



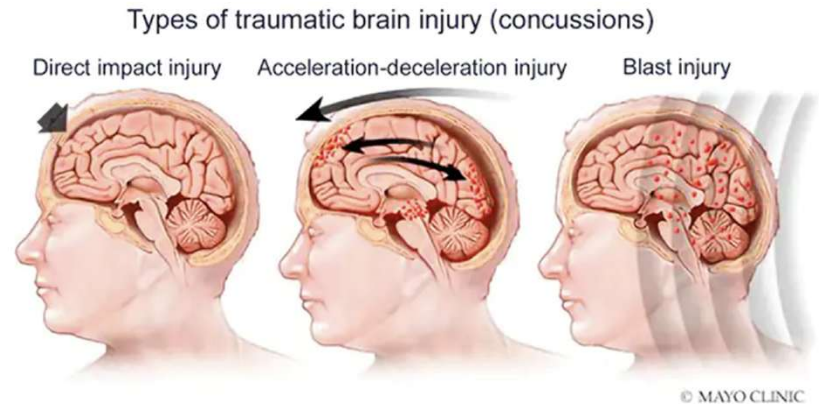
Traumatic Brain injury

Disease Information Packets – Slide Set
Public Health Services, Community Health Statistics
09/2025



What is Traumatic Brain Injury (TBI)?

- **Traumatic Brain Injury (TBI)** is a head injury caused by an external force, a blow to the head or body, or a penetrating injury to the head, resulting in a disruption of normal brain function. This disruption is caused by bleeding, swelling, and tearing damage to the brain tissue and nerve fibers. Injury can be either penetrating or non-penetrating.
- **Focal Injuries** refer to damage confined to one area. **Diffuse** injuries refer to more widespread damage.
 - Acute damage caused by TBI: Diffuse axonal injury (DAI), Concussion, Hematomas, Contusions, Skull Fractures, Chronic Traumatic Encephalopathy (CTE), Post-traumatic dementia (PTD)
 - Secondary Damage caused by TBI: Hemorrhagic progression of a contusion (HPC), breakdown of blood-brain barrier, increased intracranial pressure
- Can occur from both unintentional and intentional events, including:
 - Falls, motor vehicle crashes, firearm-related suicide, assaults, explosions/ blasts
- Can be classified into mild, moderate, or severe categories
 - Mild/ Concussion: Chemical changes in the brain causing symptoms of headache, and/ or problems with concentration, memory, and balance
 - Moderate/ Severe: Occur mostly due to falls and firearm-related injuries resulting in death or long-term health effects.



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Sources: Centers for Disease Control and Prevention. (2024, April 29). *Facts about TBI*. Centers for Disease Control and Prevention. <https://www.cdc.gov/traumatic-brain-injury/data-research/facts-stats/index.html>
National Institute of Neurological Disorders and Stroke. (2024, June 6). *Traumatic Brain Injury (TBI)*. National Institute of Health. <https://www.ninds.nih.gov/health-information/disorders/traumatic-brain-injury-tbi>

Demographic Risk Factors

- **Age**

- Older adults ages 75+ have the highest rates of TBI hospitalizations and deaths due to unintentional falls.
- Ages 15-24 have the highest risk of TBI due to unintentional MVCs.

- **Race/ Ethnicity**

- American Indian/ Alaska Native children and adults have higher rates of TBI hospitalizations and deaths than other groups. Disparity is due to higher rates of MVCs, substance use, suicide, and access to healthcare.
- Hispanic and non- Hispanic Black patients are less likely to receive comprehensive follow- up care than non-Hispanic white patients, leading to poorer outcomes in mental health and functional abilities within these groups.

- **Sex/ Gender**

- Males have higher rates of hospitalization and death from TBI than females.

- **Socioeconomic status (SES)**

- Lower incomes are associated with less access to TBI care, including procedures and rehabilitation; Low SES and uninsured patients are more likely to die in a hospital than individuals with higher incomes.

- **Geography**

- People living in rural areas have a greater risk of mortality from TBI, due to reduced access to Level I trauma centers, and longer travel distances to hospitals.



Special Populations

- **Military Service members and Veterans**

- In 2023, 19,492 TBIs were suffered by armed forces service members worldwide; 81.8 % were mild, 17.2% were moderate, <1% were severe, <1% were penetrating.
- Members who have experienced TBI may also experience PTSD, depression, and suicidal ideations.

- **Correctional/ detention facilities**

- It is estimated that nearly half of people in these facilities have a history of TBI, but the true number cannot be confirmed due to research gaps. Challenges include a lack of TBI screening and related care.
- Research shows an association between TBI history and mental health conditions, substance use disorders, and suicidal ideation.

- **People experiencing homelessness**

- More likely to have any type of TBI, along with higher likelihood to experience violence, suicidal ideations, use substances, and have poorer physical health, compared to the general population.

- **Survivors of intimate partner violence**

- TBIs are due to assault
- More likely to experience PTSD, other mental health conditions, and worse physical health compared to the general population.



Social and Behavioral Risk Factors

- **Lack of Physical Activity**

- Lack of physical activity affects balance due to weakened musculoskeletal system.

- **Lack of Education**

- TBIs are underdiagnosed in the older population due to a lack of comprehensive screening protocol after falls.

- **Substance Use**

- Substance use is prevalent in marginalized populations; American Indian and Alaskan Native communities have disproportionately higher rates of substance use than the rest of the U.S. population.
- Increased rates of substance use result in a higher likelihood of impaired driving, causing MVC related TBI. The leading causes of death if American Indian and Alaskan Natives ages 15-24 as outlined in the latest edition of Trends in Indian Health are unintentional injuries (MVC and other), suicide, and homicide.

- **Mental Health\ Adverse Experiences**

- Experiencing trauma may lead to mental health conditions like PTSD and depression, which are associated with suicidal ideation and risk of TBI through firearm related injury.
- American Indian and Alaskan Native report psychological distress 2.5 times more than the general population each month.



Concussions Are Brain Injuries, Too!

CONCUSSIONS IN CHILDREN: AN INVISIBLE INJURY

- Children aged 17 and under account for about 70% of TBI and concussions related to sports and recreation ED visits, with the top cause being collisions among athletes.
- Most concussions in children resolve in under 4 weeks.
- Longer lasting concussions may result in behavioral, mood, memory, or emotional changes, potentially lasting through adulthood.
- After having one concussion, children are more susceptible to more concussions after repeated exposure to head impacts, leading to longer recovery time and risk of chronic health issues, including mental health conditions.



Diagnosing TBI

- All TBIs should be evaluated by an experienced professional by neurological exam to test motor and sensory skills, hearing and speech, coordination and balance, mental status, and assess changes in mood or behavior.
 - Coaches and athletic trainers can quickly identify concussions using screening tools
- Brain imaging can be used to evaluate the extent of brain injuries and if surgical intervention is needed.
 - CT scans show skull fractures, bleeding, and swelling. MRI imaging can show subtle changes that may be missed by the CT
- Brain function tests used in conjunction with imaging can evaluate individuals with a mild TBI.
 - These tests include tasks that assess memory, concentration, information processing, executive functioning, reaction time, and problem solving.
- Establishing a baseline using a screening tool can be a helpful reference to assess an athlete after a collision or event that could result in possible concussion.
 - Baseline comparisons can help professionals note any abnormal changes in his or her cognitive abilities and make decisions about when to return the athlete to normal activities.



Sources: Concussion Alliance. (2025, February 6a). *Your child or adolescent was just diagnosed with a concussion. What do you do now?*. Concussion Alliance. <https://www.concussionalliance.org/concussion-management-for-children-and-adolescents>
American Brain Foundation. (2025, April 10a). *Traumatic Brain Injury*. American Brain Foundation. <https://www.americanbrainfoundation.org/diseases/traumatic-brain-injury/>

Treating TBI

■ Many factors influence how TBI is treated:

- Size, severity, and location of injury; whether damage occurs immediately after injury or if TBI develops from secondary injuries occurring days to weeks after initial trauma.

❖ Receiving immediate medical care from a certified trauma center results in the best health outcomes.

■ Mild TBI

- Follow- up with healthcare provider to confirm recovery progress and treat any ongoing symptoms.
- Be aware of any new symptoms, including feelings and mood, up to several weeks after injury.
- Medications used to treat TBI symptoms (headache, seizures, blood clots, alertness, anxiety):
 - Pain medications (OTC and prescribed), anticonvulsant drugs, anticoagulants, diuretics, stimulants antidepressants/ antianxiety medications.

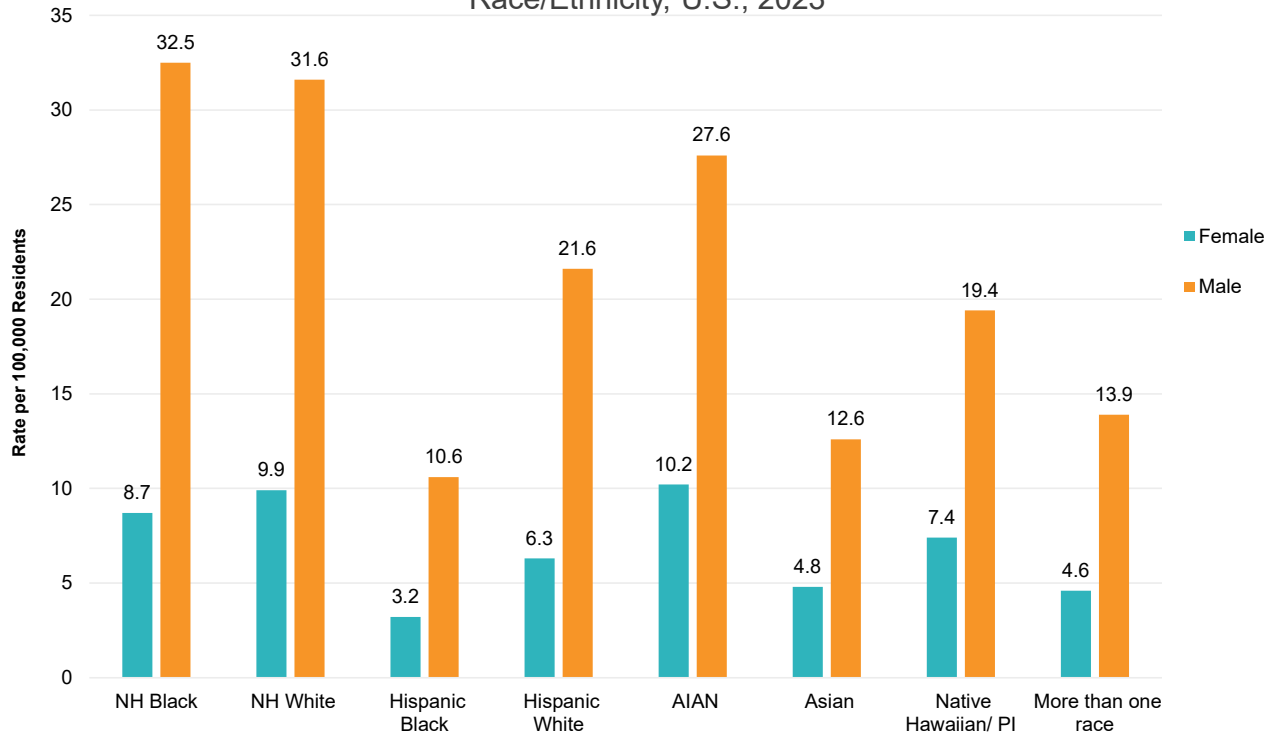
■ Severe TBI

- Focus is on preserving life: Stabilize spinal cord and vital organ functions, oxygen delivery and breathing, and preventing further brain damage or infection.
- Rehabilitation therapy to improve ability to perform activities of daily living and regaining normal brain function.



National Statistics and Disparities

Age-Adjusted* Death Rates due to Traumatic Brain Injury (TBI), by Sex and Race/Ethnicity, U.S., 2023



*Age-adjusted rates per 100,000 2000 US standard population

Source: Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System, Mortality 2018-2023 on CDC WONDER Online Database, released in 2024. Data are from the Multiple Cause of Death Files, 2018-2023, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at <http://wonder.cdc.gov/mcd-icd10-expanded.html> on Apr 7, 2025.

Prepared by County of San Diego, Health and Human Services Agency, Public Health Services, Community Health Statistics Unit, June 2025.
<https://www.sdhealthstatistics.com/>
[LiveWellSD.org](https://www.livewellsd.org).

■ In 2023, in the U.S.,

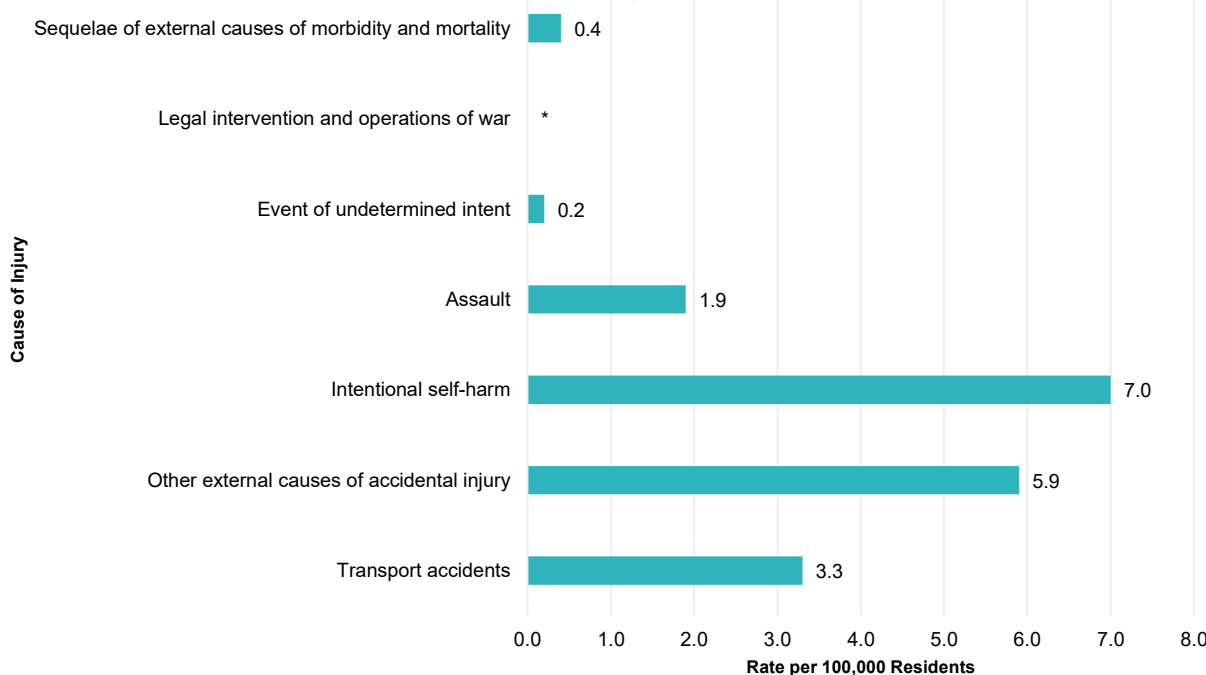
- Males had higher age-adjusted death rate due to TBI compared to females across different race/ ethnicity groups.
- non- Hispanic Black or African American males experience the highest mortality rates by TBI out of all groups (32.5 per 100,000).
- American Indian/ Alaska Native females experience higher mortality rates than all other females (10.2 per 100,000).



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National Statistics and Disparities

****Age-Adjusted Death Rates From Traumatic Brain Injury (TBI) By Cause, U.S., 2023**



*Indicates unreliable statistic

**Age-adjusted rates per 100,000 2000 US standard population

Source: Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System, Mortality 2018-2023 on CDC WONDER Online Database, released in 2024. Data are from the Multiple Cause of Death Files, 2018-2023, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at <http://wonder.cdc.gov/mcd-icd10-expanded.html> on Apr 7, 2025.

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■ In 2023, in the U.S.,

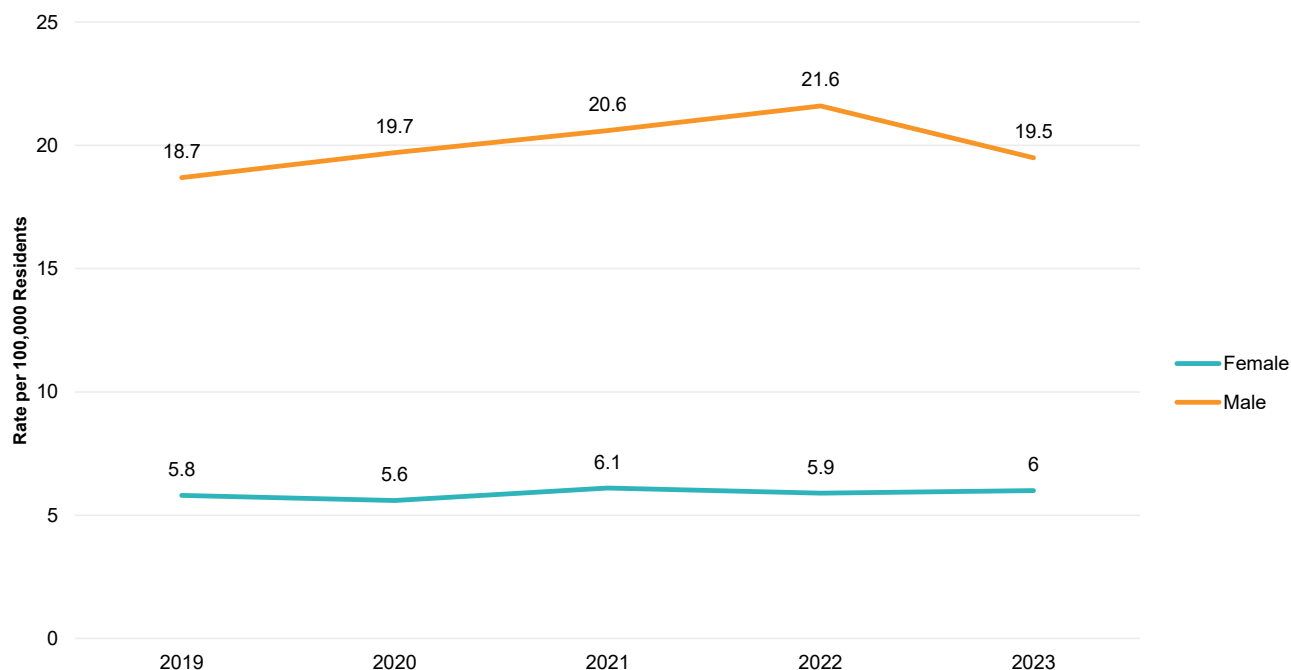
- intentional self-harm is the leading mechanism of TBI Injury resulting in death (7.0 per 100,000 population).
- other external causes of accidental injury was the second leading cause of TBI death (5.9 per 100,000 population).
- TBIs from transport accidents account for 3.3 deaths per 100,000, about half the rate of intentional self-harm.
- TBIs from assault was the fourth leading cause of TBI mortality (1.9 deaths per 100,000 population).



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State Statistics

Traumatic Brain Injury (TBI) Death Rates by Year and Sex, California, 2019-2023



Source: Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System, Mortality 2018-2023 on CDC WONDER Online Database, released in 2024. Data are from the Multiple Cause of Death Files, 2018-2023, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at <http://wonder.cdc.gov/mcd-icd10-expanded.html> on Apr 7, 2025.

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<https://www.sdhealthstatistics.com/>
[LiveWellSD.org](https://www.livewellsd.org).

- From 2019-2023, in California,
 - TBI death rates among males trended slightly upward from 2019-2022 and decreased from 2022-2023.
 - TBI death rates among females remained stable overall from 2019-2023.
 - there were 6,738 deaths due to TBI among females and 19,981 deaths due to TBI among males (26,719 total deaths due to TBI).



State Statistics

Death Rates due to Traumatic Brain Injury (TBI) by Age and Cause, California, 2021-2023



*Indicates unreliable statistic

Source: Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System, Mortality 2018-2023 on CDC WONDER Online Database, released in 2024. Data are from the Multiple Cause of Death Files, 2018-2023, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at <http://wonder.cdc.gov/mcd-icd10-expanded.html> on May 27, 2025.

Prepared by County of San Diego, Health and Human Services Agency, Public Health Services, Community Health Statistics Unit, June 2025.
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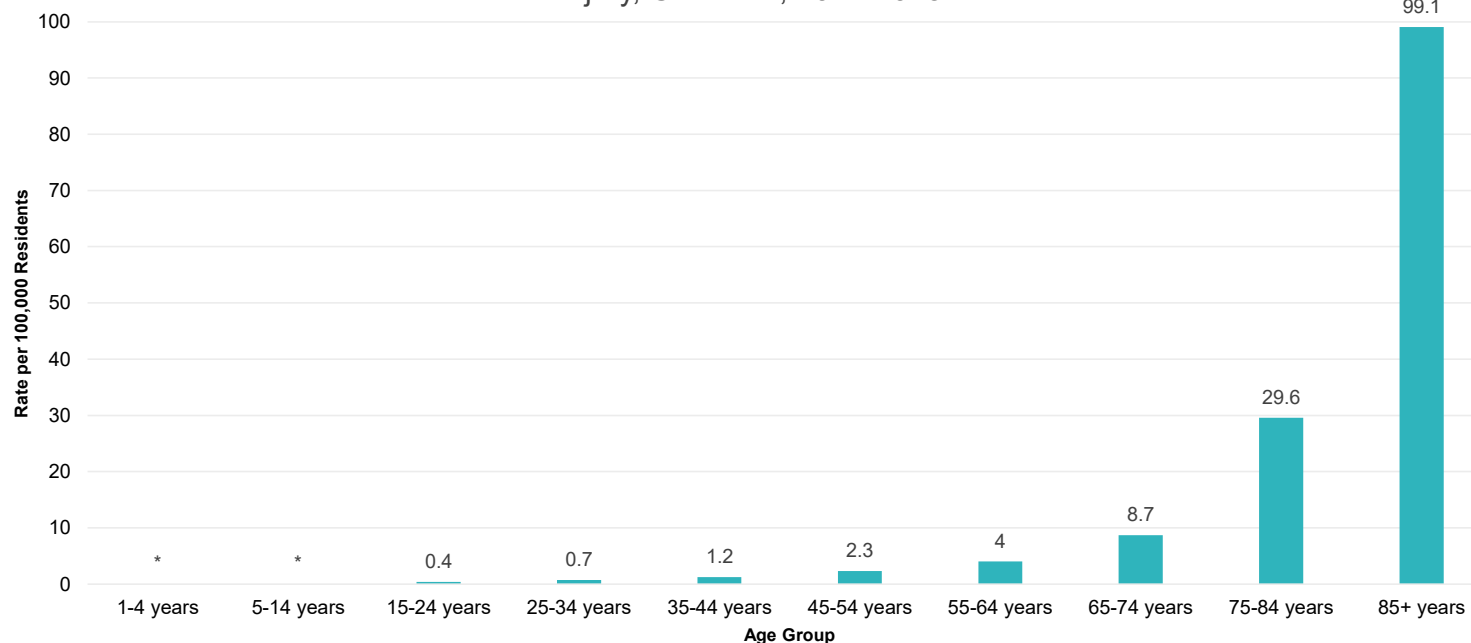
- From 2021-2023, in California,
 - the leading cause of TBI mortality in 15-24-year-olds and 25-34-year-olds was transport accidents.
 - intentional self-harm was the leading cause of TBI mortality in the age groups 35-44, 45-54, and 55-64.



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State Statistics

Death Rates due to Traumatic Brain Injury (TBI) by Age and Other External Causes of Injury, California, 2021-2023



*Indicates unreliable statistic

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, Mortality 2018-2023 on CDC WONDER Online Database, released in 2024. Data are from the Multiple Cause of Death Files, 2018-2023, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at <http://wonder.cdc.gov/mcd-icd10-expanded.html> on May 27, 2025.

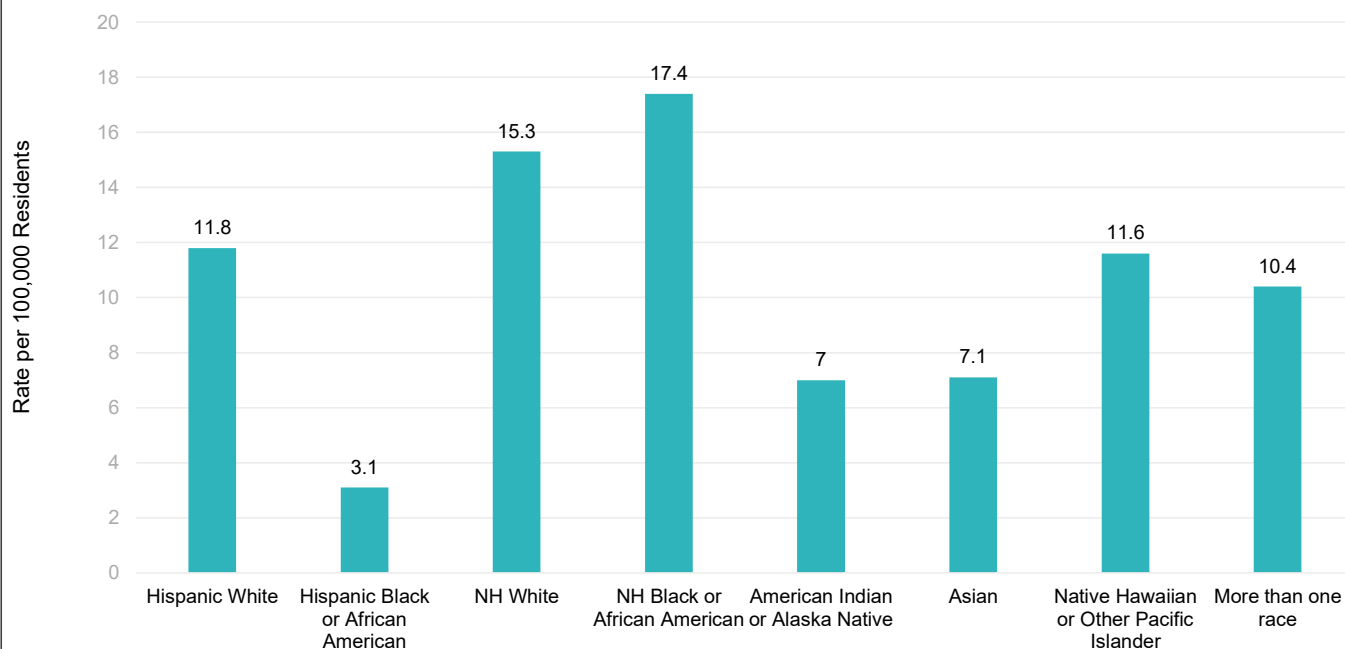
Prepared by County of San Diego, Health and Human Services Agency, Public Health Services, Community Health Statistics Unit, June 2025.
<https://www.sdhealthstatistics.com/>
 LiveWellSD.org.

- From 2021-2023, in California, those aged 85 years and older had the highest TBI mortality rate related to other external causes of accidental injury (including unintentional falls) compared to all other age groups.



State Statistics

Age-Adjusted* Death Rates due to Traumatic Brain Injury (TBI) by Race/Ethnicity, California, 2021-2023



*Age-adjusted rates per 100,000 2000 US standard population.

Source: Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System, Mortality 2018-2023 on CDC WONDER Online Database, released in 2024. Data are from the Multiple Cause of Death Files, 2018-2023, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at <http://wonder.cdc.gov/mcd-icd10-expanded.html> on Apr 8, 2025.

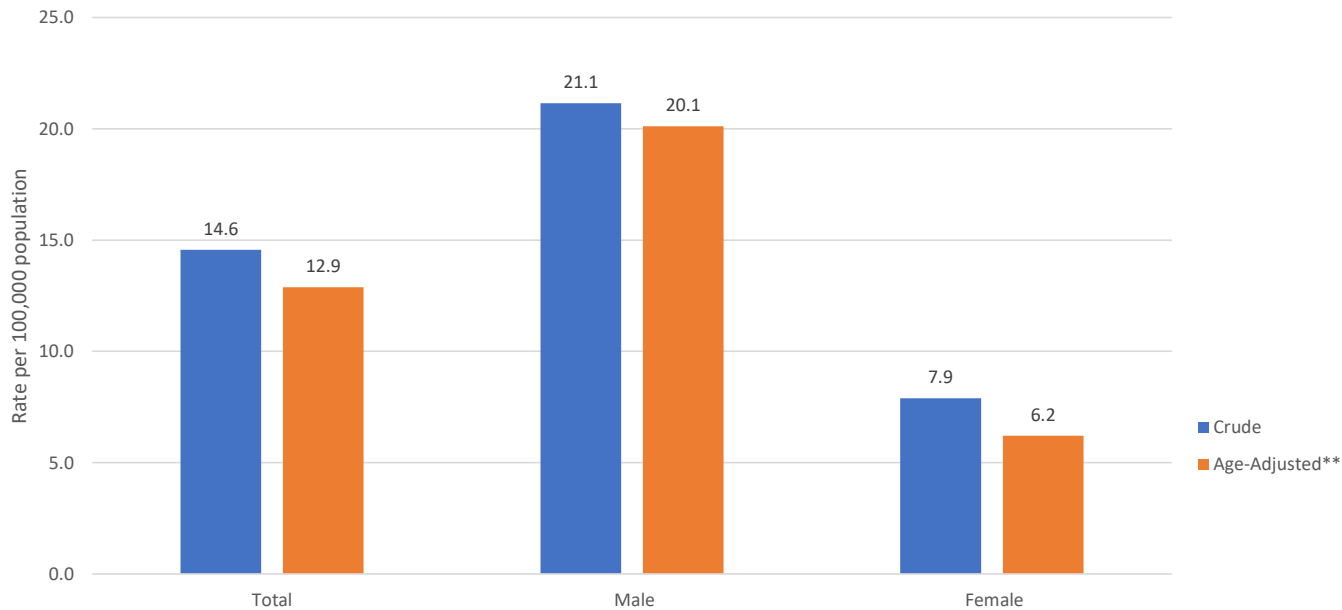
Prepared by County of San Diego, Health and Human Services Agency, Public Health Services, Community Health Statistics Unit, June 2025
<https://www.sdhealthstatistics.com/>
[LiveWellSD.org](https://www.livewellsd.org)

- From 2021-2023, non-Hispanic Black or African American population experienced the highest mortality rates due to TBI (17.4 per 100,000), followed by non-Hispanic White population (15.3 per 100,000) in California.



Local Statistics

Traumatic Brain Injury (TBI) Death* Rates, Crude and Age-Adjusted **, San Diego County, 2023



*TBI Death refers to ICD-10 Mortality Codes S010-S015, S017-S021, S023, S027-S029, S040, S060, S071, S078, S079, S097-S099, T901, T902, T904, T905, T908, T909

**Age-adjusted rates per 100,000 2000 US standard population

Prepared by County of San Diego, Health and Human Services Agency, Public Health Services, Community Health Statistics Unit. June, 2025.

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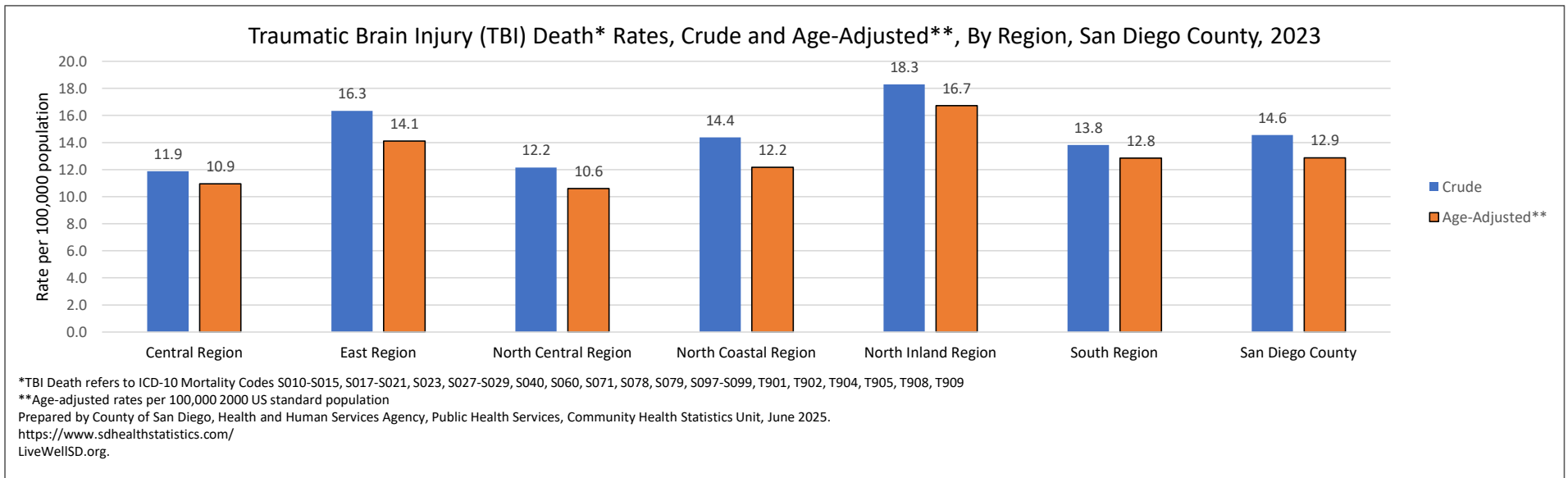
LiveWellSD.org. April 2025.

- Males in San Diego County experienced higher death rates from TBI compared to females in 2023.
- After adjusting for age, males experienced TBI mortality at a rate of 20.1 compared to females' rate of 6.2 per 100,000.
- TBI death rates for males were over 3 times higher than the rate for females 2023.



Local Statistics

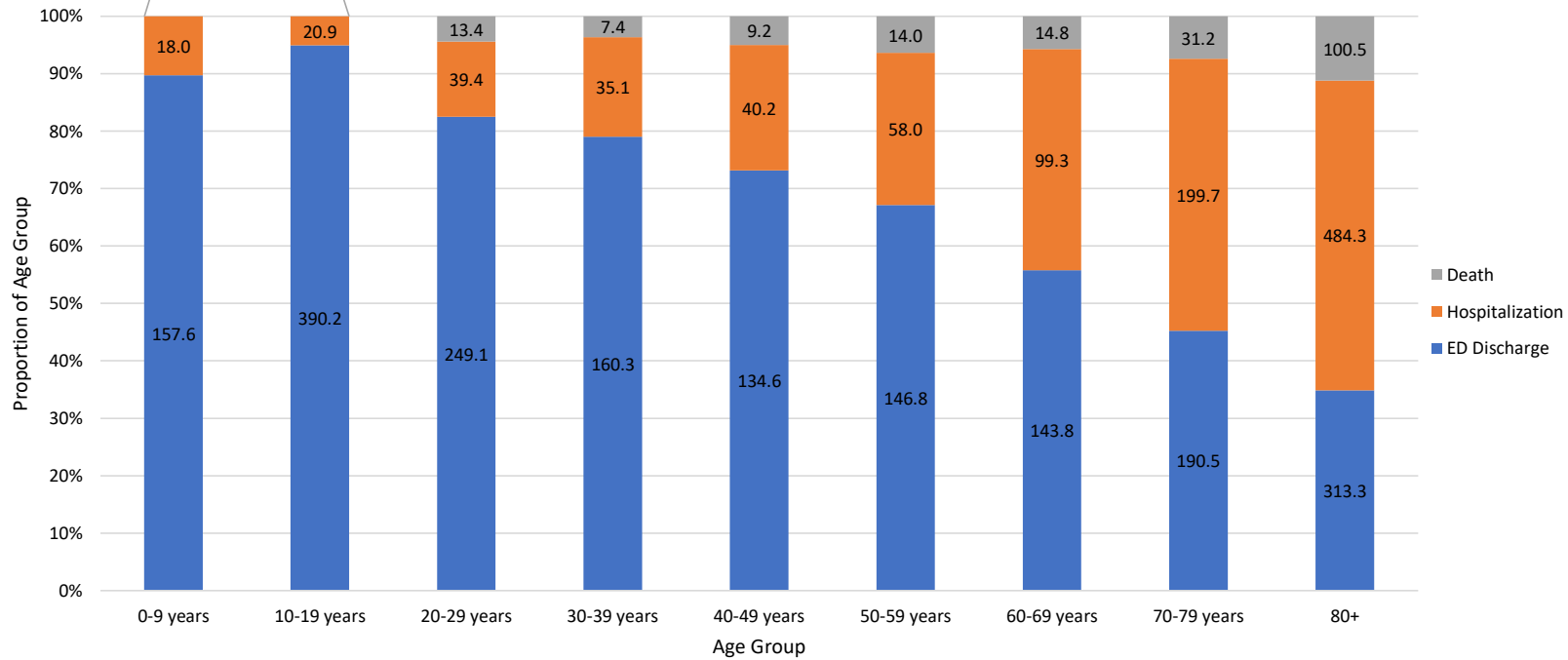
- In 2023, in San Diego County,
 - North Inland Region experienced the highest TBI death rate in the county in 2023 (18.3 per 100,000 population).
 - Central Region experienced the lowest TBI death rate (actual) in the county in 2023 of 11.9 per 100,000.



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Local Statistics

****Traumatic Brain Injury (TBI) Outcomes By Age Group, San Diego County, 2023**



*Crude and age-adjusted rates are suppressed for counts <20.

**TBI ED Discharge and Hospitalization refers to ICD-10 CM Codes S06A0XA, S06A1XA, S060X0A-S060XAA, S061X0A-S061XAA, S062X0A-S062XAA, S064X0A-S064XAA, S065X0A-S065XAA, S066X0A-S066XAA, S068A0A-S068AAA, S069X0A-S069XAA, S0630AA, S0631AA, S0632AA, S0633AA, S0634AA, S0635AA, S0636AA, S0637AA, S0638AA, S0681AA, S0682AA, S0689AA, S06300A-S06309A, S06310A-S06319A, S06320A-S06329A, S06330A-S06339A, S06340A-S06349A, S06350A-S06359A, S06360A-S06369A, S06370A-S06379A, S06380A-S06389A, S06810A-S06829A, S06890A-S06899A; TBI Death refers to ICD-10 Mortality Codes S010-S015, S017-S021, S023, S027-S029, S040, S060, S071, S078, S079, S097-S099, T901, T902, T904, T905, T908, T909

Prepared by County of San Diego, Health and Human Services Agency, Public Health Services, Community Health Statistics Unit, June 2025.
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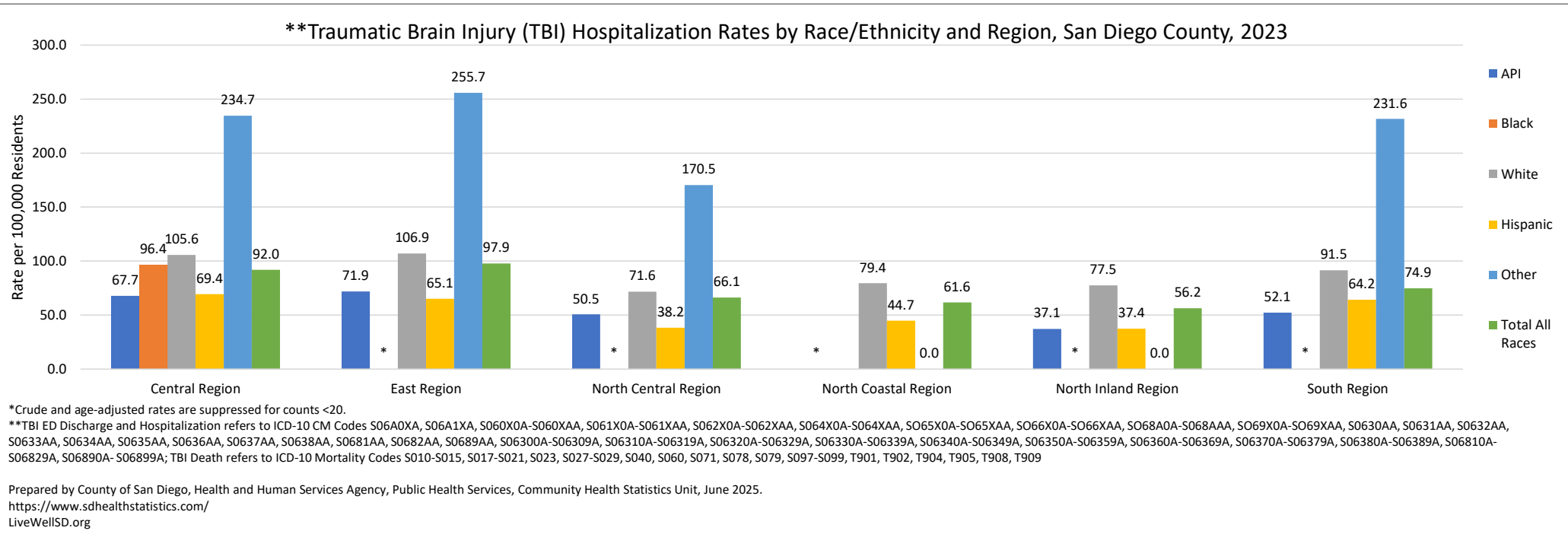
- Elderly groups had the highest rates of hospitalization and death, while children and young adults had higher ED discharge rates from TBI in 2023.
- The ED discharge rate in ages 10-19 was the highest of all age groups in 2023.
- Hospitalization and death rates from TBI trend upward with increasing age.



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Local Statistics

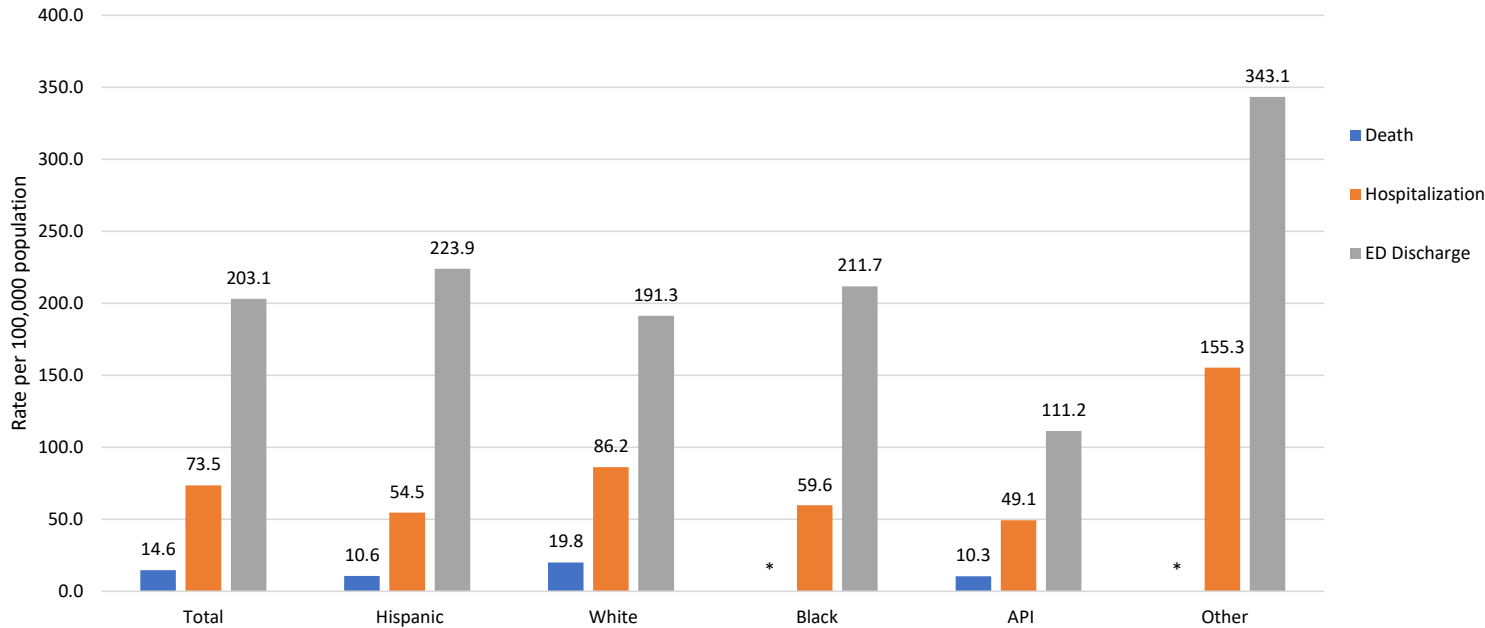
- The highest rates of hospitalization due to TBI were among residents of “other” race/ethnicities in the East Region (255.7 per 100,000), Central Region (234.7 per 100,000), South Region (231.6 per 100,000), and North Central Region (170.5 per 100,000).



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Local Statistics

****Traumatic Brain Injury (TBI) Outcomes By Race/ Ethnicity, San Diego County, 2023**



*Crude and age-adjusted rates are suppressed for counts <20.

**TBI ED Discharge and Hospitalization refers to ICD-10 CM Codes S06A0XA, S06A1XA, S060X0A-S060XAA, S061X0A-S061XAA, S062X0A-S062XAA, S064X0A-S064XAA, S065X0A-S065XAA, S066X0A-S066XAA, S068A0A-S068AAA, S069X0A-S069XAA, S0630AA, S0631AA, S0632AA, S0633AA, S0634AA, S0635AA, S0636AA, S0637AA, S0638AA, S0681AA, S0682AA, S0689AA, S06300A-S06309A, S06310A-S06319A, S06320A-S06329A, S06330A-S06339A, S06340A-S06349A, S06350A-S06359A, S06360A-S06369A, S06370A-S06379A, S06380A-S06389A, S06810A-S06829A, S06890A-S06899A; TBI Death refers to ICD-10 Mortality Codes S010-S015, S017-S021, S023, S027-S029, S040, S060, S071, S078, S079, S097-S099, T901, T902, T904, T905, T908, T909

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<https://www.sdhealthstatistics.com/>
[LiveWellSD.org](https://www.LiveWellSD.org).

- ED Discharge rates were the highest out of all TBI injury outcomes among all races in 2023.
- Residents of “other” race/ethnicities experienced the highest ED discharge rates compared to all race/ethnicities at 343.1 per 100,000 and the highest hospitalization rates at 155.3 per 100,000 population in 2023.



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Prevention

■ Intentional Self- Harm

- Preventing suicide requires protective strategies at individual, family, community, environmental, and structural levels:
 - Strategies including:
 - Strengthening economic and housing stability
 - Reducing access to lethal means among at risk persons; Reducing substance use
 - Improving access to mental health care through insurance coverage, provider availability in underserved areas, and rapid-response systems.
 - Promote healthy connections within community shared activities
 - Educate individuals on coping skills, parenting skills to strengthen family bonds, and social-emotional skills
 - Support those at risk by identifying risk, responding to crises, and following- up



Prevention

■ Violence/ Assault Intervention& Prevention

➤ Strategies for violence prevention span each level of society:

- **Individual:** Promote attitudes and behaviors that prevent violence with conflict and life skills training, social- emotional learning, safe dating and healthy relationship skills.
- **Relationship:** Education among an individual's inner circle, including family- focused programs or peer mentoring to strengthen parent- child communication and problem- solving skills.
- **Community** (schools, workplaces, neighborhoods): identify characteristics associated with being a victim or perpetrator of violence; focus on creating safe spaces by addressing conditions that contribute to violence in the community, like poverty, residential segregation, and substance use prevalence.
- **Societal:** Create a climate where violence is discouraged or inhibited; Promote efforts to strengthen household financial security, education, employment, and social policy.



Prevention

■ Lowering Risk of Motor Vehicle Crashes

- **Avoid impaired driving**
 - Utilize the CDC's Alcohol Screening Tool to assess drinking habits and create personal change plan.
- **Wear Seatbelts, use child booster seat**
 - Children should always be buckled in a car seat, booster seat, or seat belt appropriate for their size to reduce risk of serious injury.
- **Wear Helmet when riding bike, motorcycle, all- terrain vehicle, scooter**
- **Avoid distracted driving**
 - Avoid multitasking while driving, including cell phone usage



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Prevention

■ Fall Prevention (Older Adults)

➤ CDC STEADI initiative: Stopping Elderly Accidents, Deaths, and Injuries

- Evaluate and discuss reducing risk of falling with doctor
- Review medications for dizzy or sleepy side effects
- Get eyes checked annually and keep up to date eyeglass prescription
- Exercise with focus on strength and balance to improve balance
- Keep floor in home clear to avoid trip hazards, install handrails on stairways



Prevention

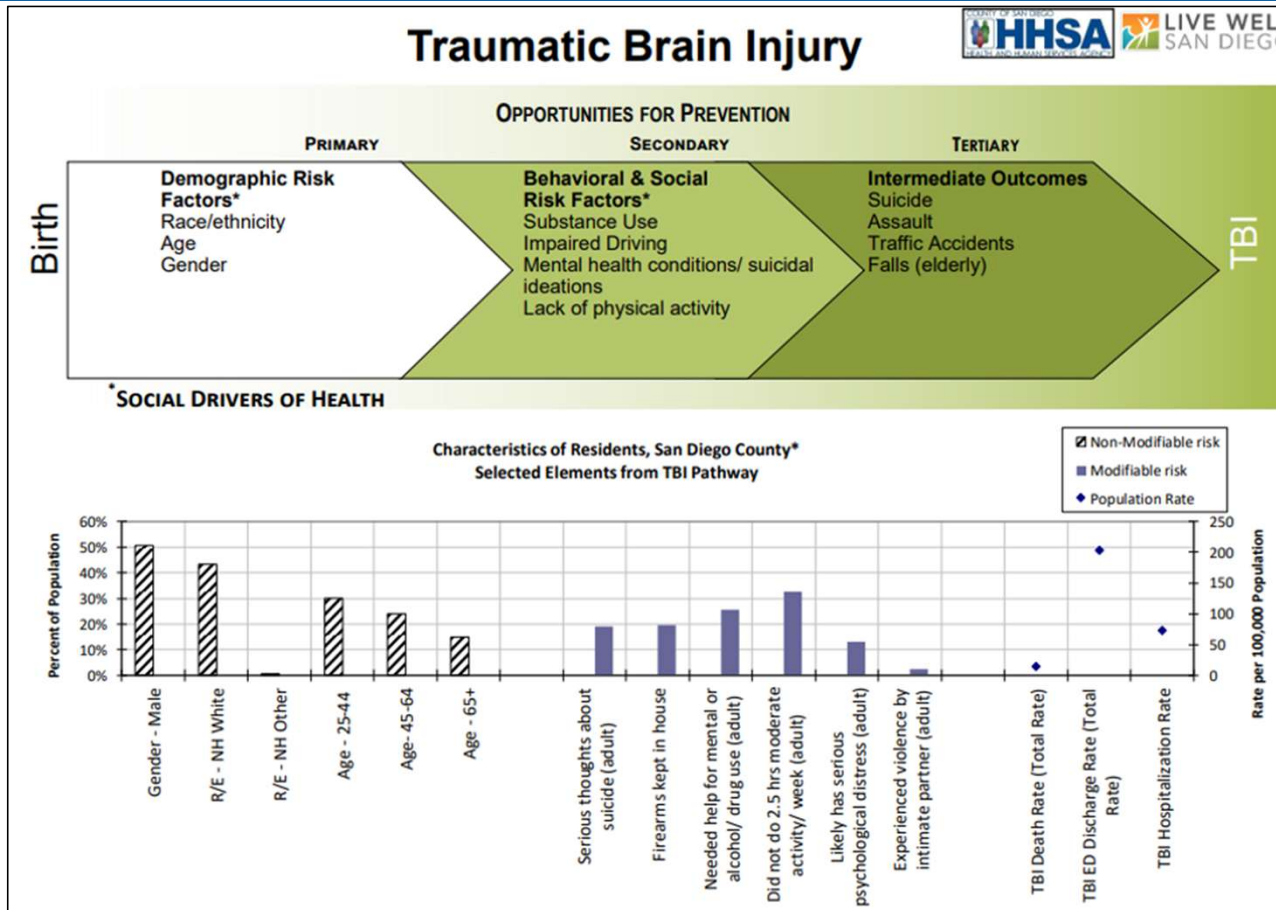
■ Preventing concussions and TBI in children:

- Choose sports programs that enforce rules for safety and actively avoid plays that increase the risk of head impact.
- Wear a helmet when:
 - Riding a bike, scooter, or skateboard
 - Horseback riding
 - Skiing, snowboarding
 - Playing a contact sport: football, ice hockey, boxing
- Make safer play areas: Install window guards to avoid falls out of open windows; use safety gates at the top of stairs; check playground to make sure base is soft material, like hardwood or sand



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Critical Pathway For Traumatic Brain Injury



Sources: U.S. Census Bureau, 2019-2023 American Community Survey (ACS) 5– Year Estimates, Tables B01001, B03002, B09020, DP02.
 UCLA Center for Health Policy Research, Los Angeles, CA. AskCHIS. 2023 California Health Information Survey. (San Diego County). Available at <https://ask.chis.ucla.edu>. Exported March 13, 2025.
 2023 Community Profiles. County of San Diego, Health and Human Services (HHSA), Public Health Services, Community Health Statistics Unit, Accessed June 25, 2025.

Prepared by County of San Diego, Health and Human Services Agency, Public Health Services, Community Health Statistics Unit, June 2025.
<https://www.sdhealthstatistics.com/LiveWellSD.org>



Resources

CDC Traumatic Brain Injury & Concussion:

www.cdc.gov/traumatic-brain-injury/

National Institute of Neurological Disorders and Stroke:

www.ninds.nih.gov/health-information/disorders/traumatic-brain-injury-tbi



Contact Us



For more information, including data, resources, and reports from the County of San Diego's Community Health Statistics Unit:

www.SDHealthStatistics.com

(619) 692-6667



The Public Health Services department, County of San Diego Health and Human Services Agency, has maintained national public health accreditation, since May 17, 2016, and was re-accredited by the Public Health Accreditation Board on August 21, 2023.