LOC in samples of individuals who sustained a PCE and were diagnosed with concussion ranges from 1% to 14%; PTA ranges from 2% to 30% (See Table, Supplemental Content 10). However, *for those presenting these signs*, limited evidence suggests a significant relationship between these signs and deficits in objective measures of neurologic or cognitive function.

**REFERENCES**