State Traumatic Brain Injury Advisory Board Annual Report
Health-General § 13–2105

October 2024

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Executive Summary

Brain injury is the leading cause of injury-related death and disability in the United States.[1] Brain injury may occur from a traumatic or a non-traumatic cause. Thirty percent of Marylanders have experienced a hospitalization related to a head or neck injury in their lifetime[2]. Data from the Maryland Health Services Cost Review Commission show that Traumatic Brain injuries, TBI, is one of the leading causes of hospital admissions and emergency room visits for non-fatal injuries in Maryland. TBI-related deaths have increased between 2016 and 2021. Marylanders age 75 and older have the highest number of TBI-related hospitalizations. Firearms are the most common cause of TBI-related deaths followed by falls and then motor vehicle crashes.

Injuries to the human brain occur from traumatic and non-traumatic causes. The degree or extent of brain tissue damage determines the severity and classification of the injury into mild, moderate, or severe. Symptomatic presentation and recovery vary widely among individuals with brain injury despite the severity. Symptoms can include headaches, fatigue, mood disorders, post-traumatic epilepsy, impaired mobility, coordination, dexterity, memory, learning, attention, behavior changes, sleep, hearing, vision, taste, and smell[3]. Symptoms can worsen with time and may not be apparent until weeks, months, or even years post-injury.

Maryland has an array of services available to individuals with disabilities; however, few are specialized for the needs of individuals living with brain injury. Service gaps in Maryland largely revolve around the lack of coordination and linkage to available services and supports, limited acute and post-acute rehabilitation services, and misdiagnosis or under-identification of brain injury by educators, behavioral health professionals, and corrections.

The TBIAB's recommendations for Maryland addresses utilizations of State and federal funding dedicated to services for individuals with brain injuries, building provider–capacity and provider–training that address the needs of individuals with traumatic brain injuries; and improving the coordination of services for individuals with traumatic brain injuries. The recommendations are intended to address these service gaps and reduce the public health burden of brain injury through appropriate resource linkage, training, effective screening practices, and availability of specialized services.

[1] "Facts about TBI." *Traumatic Brain Injury & Concussion*, Centers for Disease Control and Prevention (CDC), 29 Apr. 2024, www.cdc.gov/traumatic-brain-injury/data-research/facts-stats/index.html#:~:text=TBI%20is%20a%20major%20cause%20of%20death%20and%20disability,-There%20were%20over&text=1%20That%27s%20about%20190%20TBI,health%20problems%20after%20the%20injury.

[2] "BRFSS Questions Configuration Selection." Maryland Department of Health Data Query System, Behavioral Risk Factor Surveillance System, Maryland Department of Health, ibis.health.maryland.gov/ibisph-view/query/selection/brfss/BRFSSSelection.html. Accessed 1 Oct. 2024.

[3] "Living with Traumatic Brain Injury (TBI)." *Model Systems Knowledge Translation Center (MSKTC)*, MSKTC, 2024, msktc.org/TBI.

Introduction and Overview

Injuries to the human brain occur from traumatic and non-traumatic causes. Traumatic Brain Injuries, TBI, are caused by external forces to the brain. Well known causes are contact sports and blast injuries, additional causes include;

- Penetrating gunshot wounds to the head,
- Assaults resulting in hits to the head,
- Motor vehicle and bicycle crashes,
- Falls,
- Intimate partner violence,
- Childhood physical abuse,
- Lead poisoning,
- Drug overdose(s),
- Long-term neurocognitive and neuropsychiatric complications from the coronavirus disease 2019

The degree or extent of brain tissue damage determines the severity and classification of the injury into mild, moderate, or severe. In addition, the individual's neurologic signs and symptoms, duration of loss of consciousness (LOC), length of amnesia (memory loss), and brain scans facilitate the determination and measurement of the degree of damage. Appendix B shows the classification based on the Degree of Damage to the brain.

Symptoms and Recovery

Symptomatic presentation and recovery vary widely among individuals with brain injury despite the severity. Symptoms can include headaches, fatigue, mood disorders, post-traumatic epilepsy, impaired mobility, coordination, dexterity, memory, learning, attention, behavior changes, sleep, hearing, vision, taste, and smell[4]. Symptoms can worsen with time and may not be apparent until weeks, months, or even years post-injury.

The functional deficits in cognition, physical abilities, and behavioral health vary from person to person and depend on various factors, including; age at the time of injury, appropriate and timely access to medical care, as well as medical support and services.

In mild traumatic brain injury cases, most individuals recover within weeks; some individuals, however, experience a difficult recovery course, particularly those with multiple mild brain injuries. Multiple mild brain injuries are common in individuals who served in the armed forces, athletes, victims of intimate partner violence, and children exposed to abuse. Long-term negative outcomes are rare in a single case of mild TBI. However, multiple occurrences can result in increased levels of disability with each mild injury incurred, especially if they occur within close proximity.

Adverse Effects of Brain Injury

History of brain injury is associated with challenges in obtaining and maintaining employment, interpersonal challenges, difficulties in school, the onset of mental illness and substance use disorders, increased risk of incarceration and involvement with the criminal justice system, dementia, and early death. Research from the TBI Model Systems estimates that individuals living with moderate to severe brain injury have a reduced life span of nine years compared to their uninjured peers.
The Centers for Medicare and Medicaid Services (CMS) recognized TBIs as a chronic health condition in the year 2024[5]. The addition of TBI to the list of chronic conditions was included in a final rule published

[4] See 3
[5] "Centers for Medicare and Medicaid Services Officially Recognizes Brain Injury as a Chronic Condition." Brain Injury Association of America, Brain Injury Association of America, 31 July 2024, www.biausa.org/public-affairs/public-awareness/news/centers-for-medicare-and-medicaid-services-officially-recognizes-brain-injury-as-a-chronic-condition.

by CMS in the June 2024 Federal Register, which will become effective on January 1, 2025. Obtaining official recognition of TBI as a chronic condition from CMS is a significant step forward and provides validation that brain injury should be more broadly recognized as a chronic condition.

Caregivers of people with brain injury also report stress, grief, and loss. They may also experience adverse health effects, including stress-related disorders and depression[6]. In addition, in taking on the role of caregiver, family members can experience a loss of income as they may drop out of the workforce to provide unpaid care to their loved ones.[7]

Preventing Brain Injury

The TBI Advisory Board supports effective brain injury prevention strategies[8] to reduce the likelihood of sustaining a brain injury including:

- the use of seatbelts in motor vehicles,
- wearing of helmets or appropriate headgear in contact sports, and while biking, motorcycling, snowmobiling or riding a scooter.
- evaluating fall risk factors for older adults, and
- ensuring play areas are safe for children

Other equally important prevention efforts include:

- substance abuse and overdose prevention efforts,
- intimate partner violence resources,
- infection prevention,
- pedestrian safety awareness,
- suicide prevention efforts,
- individualizing practices within behavioral health professionals to screen for a lifetime history of brain injury, and
- targeted prevention and outreach to individuals with brain injury that would reduce the rate of substance abuse among individuals with brain injury and reduce the chance of overdose-related brain injuries.

Data, Trends, and Findings

National Surveillance Data

According to the Centers for Disease Control (CDC), nationally, there were approximately 214,110 TBI-related hospitalizations in 2020 and 69,473 TBI-related deaths in 2021[9].

- This represents more than 586 TBI-related hospitalizations and 190 TBI-related deaths per day.
- These estimates do not include the many TBIs that are only treated in the emergency department, primary care, urgent care, or those that go untreated.
- Individuals aged 75 years and older had the highest numbers and rates of TBI-related hospitalizations and deaths. This age group accounts for about 32% of TBI-related hospitalizations and 28% of TBI-related deaths.
- Males were nearly two times more likely to be hospitalized (79.9 age-adjusted rate versus 43.7) and three times more likely to die from a TBI than females (28.3 versus 8.4).

[6] Brickell, Tracey A. DPsych; Lippa, Sara M. PhD; Wright, Megan M. MA; Varbedian, Nicole V. BS; Tippett, Corie E. MA; Byrd, Anice M. BS; French, Louis M. PsyD; Lange, Rael T. PhD. Is Traumatic Brain Injury Severity in Service Members and Veterans Related to Health-Related Quality of Life in Their Caregivers?. Journal of Head Trauma Rehabilitation 37(6):p 338-349, November/December 2022. | DOI: 10.1097/HTR.0000000000000802

[7] Sabella, Scott A. PhD; Suchan, Christopher S. MS. The Contribution of Social Support, Professional Support, and Financial Hardship to Family Caregiver Life Satisfaction After Traumatic Brain Injury. Journal of Head Trauma Rehabilitation 34(4):p 233-240, July/August 2019. | DOI: 10.1097/HTR.0000000000000471

[8] "Traumatic Brain Injury (TBI)." *Maryland Department of Health Injury and Violence Prevention*, Maryland Department of Health, health.maryland.gov/phpa/OEHFP/Injury/Pages/TBI.aspx. Accessed 1 Oct. 2024.

[9] "TBI Data." Traumatic Brain Injury & Concussion, Centers for Disease Control and Prevention (CDC), 16 May 2024, www.cdc.gov/traumatic-brain-injury/data-research/index.html.

Maryland Surveillance Data[10]

The CDC's Web-based Injury Statistics Query and Reporting System in 2020 reports that:

- Males in Maryland were 3.3 times more likely than females to lose their life due to TBI.
- Most TBIs in Maryland were unintentional, followed by suicide, and then homicide.
- Data from the Maryland Health Services Cost Review Commission show that TBI is one of the leading causes of hospital admissions and emergency room visits for non-fatal injuries in Maryland.
- These data show that TBI caused at least 3,088 non-fatal hospital admissions and at least 10,419 non-fatal emergency room visits in 2020[11].

TBI-related death, hospitalization, and emergency department trends can be found in Appendix C.

Prevalence of Marylanders with a Lifetime History of Brain Injury

Maryland included a set of questions related to lifetime history of brain injury in its 2021 Behavioral Risk Factors Surveillance Survey (BRFSS)[12]. These data indicate the prevalence of Marylanders who have a lifetime history of brain injury.

- 29.7% had been hospitalized for a head or neck injury in their lifetime
- 45.7% of those individuals who had been hospitalized for a head or neck injury were living with one or more disabilities.

Recommendations

The Maryland Traumatic Brain Injury Advisory Board (TBIAB) met six times in 2024. The 36 voting members each volunteer their time, energy, and expertise to the TBIAB, initially introduced in 2005 by Senate Bill 395, Chapter 306 of the Laws of Maryland. Board members review available data and publications, and promising practices from other states. The Board values the input of individuals who are living with a brain injury-related disability and family members who are caring for individuals with brain injury. The information and recommendations in this report are intended to educate policymakers and influence state policy. They do not necessarily reflect the current views of the state agencies involved.

The TBIAB's recommendations for Maryland addresses utilizations of State and federal funding dedicated to services for individuals with brain injuries, building provider–capacity and provider–training that address the needs of individuals with traumatic brain injuries; and improving the coordination of services for individuals with traumatic brain injuries. The recommendations are intended to address these service gaps and reduce the public health burden of brain injury through appropriate resource linkage, training, effective screening practices, and availability of specialized services.

I. Appropriately identify children and youth with brain injuries.

Brain injury often has a significant impact on the development and functioning of an individual. This is especially true in the developing brains of children and adolescents. Difficulties with problem-solving,

[10] "Traumatic Brain Injury Overview." MDH Environmental Public Health Tracking, Maryland Department of Health (MDH), 14 June 2023, maps.health.maryland.gov/ephtportal/tbi.
[11] See 8
[12] See 2

impulsivity, memory, new learning, and self-regulation are some of the common sequelae of brain injury and represent just some of the serious and potentially lifelong consequences of TBI. The CDC 2018 Report to Congress[13] includes information and tools for healthcare providers, educators, parents, and students to assist with acute medical management of brain injury in children as well as recommendations for long-term monitoring and transition to school. The report demonstrates evidence of the relationship between long-term disability and behavioral health conditions that impact functional achievements in adulthood, highlighting the importance of timely, appropriate intervention with children.

Recently, the under-identification of students with lasting TBI is gaining more attention nationally and several states are considering how to best address this problem. *According to MDH, in 2021 alone, there were 2,718 ED visits and 134 hospitalizations for Marylanders ages 0–18 years old with a diagnosis of TBI.* This total does not capture the full extent of brain injury among this population, as it does not include those seen by private practitioners, in urgent care facilities, or those who did not seek medical care following a brain injury. It also most likely does not capture most incidences of "mild" brain injury, even though the effects from these types of brain injuries can have long-term impacts on an individual's cognition and functioning. Despite the number of severe brain injuries reported among school-aged children, there are currently only *205 Maryland students identified as requiring special education services as the result of a traumatic brain injury, according to the Maryland State Department of Education[14]. This is 0.18% of* the total population of students currently receiving special education services in Maryland schools.

Under-identification of brain injury may occur because TBI symptoms can be misinterpreted as other disabilities, such as emotional disability and learning disability which may lead to inappropriate individualized education plans with goals and objectives that do not fully address the student's actual needs. Improved identification of TBI through the creation and use of screening will help increase the likelihood that: (1) students who were not previously identified as having a brain injury will receive further assessments to determine their need for additional services, supports, and accommodations; (2) screening evidence will guide and inform the selection of appropriate assessments for students identified as having a TBI; and (3) services, supports, and accommodations will be individually determined based on an appreciation of the students' history of TBI and an interpretation of their assessment results.

According to a 2017 study published by the National Institutes of Health, the effects of TBI on cognition, emotional functioning, and behavior are well known, but educational professionals sometimes fail to connect learning and other problems to a TBI. This delayed recognition of TBI may "lead to unnecessary chronic and disruptive problems in activities and participation" including learning and school.

Effective and timely TBI identification is a crucial and inexpensive tool that can be used to avoid delayed diagnosis and treatment of children who have incurred a TBI. Early diagnosis leads to early treatment and often reduces or eliminates the need for long-term treatment and its associated costs. This is especially true when discussing the child's educational performance. Additionally, by providing appropriate interventions and support, the child with TBI is more likely to have better performance in school, decreased negative behaviors, and overall, more positive long-term outcomes.

[13] Centers for Disease Control and Prevention. (2018). Report to Congress: The Management of Traumatic Brain Injury in Children, National Center for Injury Prevention and Control; Division of Unintentional Injury Prevention. Atlanta, GA.
[14] Division of Early Intervention and Special Education Services. Maryland Early Intervention and Special Education Services Census Data & Related Tables, Maryland State Department of Education, Oct. 2023. https://marylandpublicschools.org/about/Documents/DCAA/SSP/20232024Student/2023-Census-Publication-Formatted-A.pdf.

II. Implement brain injury screening protocols and offer treatment accommodations to individuals receiving behavioral health services (mental health and substance use disorders) and to those charged with a crime and/or incarcerated in jails and prisons.

Individuals who sustain a brain injury have an increased risk of developing a mental illness, a substance use disorder, becoming incarcerated, and/or experiencing homelessness. Most individuals who sustain a brain injury in Maryland will not receive services from a specialized brain injury program or provider. Most will either receive no services or receive services from systems or programs that are designed for other diagnoses or disabilities.

The unique constellation of deficits that can result from a brain injury are often misinterpreted as a lack of motivation or non-compliance. In fact, the individual receiving services may be struggling with cognitive, physical, or behavioral challenges, or a psychiatric disorder that interferes with their ability to engage with and benefit from services. Research suggests that awareness of a possible brain injury in someone's history, and implementation of simple strategies and supports can greatly enhance treatment outcomes.

MDH has implemented both brain injury screening and accomodations training for behavioral health providers. Since early 2017 the department has incorporated a brief brain injury screening into the online authorization process for certain billable behavioral health services, including psychiatric rehabilitation and mobile treatment, as well as some grant-funded programs managed by local behavioral health authorities. The brief screening questions are based on the Ohio State University TBI Identification Method (OSU TBI-ID) quick screen.

These questions are currently optional and should be required for these services as well as other publicly funded behavioral health services. The screening questions are:
- Ever knocked out or lost consciousness? (yes, no, not screened)
- Longest time knocked out? (less than 30 minutes, 30 minutes-24 hours, more than 24 hours)
- When were you first knocked out or lost consciousness? (Age in years: 1-99)

The answers to these questions are predictive of future onset of mental illness, substance misuse, and legal offenses.

BHA has created a resource page on its website with information for behavioral health providers about screening for a lifetime history of brain injury[15].

The Substance Abuse and Mental Health Services Administration (SAMHSA) published an Advisory for clinicians entitled, *Treating Patients with Traumatic Brain Injury*[16]. The key messages of that advisory are as follows:

- Traumatic brain injury (TBI) is a common neurological condition that results from an external force altering normal brain function, whether temporarily or permanently.

[15] "Traumatic Brain Injury." Maryland Department of Health Behavioral Health Administration, Maryland Department of Health (MDH), health.maryland.gov/bha/Pages/Traumatic-Brain-Injury.aspx. Accessed 1 Oct. 2024.
[16] Davies, Julia et al. "Traumatic Brain Injury History Among Individuals Using Mental Health and Addictions Services: A Scoping Review." The Journal of head trauma rehabilitation vol. 38,1 (2023): E18-E32. doi:10.1097/HTR.0000000000000780

- TBIs vary greatly in severity, which concomitantly creates tremendous variability in the impact on cognition, affect, and emotion. A concussion is a mild TBI.
- The lasting effects of TBI also depend on whether there are multiple injuries, the age at which they occur, and whether a person already had another source of compromise to brain function
- The fingerprint of TBI is damage to the frontal areas of the brain, which with sufficient magnitude results in impairment of a person's ability to regulate cognition, emotion, and behavior.
- Not only does TBI cause behavioral health problems, but associated deficits can affect the effectiveness of behavioral health treatments.
- Behavioral health professionals do not identify TBI among their patients.
- The consequences of TBI necessitate screening during behavioral health treatment.
- The presence of a problematic history of TBI should lead to the identification of accommodations to minimize the effect on behavioral health treatment.

Given the prevalence of brain injury among individuals living with behavioral health conditions that often are not reflected in the medical record or an individual's self-report, it is recommended that mental health and substance use treatment programs and providers routinely screen individuals for a lifetime history of brain injury. Several longitudinal studies[17][18] have found a correlation between TBI, especially those incurred in childhood, and problematic substance use as well as criminal justice involvement by late adolescence/young adulthood.

For individuals living with a mental health disorder, researchers have found a similar bidirectional relationship. At least "1/3rd of individuals with brain injury will experience mental health problems six months to a year post-injury. People with brain injury of any severity have two to four times the risk of attempting or having a death by suicide."[19] In addition, "TBI has been demonstrated to be a risk factor for adverse life experiences. For example, 25% to 85% of incarcerated individuals report a history of TBI, and a history of brain injury in this population significantly increases the risk of assault and violence and decreases the efficacy of treatment for a mental health problem".[20] [21] [22]

III. Expand availability of services offered through the Maryland Brain Injury Waiver to underserved areas of the state

Maryland's Brain Injury Waiver was created twenty-one years ago in response to a class action lawsuit. MDH created the program as a resource for adults with TBI who were ready to discharge from State Psychiatric Hospitals but lacked community discharge resources. Due to the specialty nature of these services, as well as the cost of the services, enrollment in the program has historically been limited to individuals transitioning from certain institutional settings including state psychiatric hospitals, certain chronic hospitals, and out-of-state facilities serving Marylanders with brain injury whose care needs could

[17] McKinlay A, Grace RC, Horwood LJ, Fergusson DM, Ridder EM, MacFarlane MR. Prevalence of traumatic brain injury among children, adolescents and young adults: prospective evidence from a birth cohort. Brain Inj. 2008 Feb;22(2):175-81. doi: 10.1080/02699050801888824. PMID: 18240046.
[18] Kennedy E, Heron J, Munafò M. Substance use, criminal behaviour and psychiatric symptoms following childhood traumatic brain injury: findings from the ALSPAC cohort. Eur Child Adolesc Psychiatry. 2017;26(10):1197-1206. doi:10.1007/s00787-017-0975-1
[19]The Grassroots Project and Human Services Research Institute. "Bacs: A Vital New Element in Medicaid Service Design and Oversight." Human Services Research Institute (HSRI), HSRI, Sept. 2024, www.hsri.org/publication/behavioral-health-guide-considerations-for-best-practices-for-children-youth.
[20] Moynan CR, McMillan TM. Prevalence of head injury and associated disability in prison populations: a systematic review. *J Head Trauma Rehabil.* (2018) 33:275–82. 10.1097/HTR.0000000000000354
[21] Kreutzer JS, Marwitz JH, Witol AD. Interrelationships between crime, substance abuse, and aggressive behaviors among persons with traumatic brain injury. Brain Inj. 1995 Nov-Dec;9(8):757-68. doi: 10.3109/02699059509008232. PMID: 8605509.
[22]Corrigan, John D. "Traumatic Brain Injury and Behavioral Health Treatment." National Association of State Mental Health Program Directors (NASMHPD), Center for Mental Health Services, Substance Abuse and Mental Health Services Administration, Aug. 2019, www.nasmhpd.org/sites/default/files/TAC_Paper_6_508C_2.pdf.

not be supported by programs in the state. The Department of Health expanded access to this program in 2023 to individuals residing in Maryland nursing facilities.

Maryland's Brain Injury Waiver program, initially budgeted to serve 10 individuals in FY2004 has steadily expanded over the past two decades and is now budgeted to serve 165 people. However, participant enrollment is consistently below the budgeted number of waiver slots and provider participation has been stagnant, with only five approved providers.

The TBI Advisory Board commends the Department of Health on its responsiveness to stakeholder feedback that has led to programmatic eligibility changes throughout the years and recommends now that the Department focus on provider recruitment and expansion of service delivery to the regions of the state currently without specialty brain injury providers. Ensuring rate sufficiency will be a crucial part of provider expansion efforts.

IV. Increase funding to allow implementation of the Maryland Brain Injury Trust Fund program.

The board recommends exploring the development a system of Brain Injury Resource Facilitation[23] and support services for people with brain injury who are not eligible for Maryland's Brain Injury Waiver Program through the exploration of funding options and Implementing a system to provide services set forth in statute.
Pursuant to HG § 13–21A–02(i), MDH is required to submit a report on the State Brain Injury Trust Fund, including the number of individuals served, and the services provided in the preceding fiscal year using the fund. Since the passage of Senate Bill 632, Chapter 511 of the Acts of 2013, MDH has accrued, as of the time of this report, $330,071.74 (as of May 2024) through the voluntary vehicle registration donation program. The MDOT created a voluntary donation option for vehicle registration transactions completed via kiosk or online. Monthly revenue into the fund increased beginning in April 2021 when the Maryland Department of Transportation changed the $1 donation increment to any dollar amount, per the recommendation of the TBI Advisory Board and the Trust Fund Advisory Committee.

The TBI Advisory Board is very appreciative of the efforts of legislators and state leaders at the Maryland Department of Transportation (MDOT) and MDH for the creation of a revenue source for Maryland's Brain Injury Trust Fund and for the change in allowable donation amounts. Donations are transferred to Maryland's Brain Injury Trust fund, managed by MDHBHA. Revenues are not yet sufficient to support the types of services identified in the law.

MDH has established a Trust Fund Advisory Committee to advise and assist with developing a list of covered services, service descriptions, program and provider requirements, and conditions for client participation. This committee projects that revenue should reach $500,000 to begin efficient operationalization of service provision. This would provide approximately 50 Marylanders with brain injury 10 hours of case management/support services per week. Currently, 24 states have created brain injury trust fund programs and the annual revenue of Maryland's trust fund lags behind that of other states.

[23]"Brain Injury Resource Facilitation: A Consensus of Best Practices." National Association of State Head Injury Administrators (NASHIA), NASHIA, 2024, www.nashia.org/resources-list/birf-consensus-report.

If adequately funded, this fund would provide services to individuals with a medically documented brain injury with incomes ≤ 300% of the federal poverty level who are in need of case management and other support services and not otherwise eligible for services under Maryland's Brain Injury Waiver.

Twenty-eight states have implemented Brain Injury Resource Facilitation services and Maryland is not yet one of them[24]. Increasing funding for this program would allow Maryland to implement this best practice.

V. The Maryland Department of Health should link individuals who are hospitalized and treated in ED for brain injury with brain injury information and resources.

The Maryland TBI Advisory Board commends the Maryland Department of Health for establishing a central, publicly available repository of TBI surveillance data, information, and resources on the Department of Health Injury and Violence Prevention website. This is a significant accomplishment.

The TBI Advisory Board still believes there is a gap in terms of linkage with available resources and feels the Department needs to develop materials that can be disseminated to patients treated in hospitals and EDs. While websites with this information are important, it is a passive way of providing information. Family members of people who sustain brain injuries are often overwhelmed at the time of injury and need more direct linkages with resources and assistance.

Emerging Issue

The TBI Advisory Board surveys its membership and other brain injury stakeholders each year about resource gaps and needs. A concerning issue is the limited access to specialized brain injury rehabilitation following a severe brain injury. According to data available through Maryland's Trauma Registry, in 2023, the vast majority of people treated in a trauma center for TBI were discharged home. Of those discharged for in-patient rehabilitation, almost as many patients were discharged to a skilled nursing facility (459) as to a specialized acute rehabilitation program (549).

An ad hoc committee, consisting of representatives from acute rehabilitation programs, trauma care, long-term services and supports, individuals impacted by brain injury, and families, has been created to study this issue.

When Marylanders with brain injury are not able to access specialized acute rehabilitation, they are often referred to subacute rehabilitation in skilled nursing facilities, where brain injury expertise is lacking, interdisciplinary care is not available, and signs of coma emergence may not be recognized, further limiting rehabilitation potential.

Several barriers to accessing specialized brain injury rehabilitation in Maryland have been identified to include:

- Payor/ insurance limitations,

[24] See 23

- Acute Rehabilitation admission criteria require 3 hours of participation in skilled therapy per day, thereby limiting rehabilitation opportunities for individuals who have extended disorders of consciousness or other comorbid medical conditions impacting stamina,
- Geographic access to specialty programs, with all CARF-accredited rehabilitation programs being located in the Baltimore/Washington Corridor and no specialty programs in the rural areas of the state, and
- Lack of knowledge among family advocates of the difference between acute rehabilitation vs. subacute rehabilitation when discharge options are presented for their loved ones with brain injury.

This committee will review available data, best practices in other states, and obtain input from a broader stakeholder group with the intention of making recommendations that will optimize the rehabilitation potential for all Marylanders impacted by brain injury and potentially decrease rising long-term care costs for individuals impacted by this chronic condition.

Next Steps

The Maryland TBI Advisory Board will continue to meet six times per year. The Advisory Board has several standing subcommittees that meet to study the issues and develop the recommendations in this report. Additionally, the Advisory Board has created an ad hoc subcommittee to study rehabilitation services in Maryland and draft recommendations to be included in the 2025 annual report.

Conclusions

Created in 2006, Maryland's Traumatic Brain Injury Advisory Board has been an effective mechanism to provide oversight in acquiring and utilizing State and Federal funding dedicated to services for individuals with traumatic brain injuries, building provider–capacity, and provider–training that address the needs of individuals with traumatic brain injuries; and improving the coordination of services for individuals with traumatic brain injuries. The TBI Advisory Board's annual report includes important recommendations. Many have been implemented throughout the years to include the implementation of a Brain Injury Trust Fund[25], expansion of Maryland's Brain Injury Waiver[26] program eligibility, and establishment of a central, publicly available repository of TBI surveillance data to ensure that Marylanders who sustain these injuries and their families are provided information and linkage to available resources and assistance[27].

It is the hope of the TBI Advisory Board that Maryland will continue to consider the recommendations of this diverse board so that all Marylanders who experience a brain injury will have access to the services and resources that they need.

[25] "You Can Help Make a Difference: By Donating To The Maryland Brain Injury Trust Fund." Maryland Department of Health Behavioral Health Administration, Maryland Department of Health, health.maryland.gov/bha/Pages/maryland-brain-injury-trust-fund.aspx. Accessed 1 Oct. 2024.
[26] See 15
[27] See 10

Appendix A: TBI Advisory Board Membership

- Gil Abramson, Esq, Baltimore, MD
- Jeronica Baldwin, Office of Long Term Services and Supports, Maryland Department of Health
- Sandra Bastinelli, Representing Individuals with, Brain Injury, Carroll County
- Jody Boone, Division of Rehabilitation Services
- Paige Bradford, M.Ed., Section Chief Specialized Instruction, Division of Special Education/Early Intervention Services, Maryland State Department of Education
- Joan Carney, Ed.D., Brain Injury Association of Maryland, Baltimore City
- Joyce Dantzler, Office of Healthy Homes and Communities, Maryland, Department of Health, Baltimore City
- Laurie Elinoff, Representing Individuals with Brain Injury, Statewide Independent Living Council, Anne Arundel County
- Janet Furman, Developmental Disabilities Administration, Maryland Department of Health
- Thomas Gallup, Representing Families and Caregivers of Individuals with Brain Injury, Montgomery County, MD
- Amanda Gallagher, MA, CCC-SLP, Professional, Baltimore City
- Andrew (Drew) H Gantt III, Brain Injury Association of Maryland, Baltimore County, MD
- Martin Kerrigan, Chair, Brain Injury Association of Maryland, Howard County
- Lorri Irrgang, Representing Individuals with Brain Injury, Anne Arundel County, MD
- Norda Kittrie, Representing Families and Caregivers of Individuals with Brain Injury Montgomery County, MD
- Cory Kovacik, OTR/L, Sinai Hospital, Baltimore City
- Claudette Mathews, RN, Office of Genetics and People with Special Health Care Needs
- Stefani O'Dea, Behavioral Health Administration, Maryland Department of Health
- Bryan Pugh, Brain Injury Association of Maryland, Baltimore County
- Gabriel H. Rubinstein, Esq., Disability Rights Maryland, Baltimore Maryland
- Lt. Stephen Thomas, Law Enforcement, Anne Arundel County
- Adrienne Walker-Pittman, Representing Individuals with Brain Injury, Baltimore City
- Heather Wheeler, PT, DPT, University of Maryland Rehabilitation and Orthopedic Institute, Baltimore County
- Elizabeth Marie Wooster PhD, RN, MSN, MSE, MsEM, Trauma and Injury Specialty Care Program, Maryland Institute for Emergency Medical Services Systems

Maryland Legislative Appointments (ex-officio)

- Senator Nancy J. King, Democrat, District 39, Montgomery County
- House of Delegates, Vacant

Staff to the TBI Advisory Board

- Elena Janetopoulos, Maryland Behavioral Health Administration, Maryland Department of Health
- Mawada Hassan, MHS, Brain Injury Association of Maryland

Appendix B: Severity of Injury

"Severity of injury" refers to the degree or extent of brain tissue damage. Brain injury may be classified as mild, moderate, or severe, depending on the individual's neurologic signs and symptoms[28]. The degree of damage is estimated by measuring the duration of loss of consciousness and coma, length of amnesia (memory loss), and brain scans[29].

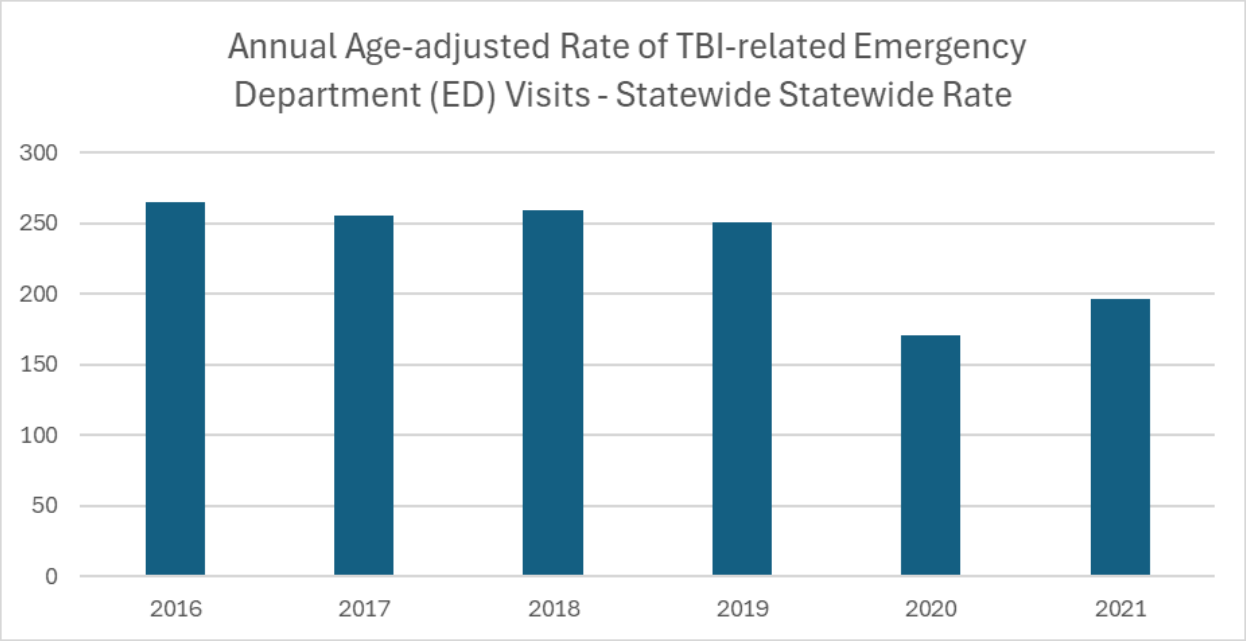
Degree of Damage to the Brain

Severity of Injury	Percentage Affected	Signs and Symptoms
Mild TBI or concussion	80% of all brain injuries- characterized by no loss of consciousness or a loss of consciousness (LOC) of less than 30 minutes and/or a period of confusion referred to as post traumatic amnesia (PTA) of less than 60 minutes	● Vomiting,dizziness, lethargy ●Memory loss for the period immediately, before and after the injury and difficulty attending to and learning new information during this time period (PTA)
Moderate TBI	10–13% of all brain injuries-characterized by LOC of 30 minutes to 24 hours, and PTA of 1–24 hours	●Signs of brain injury including bleeding, contusions ●Period of time (PTA) where memory and learning are impacted is longer than after a mild TBI ●Signs of brain injury evident on a CAT scan or other neuroimaging assessments
Severe TBI	7–10% of all brain injuries-characterized by LOC and PTA greater than 24 hours	●Unconsciousness (coma) for over 24 hours, can last days, weeks, months, or years ●No sleep/wake cycle during period of coma ●Signs of brain injury evident on a CAT scan or other neuroimaging assessments

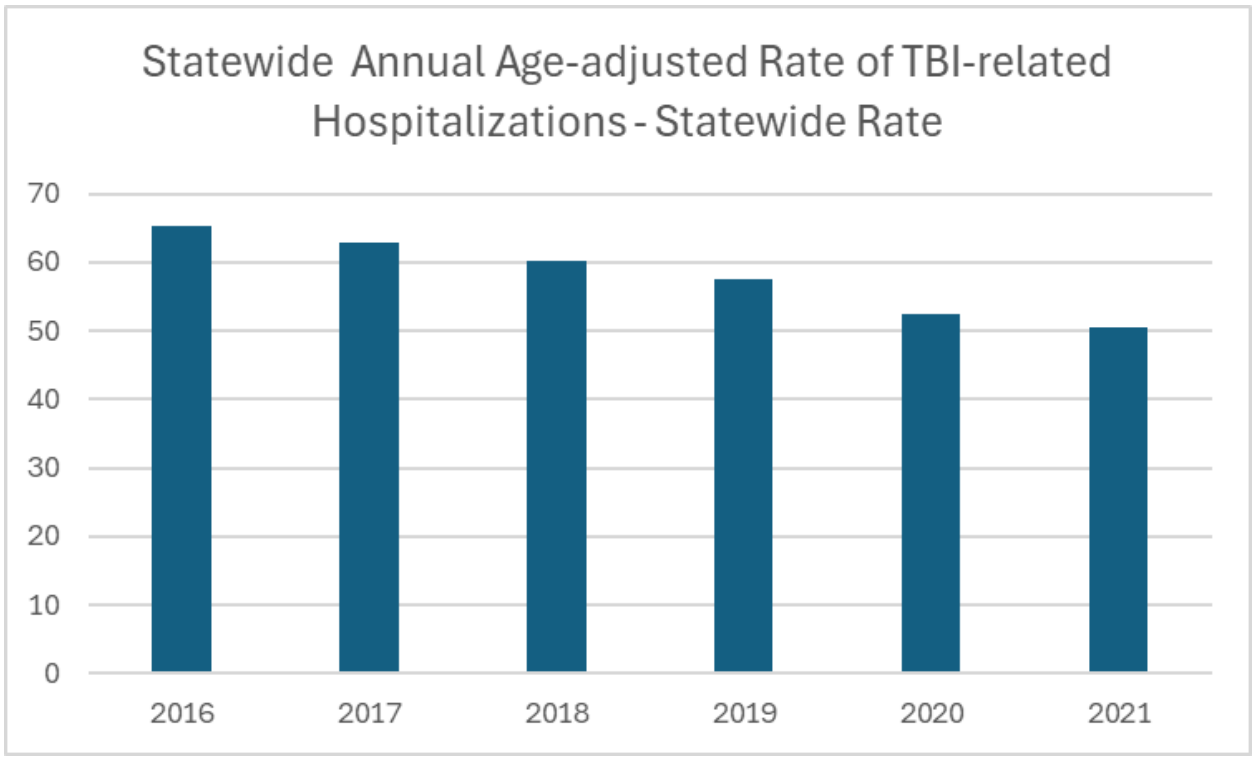
[28] See 3
[29] "Brain Injury Severity." Brain Injury Diagnosis, Brain Injury Association of America, www.biausa.org/brain-injury/about-brain-injury/diagnosis/injury-severity. Accessed 1 Oct. 2024.

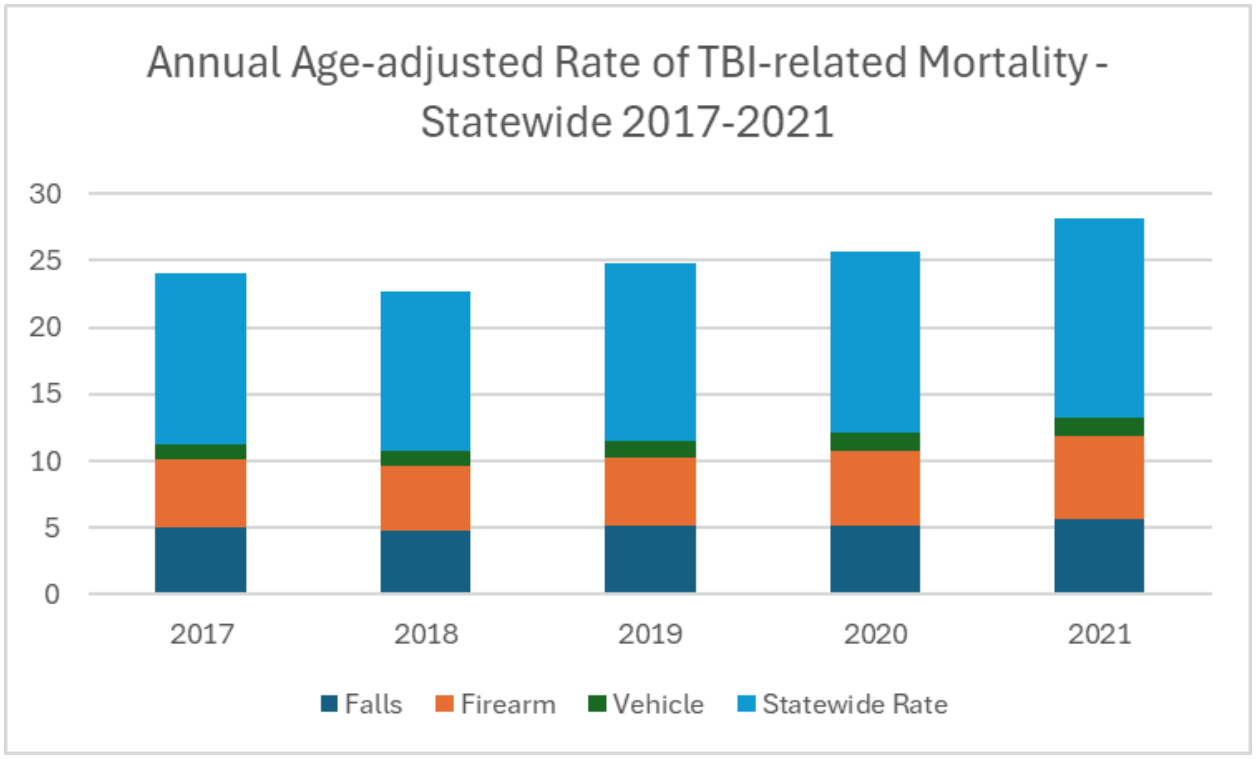
Appendix C: TBI Related deaths, hospitalizations, and emergency department visits

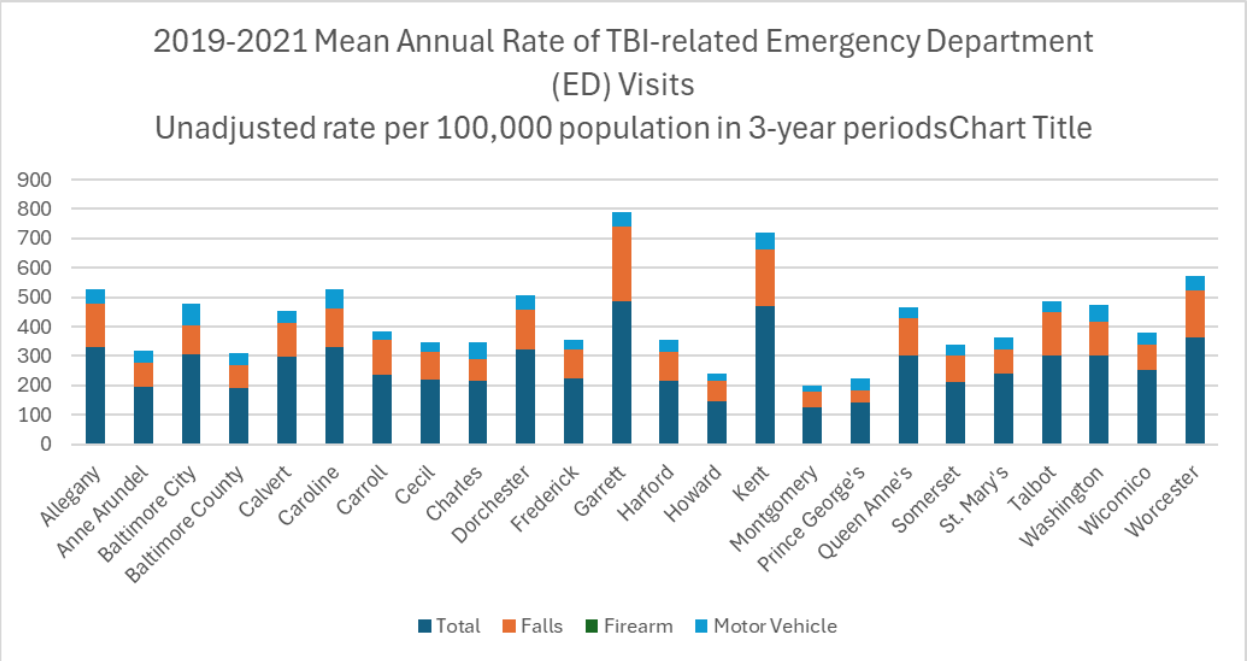
The Maryland Department of Health Environmental Public Health Tracking[30] utilizes hospital billing data from inpatient discharges and emergency department encounters to summarize the current status of traumatic brain injury in Maryland and examine the distribution of the burden of traumatic brain injury in Maryland.

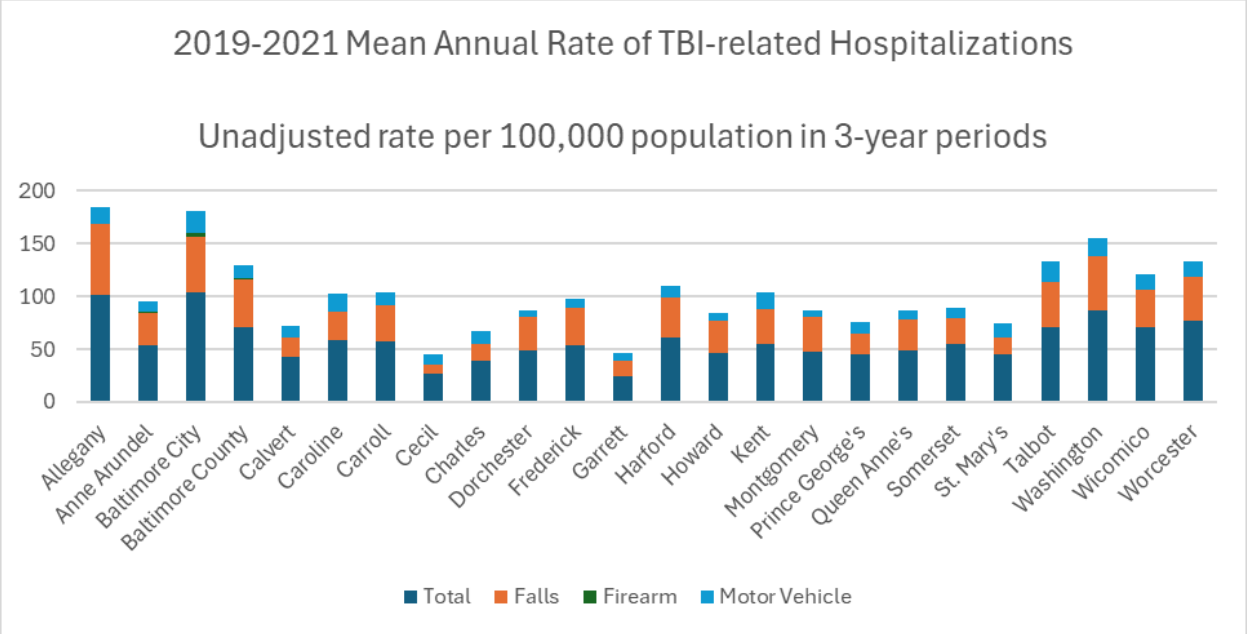


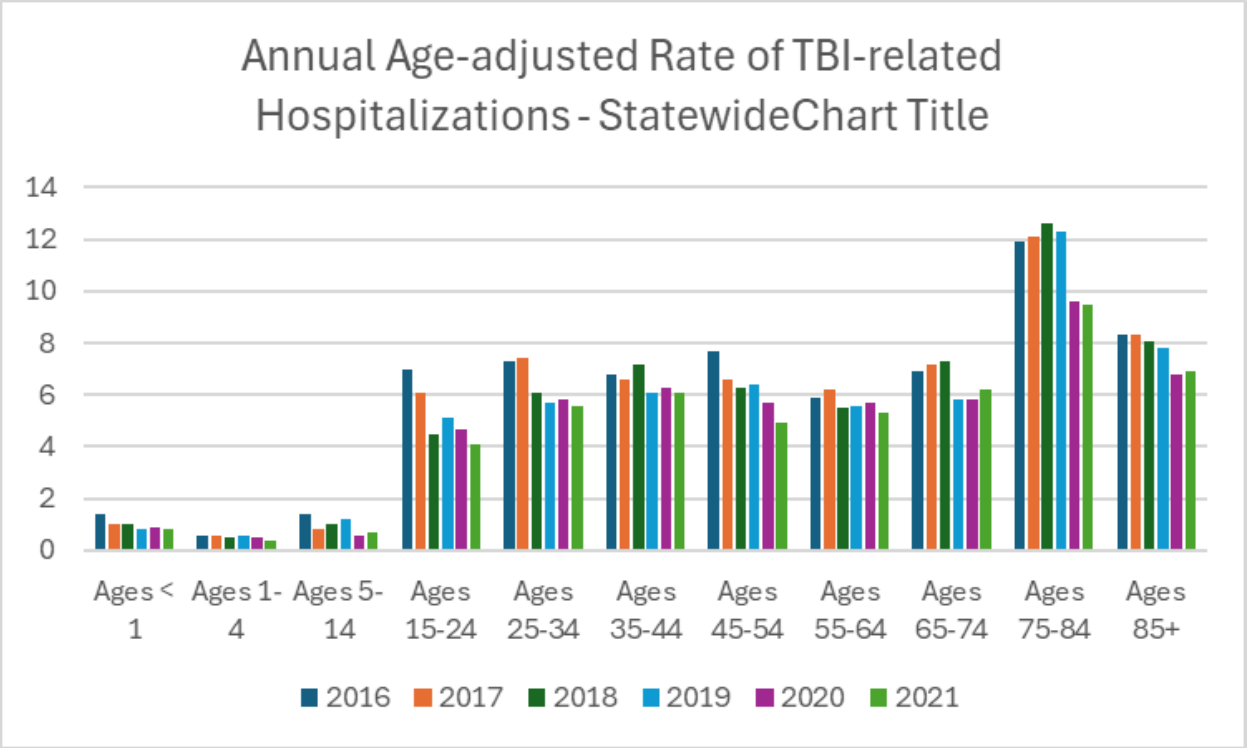
[30] See 10


Statewide Annual Age-adjusted Rate of TBI-related Hospitalizations - Statewide Rate
70
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
2021


Annual Age-adjusted Rate of TBI-related Mortality - Statewide 2017-2021
30
25
20
15
10
5
0
2017
2018
2019
2020
2021
Falls
Firearm
Vehicle
Statewide Rate


2019-2021 Mean Annual Rate of TBI-related Emergency Department (ED) Visits
Unadjusted rate per 100,000 population in 3-year periodsChart Title
900
800
700
600
500
400
300
200
100
0
Allegany
Anne Arundel
Baltimore City
Baltimore County
Calvert
Caroline
Carroll
Cecil
Charles
Dorchester
Frederick
Garrett
Harford
Howard
Kent
Montgomery
Prince George's
Queen Anne's
Somerset
St. Mary's
Talbot
Washington
Wicomico
Worcester
Total
Falls
Firearm
Motor Vehicle


2019-2021 Mean Annual Rate of TBI-related Hospitalizations
Unadjusted rate per 100,000 population in 3-year periods
200
150
100
50
0
Allegany
Anne Arundel
Baltimore City
Baltimore County
Calvert
Caroline
Carroll
Cecil
Charles
Dorchester
Frederick
Garrett
Harford
Howard
Kent
Montgomery
Prince George's
Queen Anne's
Somerset
St. Mary's
Talbot
Washington
Wicomico
Worcester
Total
Falls
Firearm
Motor Vehicle


Annual Age-adjusted Rate of TBI-related Hospitalizations - StatewideChart Title
14
12
10
8
6
4
2
0
Ages < 1
Ages 1-4
Ages 5-14
Ages 15-24
Ages 25-34
Ages 35-44
Ages 45-54
Ages 55-64
Ages 65-74
Ages 75-84
Ages 85+
2016
2017
2018
2019
2020
2021