

## Trends in Sports-Related Concussion Incidence at the High School Level, 1997-2008

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Abstract:

**PURPOSE:** Our purpose was to determine 1) whether the incidence of concussion in interscholastic sport overall increased over time, and 2) whether the trends for concussion were similar across the interscholastic sports studied.

**METHODS:** Data were prospectively gathered for each of the 25 high schools in the Fairfax County (Virginia) Public School System over a consecutive 11-year period (1996-97 to 2007-08). Certified athletic trainers recorded all injuries and illnesses on a daily basis. Participants were high school student athletes in 6 men's sports (football, lacrosse, wrestling, soccer, basketball, and baseball) and 6 women's sports (field hockey, lacrosse, soccer, basketball, cheerleading, and softball). Cases included players diagnosed with concussion from sport-related activity. Athletic-exposure (AE) was defined as 1 athlete's participation in one practice or competition. Cumulative incident rates based on 1000 athletic exposures (AEs) were calculated over the study period for each sport.

**RESULTS:** Among the 12 high school sports studied between 1997-98 and 2007-08, there were 2510 concussion events over 158,430 player-seasons and 10,926,892 AE, resulting in an overall rate of 0.23 cases per 1000 AE. Boys' sports accounted for 75% of all events. Football (n=1339, 0.57 cases per 1000 AE) accounted for 53% of all events, and boys' lacrosse (n=226, 0.28 cases per 1000 AE) had 9% of events. Among the girls' sports, soccer (n=181) represented the greatest proportion of events overall (7%), with an incident rate (0.33 cases per 1000 AE) second only to football. Cheerleading (n=125), women's basketball (n=114), and women's lacrosse (n=110) were next most frequent, though the lacrosse rate (0.20) was higher than that for cheerleading (0.06). The overall (12 sport) concussion rate increased from 0.11 per 1000 AE in 1998 to 0.49 per 1000 AE in 2008, a 4.6-fold increase, corresponding to an average yearly increase of 16.5%.

**CONCLUSIONS:** The increase in concussion rate was consistent across sports and was not limited to any individual sport. Increases in concussion incidence over time in high school sports may be attributed to better recognition and diagnosis, as well as more aggressive play and/or player athleticism (speed/energy transfer).