

# Epidemiology of Sports-Related Traumatic Hip Dislocations Reported in United States Emergency Departments, 2010-2019

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**Background:** Traumatic hip dislocations are rare injuries that most commonly occur in motor vehicle accidents. There is a paucity of literature that describes sports-related hip dislocations.

**Purpose:** To estimate the incidence of sports-related hip dislocations and determine any sport- or sex-related epidemiological trends using the National Electronic Injury Surveillance System (NEISS) database.

**Study Design:** Descriptive epidemiology study.

**Methods:** Data regarding sports-related hip dislocations from 2010 to 2019 were retrieved from the NEISS, a database that catalogs injury information during emergency department visits from 100 hospitals across the United States to produce nationwide estimates of the injury burden. The estimated number of injuries was calculated using weights assigned by the NEISS database. The injuries were then stratified by sport and sex to determine any epidemiological patterns.

**Results:** A total of 102 hip dislocation injuries were identified over the surveyed 10 years, indicating 2941 estimated injuries nationwide. Overall, 10 (9.8%) of 102 sports-related hip dislocations presented with concomitant acetabular fractures, representing an estimated 288 injuries nationally over 10 years. Male athletes sustained more sports-related hip dislocations than female athletes, with a relative incidence of 12.51 ( $P < .001$ ). Adolescents aged 15 to 19 years recorded the highest number of hip dislocations. There were 17 sports identified as having caused at least 1 hip dislocation over the 10-year period. More hip dislocation injuries were sustained from contact sports (91.2%) than noncontact sports (8.8%) ( $P < .001$ ). Football (estimated 164 injuries per year; 55.6%), snowboarding (28 per year; 9.5%), skiing (26 per year; 8.8%), and basketball (21 per year; 7.1%) had the highest rates of hip dislocation. Additionally, 43 (82.7%) football-related injuries were caused by tackling mechanisms, and 9 (17.3%) were caused by nontackling mechanisms ( $P < .001$ ).

**Conclusion:** The incidence of traumatic sports-related hip dislocations was extremely low in the United States during the study period. Male adolescents, aged 15 to 19 years, sustained the greatest number of injuries during football. Significantly more hip dislocations occurred in contact sports, most commonly football, snowboarding, skiing, and basketball, compared with noncontact sports. As adolescent athletes may have limited treatment options if osteonecrosis occurs, these data serve to increase the clinical awareness of these injuries.

**Keywords:** sports-related hip dislocations; NEISS; football injuries; traumatic hip dislocation

Traumatic hip dislocations are uncommon orthopaedic emergencies that overwhelmingly occur in high-energy motor vehicle accidents.<sup>4,8</sup> Urgent reduction, within 6 hours, reduces the risk of osteonecrosis, avascular necrosis, and sciatic nerve palsy.<sup>5,6</sup> Early recognition and proper management of these dislocations can optimize the outcome and decrease the risk of potentially disastrous long-term complications.<sup>4,6,8,19</sup>

Although less common, traumatic hip dislocations have been reported in young athletes during sports-related activities.<sup>4,5,21</sup> In 1962, a multicenter study conducted over a 12-year period identified 523 hip dislocations, with 10 (1.9%) classified as sports-related.<sup>2</sup> From the limited data in the literature, it is estimated that sports-related hip dislocations may account for 2% to 5% of all traumatic hip dislocations.<sup>1,2,4,11,12</sup> These injuries have been reported in a variety of sports such as football, skiing, snowboarding, basketball, wrestling, and rugby.<sup>4,18</sup> Further, they have also been reported to occur in noncontact sports and activities, such as running or tennis.<sup>4</sup> However,

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the majority of recent data available on sports-related hip dislocations are reported from case reports or small sample studies, making it difficult to determine the current incidence and demographic factors associated with these injuries.

As such, our objective was to describe the incidence of sports-related hip dislocations from 2010 to 2019 in the United States using a large national injury prevention database. A secondary aim was to investigate the distribution of these injuries across different sports and by sex. Such data aid in the awareness of these traumatic injuries, potentially facilitating immediate treatment and avoiding misdiagnoses as simple hip sprains or strains in adolescent athletes.<sup>4,8,19</sup>

## METHODS

The US Consumer Product Safety Commission (CPSC) and Centers for Disease Control and Prevention collaborated to generate the National Electronic Injury Surveillance System (NEISS) database, which collects injury data from emergency department visits at 100 hospitals throughout the United States and its territories. This sample of hospitals includes geographically diverse academic and community hospitals that have at least 6 beds and an emergency department to provide a nationally representative sample. At each visit, patient demographic information, suspected injury diagnosis, location of injury, disposition, products associated with the injury, and narrative histories are recorded. The NEISS assigns a code from an alphabetical listing of hundreds of products and recreational activities to each injury using as much detail as the data allow. Emergency department visits for sports-related hip injuries were identified using NEISS injury diagnosis codes (dislocation: code 55) and body part codes (lower trunk: code 79). Narrative histories were reviewed to ensure appropriate case coding. Total case numbers were estimated using NEISS hospital weights, calculated from the probability of inclusion for each visit in the database. Hospital size was assigned by the NEISS based on the number of emergency department visits each year. Given that this study was conducted using publicly available deidentified data, institutional review board approval was not required.

### Patient Selection

Using the NEISS Estimates Query Builder, we selected a sample of patients with the following search criteria: lower trunk injuries, hip injuries, injuries associated with sports,

and diagnostic codes for “dislocation.” Next, only narratives containing “hip dislocation,” “hip dis,” or “dislocated hip” were included in the final data set. Although 220 hip dislocation injuries were identified from this original search, the narratives for all cases were reviewed to confirm participation in a sports-related activity at the time of injury. Of these, 118 were not a direct result of participation in sports. Incidents that were unlikely to be sports-related from the narrative, such as those involving the recreational use of 4-wheelers, motorcycles, cars, trucks, roller coasters, ladders, stairs, furniture, lawn equipment, trampolines, ropes, poles, and waterslides, were eliminated from the data set to yield a total of 102 sports-related hip dislocations. Mechanisms of injury were documented for each sport from the narratives provided by emergency department notes. Football mechanisms of injury were recorded, with injuries resulting from a tackling or nontackling mechanism of injury. The size of the hospital (small, medium, large, very large, or children’s) where these injuries most commonly presented was provided by the NEISS and recorded.

### Statistical Analysis

To calculate the estimated incidence rates per million persons per year, population data were extracted from the US Census Bureau for the period of 2010 to 2019. Pairwise comparisons of continuous variables were performed using a 2-tailed unpaired *t* test of the means. Chi-square tests were used to compare injury rates between sexes, contact versus noncontact groups, and sizes of the reporting hospitals. Chi-square tests were also used to compare the most common sports with hip dislocations by sex. National incidence estimates were calculated using NEISS sample weights and utilized in all statistical analyses. Westat, the contractor for the current NEISS sample design, allows for the calculation of national incidence by providing the CPSC with a selection of hospitals based on size (eg, small, medium, large, very large, children’s) and geographic location. NEISS weights are adjusted annually to account for changes in the most recent sampling frame of US hospitals available, thus allowing for sample weights to reflect the total number of emergency department visits in the United States more accurately. Proportions were compared using the *z* score for multiple comparisons of population proportions. All tests were performed using Stata (Version 13; StataCorp) or Excel (Microsoft) using a default alpha level of .05. Results were plotted in Excel, and tables were created in PowerPoint (Microsoft).

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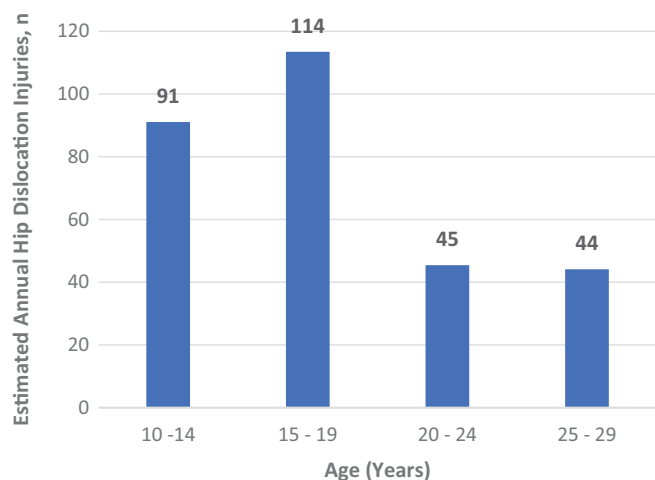
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Ethical approval was not sought for the present study.



**Figure 1.** Distribution of estimated annual hip dislocation injuries by age group. All sports-related hip dislocation injuries that presented to the National Electronic Injury Surveillance System from 2010 to 2019 occurred in patients aged between 10 and 29 years.

**RESULTS**

From 2010 to 2019, a total of 102 hip dislocations sustained via sporting activities were identified from NEISS-affiliated hospitals. Of these, 83 occurred in male patients and 19 in female patients. Using the weights assigned by the NEISS database depending on the geographic location of the injury, this sample was extrapolated to represent a national estimate of 2941 hip dislocations over the 10-year period, with 2716 injuries in male patients and 225 injuries in female patients.

The estimated incidence per million persons per year was 0.88 (95% CI, 0.71-1.05). Male patients sustained more hip dislocation injuries (0.813) than female patients (0.065) during this period, with a relative incidence of 12.51 ( $P < .001$ ). All sports-related hip dislocation injuries reported to the NEISS within this 10-year period occurred in patients aged between 10 and 29 years. Further stratification of sports-related hip dislocations by age is presented in Figure 1, showing an increased frequency of dislocations in patients aged between 15 and 19 years compared with other age ranges.

A total of 102 hip dislocations were reported across 17 different sports (Table 1). Overall, 10 (9.8%) of 102 sports-related hip dislocations presented with concomitant acetabular fractures, representing an estimated 288 injuries nationally. The sport with the greatest number of hip dislocations was football (52 reported injuries over the 10-year period), which correlated with an estimate of 164 national injuries per year. Narratives for football-related hip dislocations demonstrated that 43 of the 52 (82.7%) football injuries reported were caused by tackling mechanisms and that 9 (17.3%) were caused by nontackling mechanisms ( $P < .001$ ). More injuries were sustained while playing football than all other sports combined (50 reported injuries; 131 estimated injuries per year). The incidence of hip

**TABLE 1**  
Reported Number and Weighted Nationwide Estimates of Hip Dislocations by Sport

Sport	Reported Injuries, n	Estimated Injuries/Year, n
Football	52	164
Snowboarding	12	28
Skiing	10	26
Basketball	5	21
Running	3	10
Soccer	3	8
Horseback riding	3	8
Swimming	2	5
Lacrosse	2	4
Rugby	2	4
Baseball	2	4
Gymnastics	1	3
Softball	1	2
Hockey	1	2
Kickball	1	2
Dance	1	2
Tennis	1	2
Total	102	295

dislocation injuries was found to be significantly associated with the sport being played at the time of injury ( $P < .001$ ).

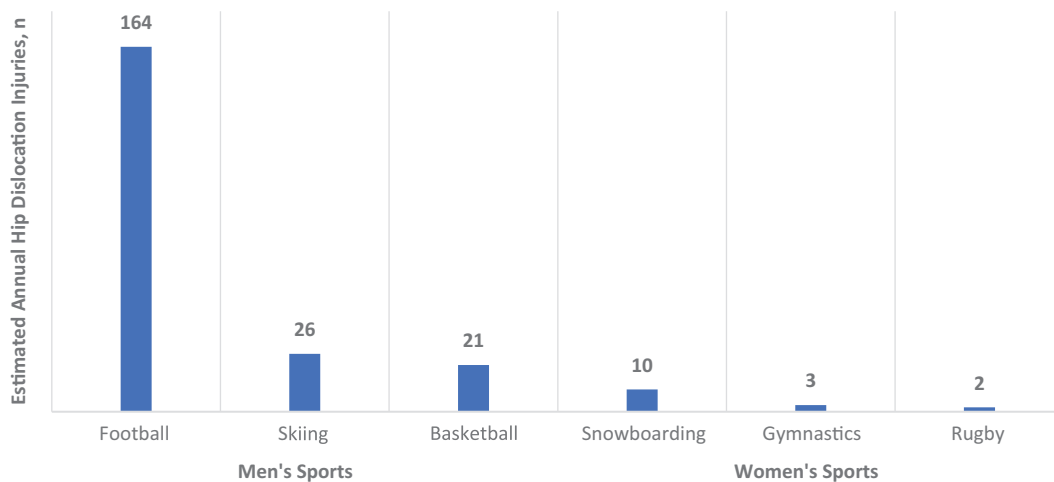
Of the 17 sports reported, contact sports included baseball, basketball, football, hockey, horseback riding, lacrosse, rugby, skiing, snowboarding, soccer, and softball, and noncontact sports included tennis, dance, running, gymnastics, kickball, and swimming. More injuries were experienced during contact sports (93 reported injuries; estimated 271 injuries per year) compared with noncontact sports (9 reported injuries; estimated 24 injuries per year). The estimated incidences of traumatic hip dislocations for the 17 sports that involved at least 1 of these injuries are listed in Table 1.

The highest incidence of hip dislocations was in male athletes when participating in football, skiing, and basketball. Female athletes had the highest incidence of hip dislocation when participating in snowboarding, gymnastics, and rugby (Figure 2).

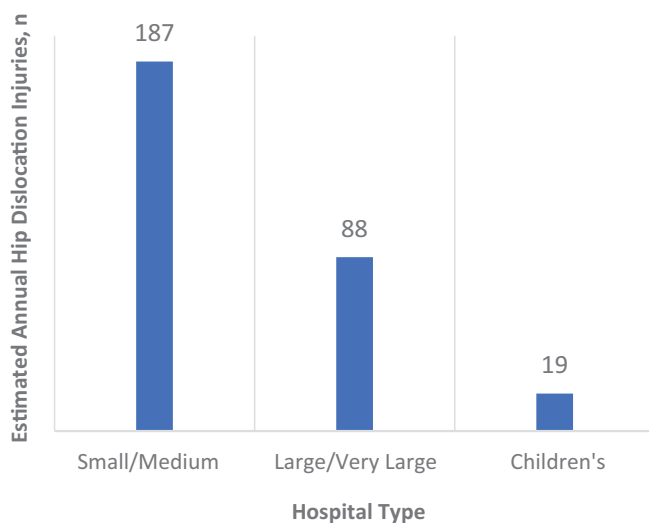
The weighted estimates of hip dislocation injuries were further stratified by the size of the reporting hospital. The number of sports-related hip dislocation injuries that presented to small and medium hospitals annually (estimated 187 injuries per year) was significantly greater than the number of injuries that presented to large and very large hospitals (estimated 88 injuries per year) ( $P < .001$ ) and children’s hospitals (estimated 19 injuries per year) ( $P < .001$ ) (Figure 3).

**DISCUSSION**

Hip dislocations are infrequent injuries that most commonly occur from traumatic, high-energy mechanisms.<sup>4,6,8</sup> Despite the high number of overall hip-related injuries that occur in sports, there is limited evidence reporting on



**Figure 2.** Distribution of estimated annual hip dislocation injuries by top 3 sports per sex. Football was the most common sport with hip dislocation injuries in male patients, whereas most sports-related hip dislocations sustained by female patients occurred while snowboarding.



**Figure 3.** Distribution of estimated annual hip dislocation injuries by hospital size.

sports-related hip dislocations, which disproportionately affect the adolescent population compared with their adult counterparts. The findings in this study reveal a very low US national estimate (0.88 per million persons per year) of sports-related hip dislocation and distribution across varying sports, information that has not been previously described in the literature. Further, the highest number of sports-related hip dislocations occurred through a tackling mechanism in male patients, aged 15 to 19 years, while playing football. We believe that the data reported in this study may help to identify demographic risk factors for sports-related hip dislocation and increase the clinical awareness of these injuries for specific patient populations.

In the current study, all sports-related hip dislocations reported to the NEISS during the 10-year period occurred

in athletes aged between 10 and 29 years, with the highest number of dislocations occurring in adolescents aged 15 to 19 years. Within this age group, the increasing level of play and contact from youth to adolescent athletics in high school years may offer an explanation for the increased number of injuries.<sup>19,22</sup> With appropriate management and treatment of hip dislocations, children and adolescents can have excellent outcomes.<sup>2,5,13,15</sup> It is well reported that the timely reduction and appropriate management of hip dislocations may improve outcomes and reduce the risk of osteonecrosis.<sup>6,8,15</sup> As such, Mehlman et al<sup>13</sup> reported a 20-fold increase in osteonecrosis when reduction was delayed more than 6 hours after the initial injury in children and adolescent patients.<sup>10</sup> However, when osteonecrosis occurs in these patients, treatment options such as hip arthroplasty/replacement remain controversial because of the limited life span of the prosthesis.<sup>10,13</sup> While it is important that all hip dislocations undergo reduction within 6 hours to prevent osteonecrosis, it is especially important in the adolescent patient population because of limited treatment options.<sup>12,18</sup>

In the present study, the estimated incidence of sports-related hip dislocations in the United States was low (0.88 per million persons per year). From 2010 to 2019, a total of 102 sports-related hip dislocations were reported to the NEISS, which is the largest collection of sports-related hip dislocations to be reported in the literature. Utilizing provided weighting, 2941 sports-related hip dislocations were estimated to have occurred over the 10-year period, representing approximately 295 injuries per year, which is higher than previously reported.<sup>4,9,21</sup> In 7 extreme sports, Sabesan et al<sup>20</sup> examined hip and knee dislocations using NEISS data from 2007 to 2012 and reported 35 hip dislocations with an estimated 742 hip dislocations during the 5-year period. While the aforementioned study is limited to hip dislocations in a select number of extreme sports, such as water skiing and wakeboarding, snowmobiling, surfing, roller skating, snowboarding, skateboarding, and snow

skiing, our data represent estimates of the incidence rates for all sports-related hip dislocations in the United States. These estimates may allow for a more inclusive understanding of the demographic and sport-specific propensity of these injuries.

Traumatic hip dislocations have been reported in basketball, bicycling, football, gymnastics, horseback riding, jogging, rugby, soccer, speed skating, skiing, tennis, snowboarding, volleyball, and wrestling.<sup>1,2,7,8,12,15,18,21</sup> However, the majority of these reports are isolated case reports or small studies that are confined to a few sports. In 1970, Lamke<sup>12</sup> identified only 6 sports-related hip dislocations (5.5%) of 110 hip dislocations that presented to his institution over a 20-year period, with 2 cases from football and 1 each from wrestling, horseback riding, soccer, and tennis. Additionally, Armstrong<sup>1</sup> reported 4 (4.0%) sports-related hip dislocations of 100 in a multicenter study over a 5-year period. The scarce data in the literature make it difficult to determine which sports confer the highest risk for traumatic hip dislocations. In the current study, an estimated 2941 hip dislocations occurred across 17 different sports between 2010 and 2019 in the United States, with an apparent preponderance among certain sports. These epidemiological and sport stratification data are unavailable in the current literature and may act as a first step in helping injury prevention experts.

Overall, the most frequent sport associated with hip dislocation injuries was football (52 reported hip dislocations, with an estimated 1640 injuries occurring over the 10-year period), with the majority being male athletes. From our analysis, 82.7% (43/52) of football-related hip dislocations occurred from being tackled by or colliding with another player. This mechanistic finding is in agreement with previous reports on football-related hip dislocations.<sup>4,21,23</sup> To date, only 6 cases of football-related hip dislocation have been reported in the literature.<sup>4,9,17,21,23</sup> Our estimates show that these injuries may be more common than previously reported. Over a 9-year period, Moorman et al<sup>16</sup> described the mechanisms of injury, pathoanatomy, and treatment methods for 8 patients who presented to their institution with traumatic posterior hip subluxations while playing football. While these injuries were not complete dislocations, the authors noted that some hip sprains in football may actually represent traumatic hip subluxations because of the transient nature of these injuries and the subtlety of physical examination findings. In the aforementioned study, 2 of the patients developed osteonecrosis, highlighting the need for proper care and awareness of these injuries, especially in the young male football player.<sup>16</sup> Overall, of 17 sports noted in our study, football carried a high risk of hip dislocation injuries and a unique risk profile.

In general, it is important to note that the majority of sports-related hip dislocations in our analysis showed an extreme predominance in male athletes compared with female athletes. The differing trends of participation in certain sports by sex likely explain the difference in the number of dislocations for each sex.<sup>14</sup> For example, football is predominantly played by male athletes, whereas female athletes are more likely to participate in sports such as gymnastics. In our study, male patients made up the

majority of hip dislocations when participating in football, skiing, and basketball, while hip dislocations sustained by female patients occurred mostly in gymnastics, snowboarding, and rugby. Moreover, swimming, baseball, softball, and kickball were all sports that did not have reports of hip dislocations in the literature but were associated with at least 1 dislocation in our analysis.

## Limitations

This study is not without limitations. Using a large database has inherent bias. The NEISS data set creates the possibility of a sampling bias, despite being strategically geographically selected to generate national estimates as accurately as possible. Because national estimates were calculated using weighted numbers assigned to each hospital, small inaccuracies in these weighted values can produce errors in estimated incidence rates. Additionally, given that the use of a database relies on coders to look through hospital charts and translate and code the data, this invites the possibility of coding and data entry errors, which could lead to inaccurate comparisons between sports, age groups, and other categories.<sup>3</sup> However, we attempted to obviate these errors by carefully reviewing the narratives of each patient with a reported sports-related hip dislocation. Moreover, the NEISS uses data collected from emergency departments across the country, but the actual incidence may be higher for those athletes who did not present to an emergency department.

## CONCLUSION

The incidence of traumatic sports-related hip dislocations was extremely low in the United States during the study period. Male adolescents, aged 15 to 19 years, sustained the greatest number of injuries during football. Significantly more hip dislocations occurred in contact sports, most commonly football, snowboarding, skiing, and basketball, compared with noncontact sports. As adolescent athletes may have limited treatment options if osteonecrosis occurs, these data serve to increase the clinical awareness of these injuries.

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