



The epidemiology of basketball-associated eye injuries in the United States, 2012–2021

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Keywords Basketball · Eye injury · Emergency department

Key messages

What is known:

- Limitations of previous studies of basketball related-eye injuries include incomplete descriptions of mechanisms of injury and small sample sizes.

What is new:

- We describe the epidemiology of basketball-related eye injuries in United States (US) Emergency Departments (EDs) using the National Electronic Injury Surveillance System database.
- The estimated number of yearly ED visits for basketball-related eye injuries in the US decreased significantly from 2012 through 2021, with the largest decrease from 2019 through 2020.
- The injuries mostly affected males and children and were most commonly corneal abrasions.

Basketball-related eye injuries comprise up to 31.6% of sports and recreational eye injuries in the United States (US) [1]. However, previous studies of basketball-related eye injuries have limited descriptions of the mechanisms of injury and small sample sizes, and are only focused on selected populations [1–4]. We investigated the epidemiology of

basketball-related eye injuries in US Emergency Departments (EDs) using the National Electronic Injury Surveillance System (NEISS) database.

The NEISS database is a probability sample of 100 hospitals with 24-h EDs in the US and, for a given period, can provide national estimates of number of ED visits for a consumer product-associated injury for the greater than 5,000 US EDs. We conducted a query for all basketball-related injuries (Product Code: 1205) of the eyeball (Body Part Code: 77) from 2012 through 2021. The inclusion criterion was any basketball-related injury with no restriction on age. The exclusion criterion was any eye injury that did not directly result from playing basketball. The case narrative for each injury was reviewed to assign each patient a diagnosis and determine the mechanism of injury. A modified version of Patel et al.'s framework scheme for sports-related eye

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injuries was used to assign diagnoses [5]. The categories included the following: corneal abrasions; contusions; irritation and inflammation; foreign body; laceration or puncture; subconjunctival hemorrhage; hyphema; vitreoretinal damage; “other”; not specified. The category of irritation and inflammation included iritis, iridocyclitis, and conjunctivitis. Cases of basketball-related acute angle-closure glaucoma, globe perforations, and orbital fractures were categorized as “other.” The Lifespan Institutional Review Board exempted this study from review.

The NEISS query yielded a sample of 1584 cases; 1570 were included for analysis. Per the NEISS algorithm, this extrapolated to an estimated 46,793 (95% CI: 37,654–55,933) ED visits for basketball-related eye injuries. The estimated number of yearly ED visits decreased by 54.1% during the study period ($\beta = -333.0$, $p = 0.0079$) (Fig. 1). This trend was largely driven by a significant decrease (47.2%) in ED visits from 2019 through 2020 ($\beta = -2168.0$, $p < 0.001$); there was no significant decrease from 2012 through 2019 ($\beta = -153.1$, $p = 0.1967$).

Table 1 describes the characteristics of victims of basketball-related eye injuries and the types and mechanisms of injury. Of the 1570 cases, 87.1% (1368/1570) were male and 56.7% (890/1570) involved children (< 18 years old). Corneal abrasions were the most frequent injuries in both children [49.6% (441/890)] and adults [53.7%

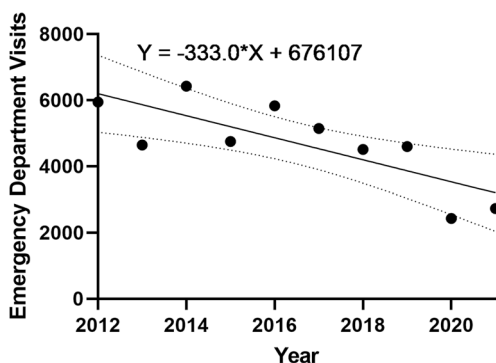


Fig. 1 Yearly ED visits for basketball-associated eye injuries in the US, 2012–2021

(365/680)]. Using the narratives, it was possible to ascertain the mechanism of injury in 91.6% (1438/1570) of cases; most were caused by contact with another player [children: 69.6% (619/890); adults: 79.1% (538/680)]. Most patients were released from the ED following examination and treatment [children: 97.4% (867/890); adults: 95.9% (652/680)].

Discussion

The estimated number of yearly ED visits for basketball-related eye injuries in the US decreased significantly from 2012 through 2021. However, the largest decrease was observed between 2019 and 2020; this trend mirrors that observed in baseball-related eye injuries and most likely stems from decreased participation in sports due to COVID-19 [5]. Other possible factors contributing to the decrease include (a) the impact of campaigns initiated by organizations such as the American Academy of Ophthalmology in 2009 and Prevent Blindness in 2015 to encourage the use of eye protection in basketball and (b) the greater use of urgent care over EDs for acute care [5].

The most common eye injury was a corneal abrasion, and the most common mechanism of injury was contact with another basketball player. Both underscore the potential role of eye protection as a preventative measure; however, most basketball players do not have eye protection at the time of injury [1, 4] and there are no requirements for eye protection for US basketball players at any level.

The NEISS database has several limitations. As it only captures patients treated in EDs, the data may be skewed towards more severe eye injuries. In addition, the NEISS database only provides data on demographics, diagnosis, mechanism of injury and final disposition for patients on the ED visit; other examination findings (e.g., visual acuity) and follow-up data are not available. Furthermore, the case narratives did not consistently specify the parts of the eye that were involved in the basketball-related eye injuries. Finally, the NEISS database only includes closed or open globe injuries that were evaluated in an ED.

Table 1 Characteristics of Basketball-Related Eye Injuries in United States Emergency Departments, 2012–2021

<i>Characteristics</i>	Age < 18 years n (%)	Age ≥ 18 years n (%)	<i>Total</i> n (%)
Sex			
<i>Male</i>	733 (82.4)	635 (93.4)	1368 (87.1)
<i>Female</i>	157 (17.6)	45 (6.6)	202 (12.9)
Race			
<i>White</i>	223 (25.1)	110 (16.2)	333 (21.2)
<i>Black</i>	333 (37.4)	266 (39.1)	599 (38.2)
<i>Asian</i>	10 (1.1)	16 (2.4)	26 (1.7)
<i>American Indian/Alaska Native</i>	4 (0.4)	1 (0.1)	5 (0.3)
<i>Native Hawaiian/Pacific Islander</i>	1 (0.1)	3 (0.4)	4 (0.3)
<i>Other</i>	44 (4.9)	27 (4.0)	71 (4.5)
<i>Not Stated</i>	275 (30.9)	257 (37.8)	532 (33.9)
Diagnosis			
<i>Corneal abrasion</i>	441 (49.6)	365 (53.7)	806 (51.3)
<i>Contusion</i>	58 (6.5)	53 (7.8)	111 (7.1)
<i>Irritation / Inflammation</i>	71 (8.0)	45 (6.6)	116 (7.4)
<i>Foreign Body</i>	31 (3.5)	10 (1.5)	41 (2.6)
<i>Laceration or Puncture</i>	36 (4.0)	24 (3.5)	60 (3.8)
1. Conjunctiva	19 (2.1)	4 (0.5)	23 (1.5)
2. Cornea	3 (0.3)	3 (0.4)	6 (0.4)
3. Eyelid	4 (0.4)	1 (0.1)	5 (0.3)
4. Non-specific	10 (1.1)	16 (2.4)	26 (1.7)
<i>Subconjunctival Hemorrhage</i>	71 (8.0)	57 (8.4)	128 (8.2)
<i>Hyphema</i>	12 (1.3)	4 (0.6)	16 (1.0)
<i>Vitreoretinal Damage</i>	3 (0.3)	11 (1.6)	14 (1.0)
<i>Other</i>	10 (1.1)	4 (0.6)	14 (1.0)
1. Globe Perforations	3 (0.3)	3 (0.5)	6 (0.4)
2. Acute Angle-closure Glaucoma	1 (0.1)	0	1 (0)
3. Orbital Fractures	6 (0.7)	1 (0.1)	7 (0.5)
<i>Non-specific</i>	157 (17.6)	107 (15.7)	264 (16.8)
Mechanism			
<i>Contact with Another Player</i>	619 (69.6)	538 (79.1)	1157 (73.4)
<i>Contact with Basketball</i>	112 (12.6)	63 (9.3)	175 (11.1)
<i>Contact with Self</i>	10 (1.1)	3 (0.4)	13 (0.8)
<i>Fall</i>	12 (1.3)	1 (0.1)	13 (0.8)
<i>Loose Fine Objects / Projectiles</i>	59 (6.6)	11 (1.6)	70 (4.5)
<i>Collide into Equipment</i>	6 (0.7)	4 (0.6)	10 (0.6)
<i>Unknown</i>	72 (8.1)	60 (8.8)	132 (8.4)
Disposition			
<i>Released Following Examination and Treatment</i>	867 (97.4)	652 (95.9)	1519 (96.8)
<i>Treated and Transferred</i>	4 (0.5)	3 (0.4)	7 (0.4)
<i>Treated and Admitted</i>	9 (1.0)	9 (1.3)	18 (1.1)
<i>Held For Observation</i>	1 (0.1)	0	1 (0)
<i>Left Without Being Seen/Left Against Medical Advice</i>	9 (1.0)	16 (2.3)	25 (1.6)
Total	890	680	1570

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Declarations

Competing interests The authors of this work report no competing interests. The views expressed here are those of the authors and do not necessarily reflect the position or policy of the US Department of Veterans Affairs or the US government.

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References

1. Lee T-H, Chen Y-H, Kuo H-K et al (2017) Retinal detachment associated with basketball-related eye trauma. *Am J Ophthalmol* 180:97–101. <https://doi.org/10.1016/j.ajo.2017.05.025>
2. Wisely CE, Legault G, Kim T (2021) Retrospective review of Duke men's basketball eye care: annual screenings and traumatic injuries. *Phys Sportsmed* 49:337–341. <https://doi.org/10.1080/00913847.2020.1835137>
3. Go JA, Lin SY, Williams KJ et al (2020) Eye injuries in the National Basketball Association. *Ophthalmology* 127:696–697. <https://doi.org/10.1016/j.ophtha.2019.12.016>
4. Zigelbaum BM, Starkey C, Hersh PS et al (1960) (1995) The National Basketball Association eye injury study. *Arch Ophthalmol Chic Ill* 113:749–752. <https://doi.org/10.1001/archophth.1995.01100060075035>
5. Patel PA, Gopali R, Reddy A, Patel KK (2022) Baseball-related ocular injuries in the United States: a 10-year analysis. *Expert Rev Ophthalmol* 17:145–151. <https://doi.org/10.1080/17469899.2022.2039629>

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