The Association Between BMI, Age and Severity of MSK Injuries Sustained During High School Contact Sports: A National Multi-Year Study

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INTRODUCTION: Over 7 million students participate in high school (HS) sports, accounting for around 2 million yearly sports injuries. Players in contact sports face a high risk of severe MSK injuries. There is little investigation into the sport-specific associations between BMI, age and the severity of MSK injuries. The objective of this study is to elucidate the relationships between these variables to gain a better understanding of the factors related to severity of MSK injuries and develop targeted prevention plans to limit high school sports injuries.

METHODS: De-identified, national HS sports injuries data for boys football, boys and girls soccer, boys and girls basketball, and boys wrestling was provided by the High School Reporting Information Online (RIO) Study. High School RIO is a data collection tool capturing athletic exposures and injury information that has been updated annually since the 2005/2006 academic year. Data was entered weekly by certified athletic trainers, who received an individualized school report in addition to a small stipend. Individual observations are weighted such that the sample is best representative of the national HS athlete population. Our outcome of interest was return to activity (RTA), a proxy used for severity of MSK injuries since generally more severe injuries require a longer return to activity period. The RTA variable was provided categorically by 1-2 days, 3-6 days, 7-9 days, 10-21 days, and more. To make the outcome variable binary for regressions, we binned the outcome variable into RTA of 6 days or less vs. greater than 6 days. A unique logistic regression model controlling for region of bodily injury, type of injury, level of play, geographic region, event type, and timing of injury during season was estimated for each sport, with BMI and age as the independent variables of interest.

RESULTS SECTION: Total nationwide injury observations from 2005-2019 were n = 23,407 MSK injuries (weighted n = 218,163), with boys football players being the most represented at n = 12,726 (weighted n = 32,391) (Figure 1). Average BMI and age were similar across all sports. The highest average BMI was found in boys football players (26.10, σ = 4.82), and the lowest average BMI was found in girls soccer players (21.98, σ = 3.11). The highest average age was found in basketball players (16.11, σ = 1.27) and the lowest average age was found in girls basketball players (15.70, σ = 1.46). Freshmen through Seniors were represented in all sports, with the mean class of students in all sports being Sophomore students. Differences in BMI and age across all sports was not statistically significant. In the regression models with BMI and RTA within 6 days or less as the independent and dependent variables, respectively, BMI was significant among boys basketball (OR = 1.04, 95% CI 1.0-1.1, P = 0.017) and boys wrestling (OR = 1.03, 95% CI 1.0-1.1, P = 0.032) (Figure 2). Specifically, greater BMIs among girls basketball players and boys wrestlers were significant with an RTA greater than 6 days. We did not find that player age was associated with RTA of 6 days or less when controlling for factors including region of bodily injury, type of injury, and level of play among any of the sports analyzed—specifically boys football, boys and girls soccer, boys and girls basketball, and boys wrestling (Figure 3).

DISCUSSION: BMI was associated with return to activity greater than 6 days—a proxy for MSK injury severity—in girls basketball and boys wrestling. Specifically, higher BMIs among girls basketball players and boys wrestlers were associated with more severe MSK injuries. We did not find that player age was associated with return to activity within six days. Age, BMI, and class year values were all very similar among athletes of all sports analyzed, so baseline differences in these values would likely not play a role in the associations seen.

SIGNIFICANCE/CLINICAL RELEVANCE: Targeted injury prevention measures—whether that takes the form of stretching, equipment, or other means—and additional attention should be paid to HS girls basketball players and boys wrestlers with higher BMIs since they are more susceptible to severe MSK injuries. Broadly, these results may indicate that a high BMI increases risk of severe MSK injury in basketball players and wrestlers of all ages, including adult recreational athletes and weekend warriors; sports physicians and team trainers can help mitigate this risk by spending extra time with players of high BMI and discussing injury prevention measures.

IMAGES AND TABLES:

Figure 1: MSK Injury Observations for the Included Boys + Girls HS Sports
Boys and Girls High School Athletes (n = 33,407) were included in the study to determine associations between BMI, age, and severity of MSK injury. The numbers of athletes by specific boys/girls sports are plotted in the bar chart above.

Figure 2: BMI Odds Ratios for the included Boys + Girls HS Sports
A unique logistic regression model controlling for region of bodily injury, type of injury, level of play, geographic region, event type, and timing of injury during season was estimated for each sport, with BMI as the independent variable of interest and return to activity within six days as the dependent variable. The points represent the odds ratios and the error bars represent confidence intervals above.

Figure 3: Age Odds Ratios for the included Boys + Girls HS Sports
A unique logistic regression model controlling for region of bodily injury, type of injury, level of play, geographic region, event type, and timing of injury during season was estimated for each sport, with age as the independent variable of interest and return to activity within six days as the dependent variable. The points represent the odds ratios and the error bars represent confidence intervals above.

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