

General

Volleyball Related Injuries in Adolescents: A Decade of Data

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Objectives

Playing sports is crucial to adolescents as a source of entertainment, a factor in improving mental health, and a way to promote physical development. However, sports, including volleyball, have an inherent risk of causing injuries to its players. The objective of this study is to determine the most common locations, types, and outcomes of volleyball injuries in adolescent athletes so that more people are aware of how these injuries occur. This would encourage volleyball athletes to be more mindful of these injuries when playing.

Methods

The National Electronic Injury Surveillance System (NEISS) was used to analyze injuries in adolescents (ages 10-19) that occurred due to volleyball between the years 2013 and 2022.

Results

Approximately 347,395 volleyball injuries occurred in adolescents between 2013 and 2022, with the median age of patients being 15 years old. 274,003 patients were female (78.9%) while 73,392 patients were male (21.1%). 59,530 had injuries in the head or neck (17.1%), 141,660 in the lower extremities (40.8%), and 119,230 in the upper extremities (34.3%). 151,364 patients had sprains or strains (43.6%), 35,760 had fractures (10.3%), 36,804 had contusions or abrasions (10.6%), and the rest of the patients had other injuries. 342,567 patients were treated and released (98.6%), 2049 patients were left without being seen (0.6%), and 1648 patients were hospitalized (0.5%).

Conclusions

This study shows that volleyball players are most vulnerable to getting sprains, strains, fractures, or bruises in the upper or lower extremities. While there are more injuries in adolescent females, this is likely because a majority of volleyball players between the ages of 10 and 19 are female. Further study may be done to identify how volleyball causes these injuries in an effort to prevent them.

INTRODUCTION

Volleyball is a staple sport amongst adolescent age groups, and the importance of participating in team sports is being discussed due to physical and emotional well-being. A publication from the Statista research department reported that in the 2021-2022 school year alone, 520.6 thousand high school students played volleyball.¹ In a detailed consideration of the emotional and physical benefits of participation in sports among children, it was noted that multiple studies reported positive impacts in spheres such as psychosocial health and self-esteem. While there may be methodological limitations, the evidence highlights the potential of volleyball to significantly enhance adolescents' physical health and mental well-being.² This sport can play

a crucial role in addressing health issues commonly encountered by teenagers, including those related to depression and suicide. Health professionals and educators should acknowledge the positive impact of volleyball and other team sports as an exercise option, considering it for adolescents seeking an enjoyable and effective way to maintain both physical fitness and emotional balance.

Dismally, participating in a team sport could expose an individual to injuries. Due to their ongoing growth, young athletes have open growth plates, the weakest points in the musculoskeletal system. This makes them more susceptible to injuries affecting growth plates, apophyses, and joint surfaces.³ Many individuals believe that physical sports are too risky to participate in, thus causing them not to receive the full benefits of participating in such activities. Address-

ing injuries is crucial due to their significant financial burden. In 2019, the CDC reported that the economic cost of injuries amounted to \$4.2 trillion, with \$327 billion attributed to medical care alone.⁴

Many individuals who wish to resume sports like volleyball after injury opt for ligament reconstruction surgery post-traumatic injuries. This surgery stabilizes the knee and lowers the risk of additional meniscal injuries. However, many athletes do not return to their former level of play. Research indicates that less than 50% of athletes return to their pre-injury performance level or engage in competitive sports 2 to 7 years following ACL (anterior cruciate ligament) reconstruction.⁵

Given the high incidence of injuries among adolescent athletes, this study addresses various injuries commonly encountered in volleyball, including those affecting the upper and lower extremities. Primary care and sports medicine physicians frequently deal with such injuries. This emphasis stems from the understanding that sports-related injuries are prevalent and require specialized knowledge for accurate diagnosis and effective treatment. By examining the full range of common injuries in volleyball, this study aims to offer valuable insights and guidance for healthcare professionals, providing general treatment guidelines and identifying criteria for referral to sports medicine or orthopedic specialists for comprehensive management.

METHODS

STUDY DESIGN

The National Electronic Injury Surveillance System (NEISS) database, managed by the United States Consumer Product Safety Commission, was used to conduct a retrospective study on adolescent volleyball injuries. NEISS collects data from emergency departments nationwide to monitor injuries related to consumer products.

STUDY POPULATION

Data from the National Electronic Injury Surveillance System (NEISS), overseen by the United States Consumer Product Safety Commission, examined emergency department records from a representative sample of approximately 100 hospitals out of the 5,000 nationwide. This study focused on data collected over ten years, from 2013 to 2022. The ages of individuals in the database ranged from 10 to 19 years. This particular analysis centered on volleyball-related injuries among adolescents. The results were not filtered based on anatomical region. A total of 347,395 volleyball-related injuries were recorded in the database. All diagnosis codes with numerical results were considered.

STATISTICAL ANALYSIS

The study examined age, gender, diagnosis, affected body parts, and patient disposition. All volleyball-related incidents were classified under the general category of "sports and recreation equipment." Statistical analyses were performed using JMP 17.0 software. The main objective of this

study was to investigate the correlation between playing volleyball and the likelihood of sustaining injuries among adolescents.

RESULTS

Between 2013 and 2022, a total of 347,395 volleyball-related injuries were reported. The median age of the injured patients was 15 years old. The data showed that 274,003 patients were female (78.9%), while 73,392 were male (21.1%). The most common sites of injury were the lower extremities, which accounted for 40.8% of the injuries, and the upper extremities, which accounted for 34.3%. Injuries to the head or neck were also significant, making up 17.1% of the cases [Figure 1]. Regarding the type of injuries, the most common diagnosis was a sprain or strain, with 151,364 cases (43.6%). There were also 35,760 fractures (10.3%) and 36,804 contusions or abrasions (10.6%). The remaining cases involved other types of injuries. Regarding patient outcomes, most patients (98.6%) were treated and released from the emergency department. Some patients were either not seen (0.6%) or required hospitalization (0.5%). This data suggests that while volleyball-related injuries among adolescents are common, they are typically not severe enough to require hospitalization. Most patients receive treatment and are released, indicating that the injuries, though frequent, are generally manageable within the emergency department setting.

DISCUSSION

Volleyball-related injuries among adolescents constitute a significant portion of sports-related emergency department visits in the United States. From 2013 to 2022, there were 347,395 reported injuries associated with volleyball, highlighting the sport's prevalence and the associated risks among young athletes.

Compared to other sports, volleyball contributes prominently to sports-related injuries, particularly among adolescents. The median age of injured patients was 15, with females comprising 78.9% of cases, underscoring their active and predominant participation in volleyball.⁶ This demographic skew towards females aligns with the broader participation trends observed in volleyball across various age groups and competitive levels, given the increased proportion of female participation relative to males. The increased risk of non-contact ACL injuries in female athletes is also worth mentioning in this context. Multiple factors contribute to non-contact ACL injuries including but not limited to the effect of estrogen and other reproductive hormones on ligaments and the propensity for valgus habitus in the female knee stemming in part from ante version of the hip and the proportionally wider female pelvis. When landing in a valgus (knee abduction) stance the propensity for medial laxity and lateral tension allow for greater internal rotation of the femur placing undue stress on the ACL. Given the prolonged recovery of partial tears that do not require surgery and that the substantial decrease in chances of full return to sports after surgical repair of ACL

Adolescent Volleyball Injuries: Location

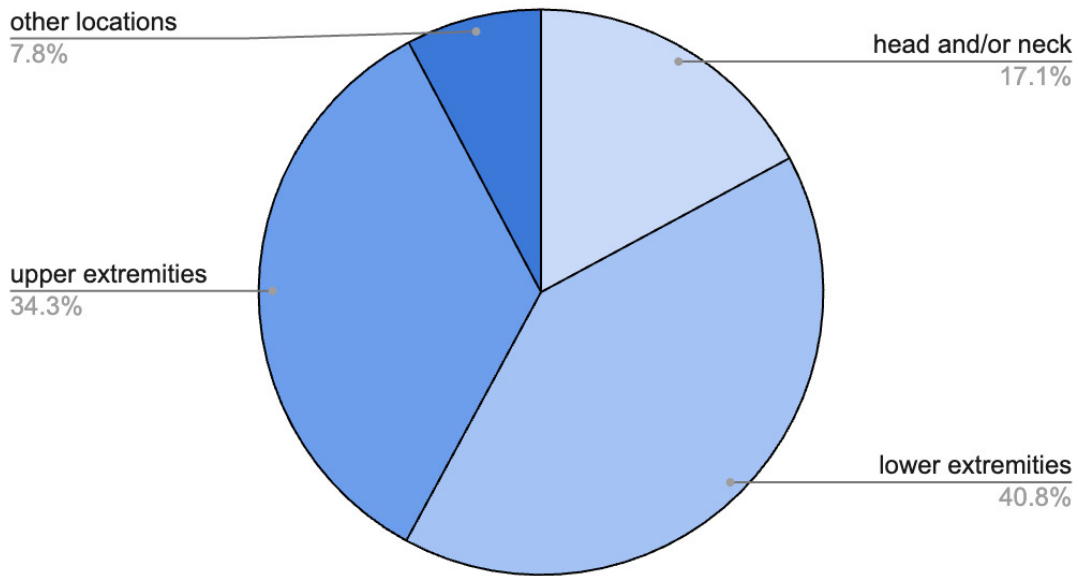


Figure 1.

tears in any sport that has a predominance of female participation (including volleyball) prevention efforts to include gait training, muscle strengthening and awareness of the issue may substantially decrease injury rates.

In both sexes lower extremity injuries were the most prevalent, at 40.8 percent, in line with a 2004 study that reported 41 percent of injuries are in the lower extremities, followed closely by upper extremity injuries and head/neck injuries.⁷ These injury patterns reflect the dynamic and physically demanding nature of volleyball, where rapid movements and sudden changes in direction can predispose athletes to strains, sprains, and fractures.⁸

Strains and sprains were the most frequently diagnosed injuries, followed by fractures and contusions/abrasions. These findings emphasize the importance of injury prevention strategies that improve technique, conditioning, and awareness among adolescent volleyball players.⁹

Volleyball is typically considered a non-contact sport, yet a significant proportion of ankle sprains result from landing on another athlete's foot after a jump.¹⁰ Lateral ankle sprains (LASs) are prevalent in various sports, including volleyball, and can lead to chronic ankle instability (CAI) in a significant number of cases.¹¹ Given the high incidence of lower extremity injuries in volleyball, LASs and CAI represent critical concerns that warrant targeted prevention efforts within sports medicine and physiotherapy communities. Strategies should include strengthening exercises, proprioceptive training, and appropriate footwear to mitigate the risk of LAS and subsequent CAI among adolescent volleyball players.

Furthermore, the demographic distribution of injuries, particularly the predominance of female athletes and the age-specific injury rates during adolescence, underscores critical periods of vulnerability for young athletes.¹² Under-

standing these injury patterns and risk factors is essential for developing targeted preventive strategies that address the unique needs of adolescent volleyball players.

Despite its contributions, this study has several limitations that warrant consideration. First, relying on emergency department data from the NEISS database may underestimate less severe injuries managed outside hospital settings. This limitation could skew the prevalence and types of injuries reported, particularly for injuries treated through primary care or non-emergency settings.

Second, the NEISS database lacks detailed information on race, geographic location, and specific volleyball activities. These factors are crucial for understanding injury disparities and tailoring interventions to diverse populations of adolescent athletes.

Before 2019, the NEISS database did not permit the entry of multiple diagnoses or body parts for each injury record; however, from 2019 onwards, the NEISS expanded its data collection capabilities to include up to two diagnoses and body parts, as well as up to three product codes per injury record. This update has implications for estimating national injury rates and their variability, as a single NEISS record can now contribute multiple counts toward these estimates, affecting how product groups and diagnoses are reported. This enhancement enhances data granularity, although it is essential to note that the NEISS database relies on estimates from 100 national hospitals and does not reflect accurate incidence rates.

Additionally, the study's retrospective nature limits the ability to establish causality or identify specific risk factors contributing to volleyball injuries. Future research could benefit from prospective studies or longitudinal data collection to explore injury mechanisms and validate preventive strategies in real-world settings.

CONCLUSIONS

This study highlights the significant impact of volleyball on adolescent health, underscoring both the benefits and risks associated with participation in this popular sport. The data reveals a high incidence of volleyball-related injuries, particularly among female athletes, with sprains, strains, and fractures being the most common. The prevalence of lower and upper extremity injuries suggests a need for targeted prevention and management strategies. Despite the fre-

quent occurrence of injuries, the fact that most patients are treated and released from the emergency department indicates that these injuries are generally not severe. However, the findings emphasize the importance of implementing effective injury prevention programs to ensure the safety and well-being of young volleyball players.

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