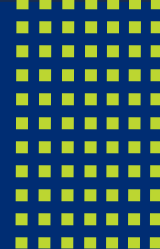




HEALTH MATTERS BRIEF

Sports and Recreation-Related Traumatic Brain Injuries in Riverside County, CA (2018-2022)



INTRODUCTION

In the United States, sports and recreation-related traumatic brain injuries (SRR-TBI) saw a significant decline in 2018 after a decade long increase, primarily due to a reduction in incidents associated with football, likely contributing factors include decreased participation and the implementation of contact limitations (Waltzman, 2020). Despite the decline, football remains the sport with the highest incidence of contact SRR-TBI across all demographics within Riverside County. Understanding the leading causes of SRR-TBI can help in identifying emerging health concerns and support public health decisions for improving population health. This brief examined SRR-TBI among Riverside County residents by analyzing emergency department and hospitalization data to inform public health strategies aimed at preventing SRR-TBIs.

Between 2018 and 2022, non-fatal sports and recreation-related traumatic brain injuries (SRR-TBI) accounted for 21% (4,292) of the 20,491 TBI-related treat-and-release emergency department (ED) visits. Individuals aged 10-18 experienced the highest number of these visits, a trend consistent with national studies (Reid, 2017). According to Reid, SRR-TBI data are based on the level of contact involved: contact, limited contact, non-contact, and other.

- Contact activities include football, soccer, basketball, wrestling, and lacrosse.
- Limited Contact activities include bike riding, horseback riding, and cheerleading.
- Non-Contact activities include walking.
- Other activities include mountain climbing, climbing, and racquetball.

RIVERSIDE COUNTY KEY FINDINGS



Football was the contact sport with the highest incidence of SRR-TBI ED visits.



Bike riding was the limited contact sport with the highest incidence of SRR-TBI ED visits.



Black/African American residents had the highest age-adjusted rates of contact SRR-TBI ED visits (24.8 per 100,000 population).



Youth aged **10-18** had the highest SRR-TBI ED visit rates for contact, limited contact, and non-contact activities.



Sports and Recreation-related Traumatic Brain Injury Emergency Department Visits

Among SSR-TBI ED visits in 2022, contact and limited contact experienced the highest rate of ED visits (Figure 1). All categories, except "other", experienced a decline in SRR-TBI ED visits in 2020, with a gradual return to pre-pandemic levels.

Figure 1. Age Adjusted SRR-TBI Emergency Department Visits by Contact Level and Year, Riverside County (2018-2022)

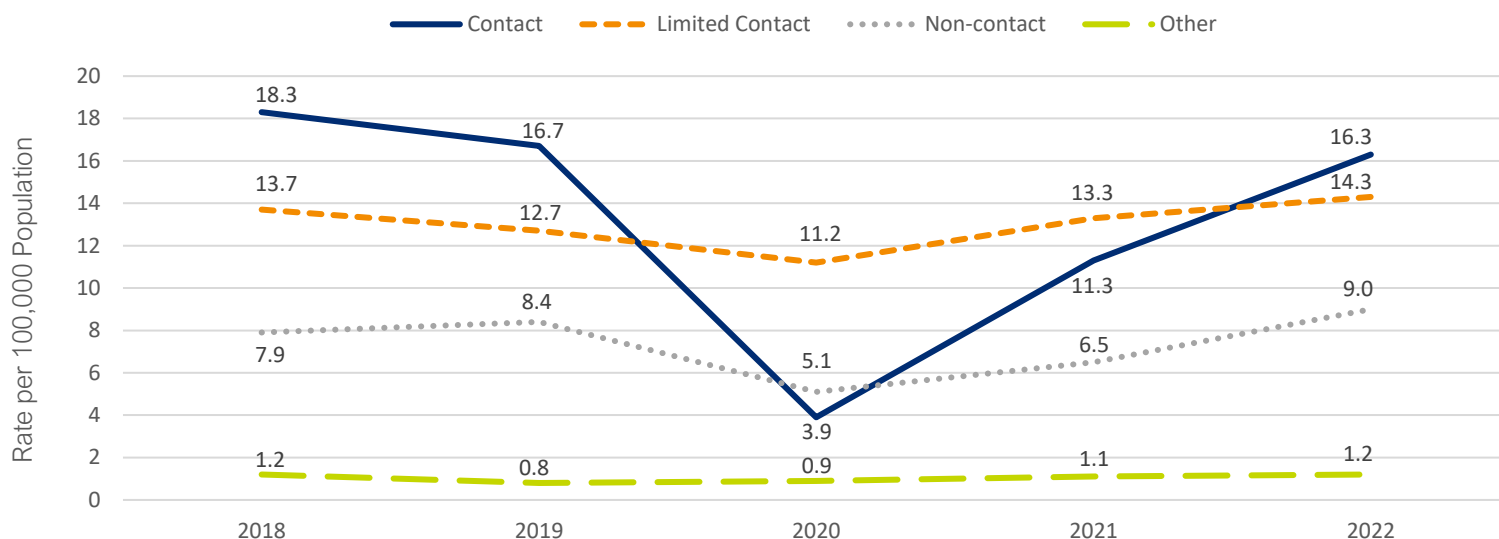
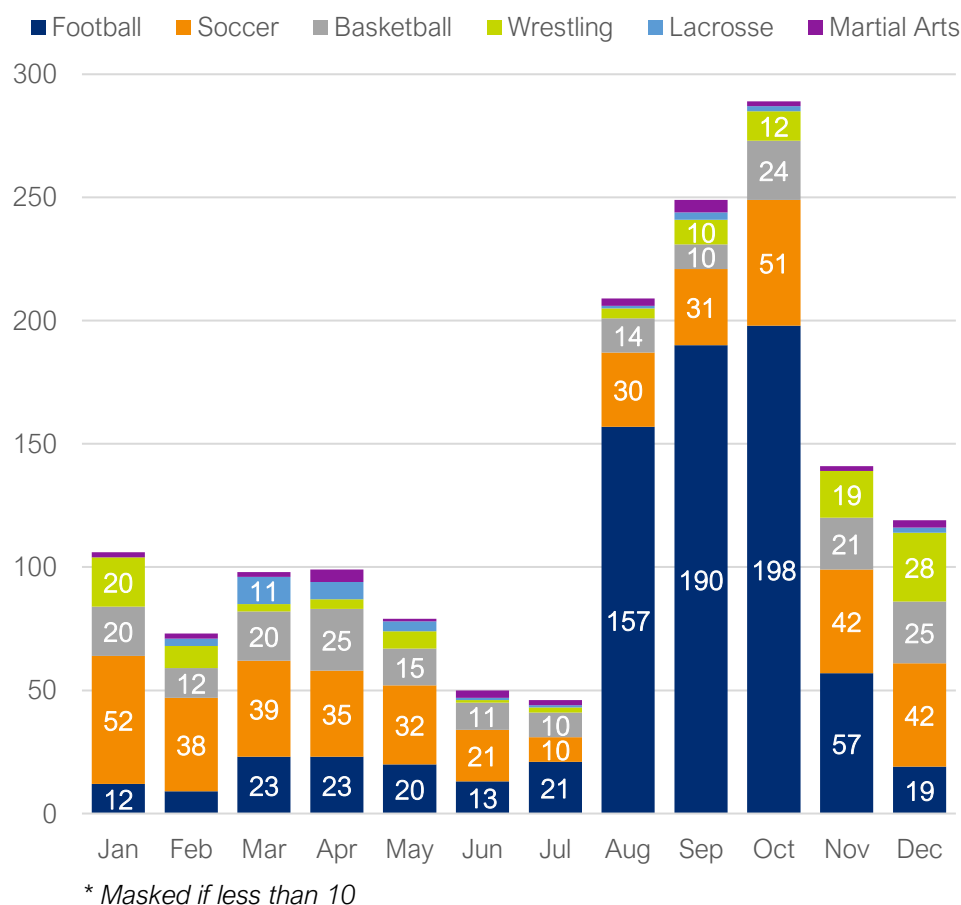


Figure 2. Number of SRR-TBI Emergency Department Visits for the Top Six Contact Sports by Month, Riverside County (2018-2022)

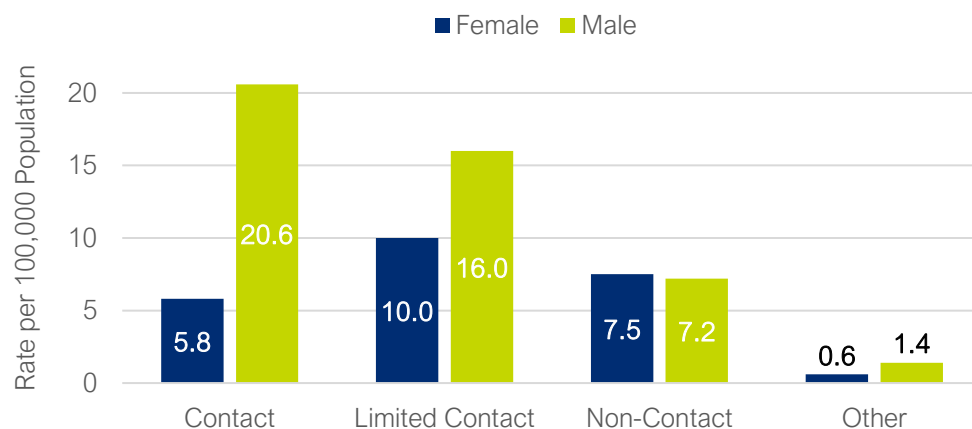
Temporal trends of contact SRR-TBI ED visits align with specific contact sport seasons. From 2018 to 2022, the highest monthly counts of contact SRR-TBI ED visits occurred in August (n=213), September (n=252) and October (n=298) (Figure 2) with October having the highest overall number. Football had the highest number of SRR-TBI ED visits, peaking from August to October (Figure 2). Soccer saw the highest count from October to January and maintained elevated incidences throughout the year, with the lowest count in July (Figure 2). Basketball TBI injuries remained steady across all months (Figure 2).





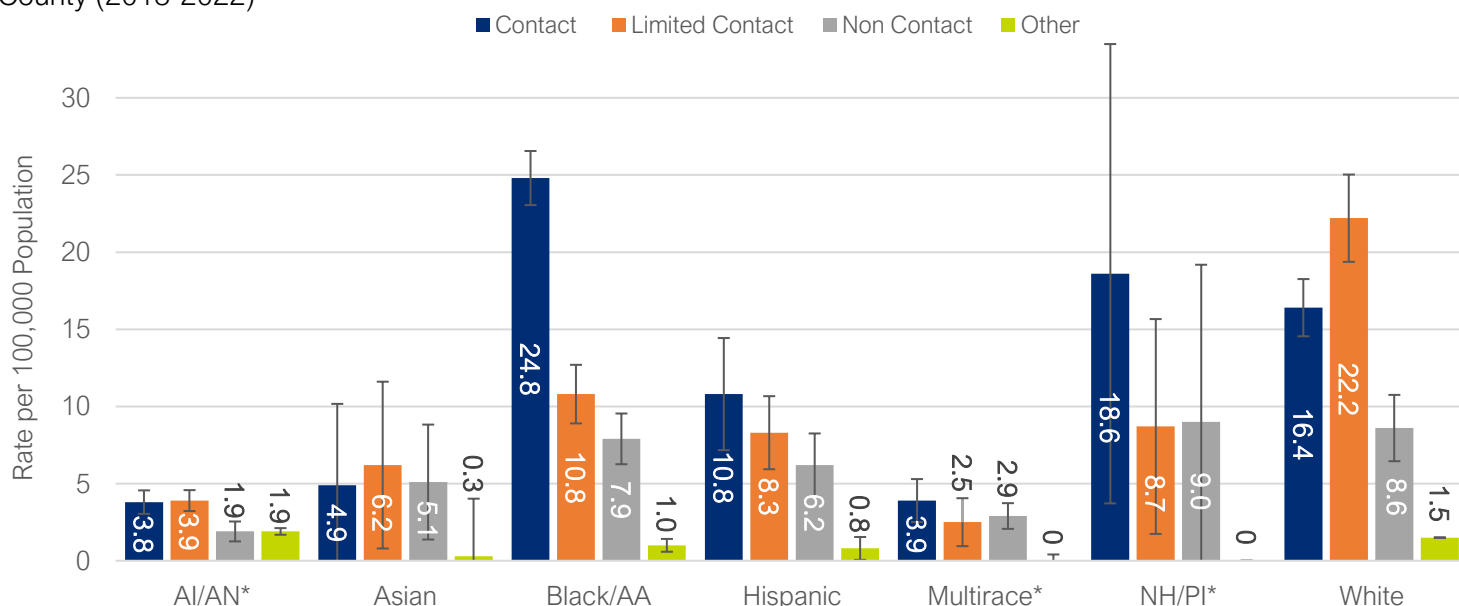
Males had higher SRR-TBI ED visit rates across all contact levels. Among females, the highest rates were observed in limited-contact sports (Figure 3). The leading activities by contact level for SRR-TBI ED visits were football for contact, bike riding for limited contact, walking for non-contact activities, and other rappelling or jumping for other.

Figure 3. Age Adjusted SRR-TBI Emergency Department Visits by Contact Level and Sex, Riverside County (2018-2022)



Among those who participate in contact sports, Black/African American residents maintained the highest rate of ED visits (Figure 4). White residents had the highest rate of limited contact SRR-TBI ED visits. Contact and limited contact sport injuries were the primary cause of SRR-TBI ED visits (n=2,553), with those aged 10-18 accounting for the highest rates (86.9 and 52.3, respectively) of SRR-TBI ED visits (Figure 5).

Figure 4. Age Adjusted SRR-TBI Emergency Department Visits by Contact Level and by Race and Ethnicity, Riverside County (2018-2022)



Note: Racial groups with an asterisk * have unstable rates due to low counts.

Abbreviations: American Indian/Alaska Native (AI/AN), Black/African American (Black/AA), and Native Hawaiian or Pacific Islander (NH/PI)

Figure 5. Age-Specific SRR-TBI Emergency Department Visits by Contact Level and Age Group, Riverside County (2018-2022)

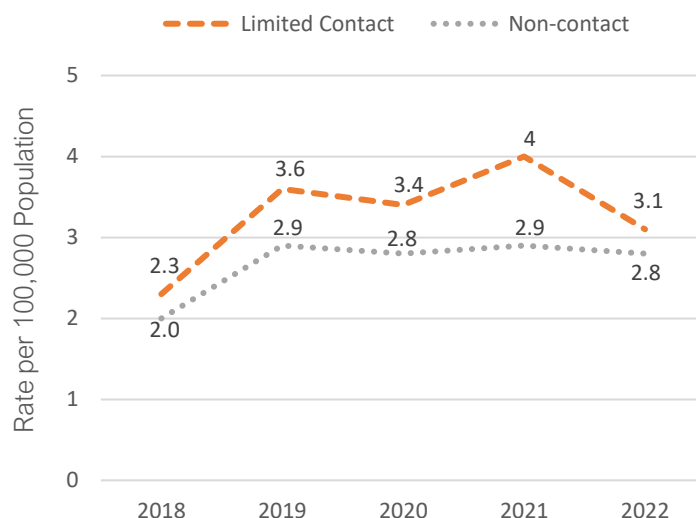
Contact Level	0-9	10-18	19-24	25-44	45-64	65+
Contact	5.7	86.9	8.6	2.2	0.7	*0.2
Limited Contact	6.4	52.3	18.6	8.8	5.0	2.4
Non-Contact	10.6	12.8	4.7	5.0	4.8	11.1
Other	2.6	2.0	1.5	0.6	0.4	*0.2

*: unstable rate

Sports and Recreation-related Traumatic Brain Injury Hospitalizations

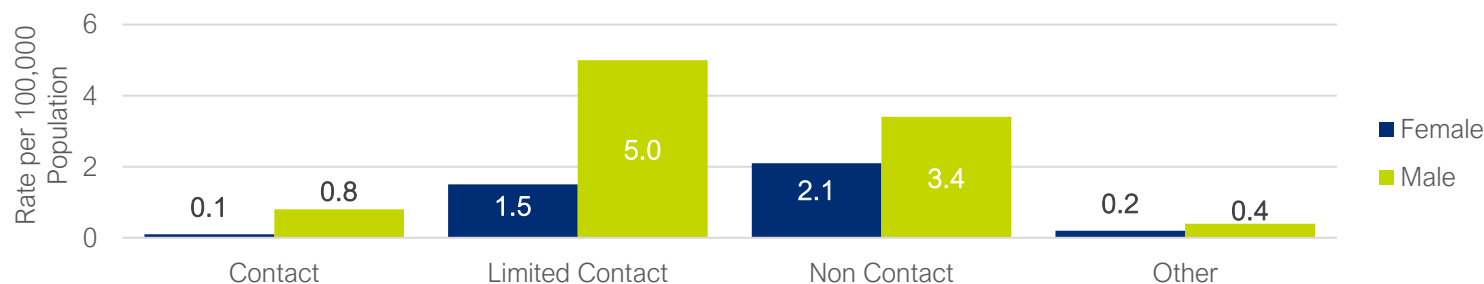
From 2018 to 2022, sports and recreation-related traumatic brain injury (SRR-TBI) hospitalizations in Riverside County were most frequently associated with limited-contact and non-contact sports. Hospitalization rates for limited-contact sports peaked in 2021, before declining in 2022 (Figure 6). Non-contact sports-related TBIs maintained similar rates from 2019 to 2022 (Figure 6). Males had the highest age-adjusted rate of SRR-TBI hospitalizations for limited-contact sports, at 5 per 100,000 residents for limited contact, compared to 1.5 per 100,000 among females (Figure 7). Hospitalizations due to limited contact SRR-TBI were highest rate among white residents (8.7 per 100,000 population)(Figure 8).

Figure 6. Age Adjusted SRR-TBI Hospitalizations by Contact Level* and Year, Riverside County (2018-2022)



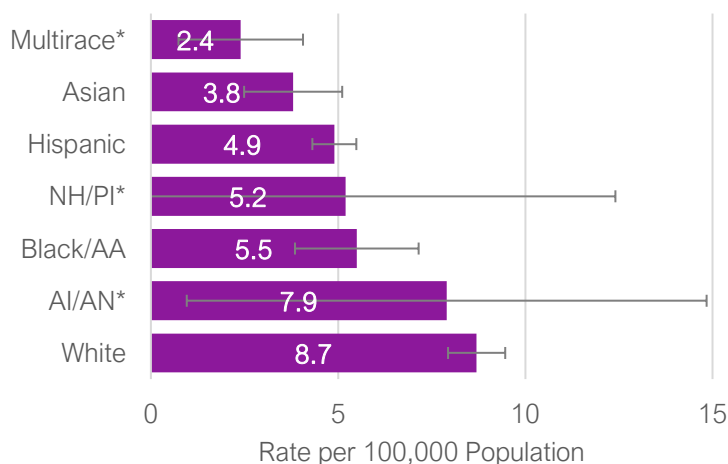
Note: Contact and Other Type were excluded due to unstable rates

Figure 7. Age-Adjusted SRR-TBI Hospitalizations by Contact Level and Sex, Riverside County (2018-2022)



Among all SRR-TBI Hospitalizations combined, residents aged **65+** had the highest hospitalization rate (Figure 9).

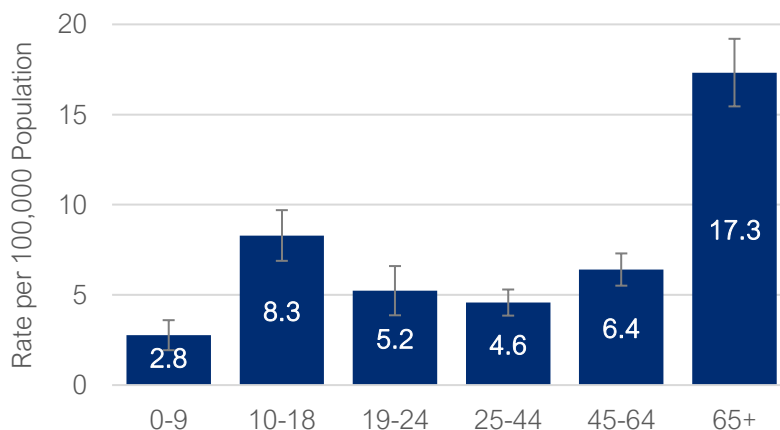
Figure 8. Age-Adjusted SRR-TBI Hospitalizations by Race and Ethnicity, Riverside County (2018-2022)



Note: Racial groups with an asterisk * have unstable rates due to low counts.

Abbreviations: American Indian/Alaska Native (AI/AN), Black/African American (Black/AA), and Native Hawaiian or Pacific Islander (NH/PI)

Figure 9. Age-Specific SRR-TBI Hospitalizations by Age Group, Riverside County (2018-2022)



DISCUSSION

Our analysis of Riverside County found a decline in SRR-TBI emergency department (ED) visits in 2020, with rates returning to pre-pandemic levels once sports resumed. Riverside County mirrored national trends where football remains the leading cause of SRR-TBI visits (Waltzman, 2020). Overall differences among age and racial groups by contact type activities underscore the need for tailored prevention strategies. Targeted public health campaigns are essential to reducing SRR-TBI risks and improving long-term health outcomes for youth who experience particularly high rates of SRR-TBI ED visits, such as Injury Prevention Services helmet distributions. Rates were calculated using California Department of Finance (DOF) population denominators; however, a key limitation was the lack of data on the number of individuals participating in activities at various contact levels.

METHODOLOGY

1. Data was obtained from the California Department of Health Care Access and Information (California Department of Health Care Access and Information, n.d.). Records were selected between 2018 and 2022 for emergency department visits and hospitalizations:
 - Traumatic Brain Injuries (TBI) ED visits were classified using ICD-10 diagnosis codes: S02.0, S02.1, S02.8X**, S02.80, S02.81, S02.82, S02.91, S04.02, S04.03, S04.04, S06, S07.1, T74.4 (citation 2).
 - Traumatic Brain Injuries (TBI) hospitalizations were classified using ICD-10 diagnosis code S09.90 (citation 2).
 - Observations were filtered to sports and recreation-related TBI ed visits and hospitalizations. Contact types were classified using ICD-10 codes as defined in table 4 of citation 3.

REFERENCES

- California Department of Health Care Access and Information (HCAI). (n.d.). Emergency Department (ED) and Patient Discharge Data (PDD), Riverside County, 2018–2022. <https://hcai.ca.gov/>
- Centers for Disease Control and Prevention. (2021). State injury indicators report: Instructions for preparing 2021 data. National Center for Injury Prevention and Control. <https://stacks.cdc.gov/view/cdc/128417>
- Reid LD, Fingar KR. (2020). Inpatient Stays and Emergency Department Visits Involving Traumatic Brain Injury, 2017. HCUP Statistical Brief #255. Agency for Healthcare Research and Quality, Rockville, MD. <https://hcup-us.ahrq.gov/reports/statbriefs/sb255-Traumatic-Brain-Injury-Hospitalizations-ED-Visits-2017.pdf>
- Waltzman D, Womack LS, Thomas KE, Sarmiento K. (2020). Trends in Emergency Department Visits for Contact Sports–Related Traumatic Brain Injuries Among Children — United States, 2001–2018. MMWR Morb Mortal Wkly Rep 2020;69:870–874. DOI: <http://dx.doi.org/10.15585/mmwr.mm6927a4>

SUGGESTED CITATION

Perez. A, Corzine, K. (June 2025). *Sports and Recreation-Related Traumatic Brain Injuries in Riverside County, CA (2018-2022)*. Health Matters Brief. Riverside University Health System-Public Health, Epidemiology & Program Evaluation.

ACKNOWLEDGEMENTS

Patton, T., PhD, Hutajulu, R., MEcon, Law, E., MPH, Gardner, A., MA, MPH, Hetherington, W., MPH, Penny, M., DrPH, MPH, Chevinsky, J., MD, MPH, Saruwatari, K., MPH, were integral to the development of this brief.