

Trends in US High School Football Concussion Reporting, 2012-2017

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Objectives: Football has been a sport with high concussion rates when examined independently (Rosenthal et al., 2014). Accurately describing injury trends in high school sports is necessary to identify student-athletes at the greatest risk of injury and where potential injury reduction interventions should be focused. With increased reported high school concussion injuries and associated state legislative requirements, increased incidence rates are needed. The purpose of this study was to provide updated high-school football concussion incidence rates.

Methods: Data Source and Study Period This study used data from the Rank One Health Injury Surveillance Database (ROH ISD). Data for the current study were analyzed across 6 calendar years (2012 through 2017) from 1,999 high schools. Data from the current study examined high school football concussion data in males ages 14 to 18. The ROH ISD consists of a convenience sample of participating schools from 2012 to 2017. Exposure and injury data represent a convenience sample of US high schools. For the current study, only data provided across all 1,999 high schools were included. All 1,999 high schools included in the current study logged practice and game participation events for each individual athlete participating in football at the respective high school and athletic exposures (AEs) are an accurate representation of rostered athletes participating in either practices or games by age and calendar year. The ROH ISD was deemed Category 4 IRB exempt. Statistical Analysis Injury counts, practice exposures, game exposures, and distributions by event type (practice or game), age, and injury mechanism were examined. Injury rates per 1,000 AEs and injury rate ratios (IRRs) were calculated by event type. Injury proportion ratios (IPRs) were used to examine differences by calendar year. Risk ratios (RRs) were calculated to compare event type by calendar year. All 95% confidence intervals (CIs) not containing 1.0 were considered statistically significant.

Results: 997,308 male student-athletes participated in high school football. ATs recorded a total of 14,103 concussions in high school football from a total of 235,134 total injuries across all high school sports. High school football concussions accounted for 6% of all injuries in high school sports from 2012-2017. More concussions occurred in games (51.8%) than practices (48.2%). Decreases were found in annual injury rates for practices in high school football student-athletes from 2012 to 2016 with an increase in 2017. Decreases were found in annual injury rates for games from 2012 to 2016 with an increase in 2017. IPR decreased by year from 2012 to 2016 (with an increase in 2017). IRR and RR comparisons for games versus practices were significant from 2012 to 2017 (Table 1).

Conclusion: This study marks the largest epidemiological high school football concussion incidence investigation to date. The findings from this study provide updated high school football concussion incidence rates and provide further evidence of differences in injury rates when comparing practices and games. The higher rates of concussions occurring in games relative to practices emphasize prior trends of injury risk relative to the level of competition. Overall, results highlight a decline in injury rates over time and lower rates of injury compared to prior high school football epidemiological concussion studies.

Table 1. Injury Rates by Calendar Year with Injury Proportion (IP), Injury Rate and Type of Athletic-Exposure (AE), Injury Rate Ratio (IRR), and Risk Ratio (RR) in High School Football Student-Athletes

Year	Total Conc.	Practice Conc. (%)	Game Conc. (%)	IP (w/95% CI)	IP %	IR Practice/1000 AE (w/95% CI)	IR Game/1000 AE (w/95% CI)	IR Total/1000 AE (w/95% CI)	IRR (w/95% CI)	RR (w/95% CI)
2012	1243	618 (49.7)	625 (50.3)	0.024 (0.023, 0.025)	2.4	0.15 (0.00, 0.43)	1.12 (0.00, 3.31)	0.26 (0.00, 0.77)	*2.77 (2.71, 2.83)	*1.02 (0.96, 1.08)
2013	1439	678 (47.1)	761 (52.9)	0.017 (0.016, 0.018)	1.7	0.09 (0.00, 0.28)	0.81 (0.00, 2.38)	0.18 (0.00, 0.52)	*3.45 (3.39, 3.50)	*1.13 (1.08, 1.18)
2014	1755	875 (49.9)	880 (50.1)	0.014 (0.013, 0.015)	1.4	0.09 (0.00, 0.25)	0.66 (0.00, 1.94)	0.15 (0.00, 0.45)	*3.63 (3.58, 3.68)	*1.01 (0.97, 1.05)
2015	2483	1146 (46.2)	1337 (53.8)	0.012 (0.011, 0.013)	1.2	0.07 (0.00, 0.20)	0.61 (0.00, 1.80)	0.13 (0.00, 0.39)	*4.04 (4.00, 4.08)	*1.16 (1.12, 1.20)
2016	3249	1545 (47.6)	1704 (52.4)	0.012 (0.011, 0.013)	1.2	0.07 (0.00, 0.21)	0.59 (0.00, 1.75)	0.13 (0.00, 0.39)	*3.99 (3.96, 4.02)	*1.10 (1.07, 1.13)
2017	3934	1937 (49.2)	1997 (50.8)	0.015 (0.014, 0.016)	1.5	0.09 (0.00, 0.26)	0.68 (0.00, 2.00)	0.16 (0.00, 0.46)	*3.62 (3.59, 3.65)	*1.03 (1.00, 1.06)
Total	14103	6799 (48.2)	7304 (51.8)	0.014 (0.013, 0.015)	1.4	0.08 (0.00, 0.24)	0.66 (0.00, 1.97)	0.15 (0.00, 0.45)	*3.70 (3.68, 3.72)	*1.07 (1.05, 1.09)

* = statistically significant.

