

VIRGINIA INJURY

TRAUMATIC BRAIN INJURY IN VIRGINIA, 1999-2003

According to a recent report, at least 1.4 million people sustain a traumatic brain injury (TBI) each year, and an estimated 80,000 to 90,000 people with TBI experience a permanent disability from their injury¹. An analysis of population based TBI studies estimates a total TBI incidence rate between 180 and 250 per 100,000 population each year for the US². This report analyzes five years of hospitalization and mortality data to determine the incidence and impact of TBI on Virginians.

TBI-related Morbidity

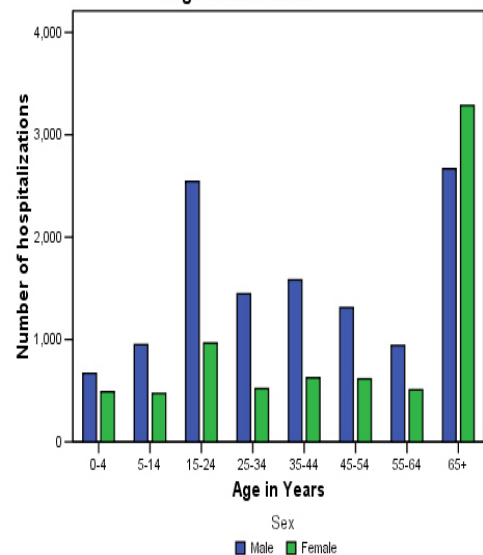
During the years 1999-2003, there were a total of 19,598 hospitalizations with a TBI-related diagnosis for a 5-year hospitalization rate of 54.4 per 100,000 population³. Of these hospitalizations, 1,621 (8.4%) died from their injuries. The average length of stay for an episode of TBI-related care was 7 days, with a median cost of \$9,944 per episode of care. Virginia hospitals charged over 390 million dollars to payers during this 5 year period. Commercial or HMO Insurance payers were billed 48% of the time, and government payers (mainly Medicaid and Medicare) were billed 38% of the time. Twelve percent of the cases were classified as “self pay”.

Causes of TBIs could be determined for 78% of the cases; valid E-codes were not available for the others. A majority of hospitalizations (90%) were classified as unintentional. The leading causes of TBIs were falls (39%), motor vehicle traffic occupant (29%), and striking injuries (9%). Firearms were involved in 12% of the hospitalizations that resulted in a fatality.

Infants and the elderly have the highest TBI rates in Virginia

Ages of persons injured ranged from less than 1 year of age to 108, with an average age of 45 years; elderly adults 65 and above accounted for 30% of the hospitalizations, while 15-24 year olds accounted for an additional 18%. Injuries to the elderly were most likely to be caused by falls (78%). Adolescents and young adults were most likely to be hospitalized for motor vehicle occupant incidents (52%), striking injuries (12%), and falls (10%). The motor vehicle traffic (MVT) incidents mainly involved injuries to the driver (65%). Most striking injuries involved interpersonal violence (68%) and

Figure 1. Traumatic Brain Injuries by Age and Sex
Virginia 1999 - 2003



sports (16%). Across all age groups, whites were more likely to be hospitalized for TBI than were blacks, and males were more likely to be hospitalized than females except for those 65 or older where females were almost four times more likely to be hospitalized than were elderly males (See Figures 1 and 2).

Most traumatic brain injury related deaths are unintentional.

TBI-related Mortality

During the same five-year time period, there were a total of 6,870 TBI-related deaths, 2.4% of all deaths for this time period⁴. The crude 5-year rate for TBI-related deaths is 19.1 per 100,000 population and the age-adjusted rate is 19.5 per 100,000 (when adjusted to the 2000 Census standard population). A common measure of premature mortality is the years of potential life lost or YPLL⁵. For TBI alone, Virginians lost 200,633 years of potential life during the five-year period!

Almost 60% of TBI-related deaths were unintentional. The leading causes of unintentional deaths were motor vehicle crashes (53%) and falls (21%). As with TBI-related hospitalizations, fall-related deaths occurred disproportionately among the elderly with almost 75% of the TBI fall-related deaths occurring to those over the age of 65.

Twenty-seven percent of TBI-related deaths were suicide related and 13% were homicide related. Of the deaths that were not unintentional (including legal intervention and undetermined causes), almost 90% involved the use of a firearm.

Across all age groups, there were more male deaths from a TBI related injury than female deaths and in most age groups, except for adolescents and young adults, more white deaths than minority deaths (See Figures 3 and 4).

Figure 2. Traumatic Brain Injuries by Age and Race Virginia 1999 - 2003

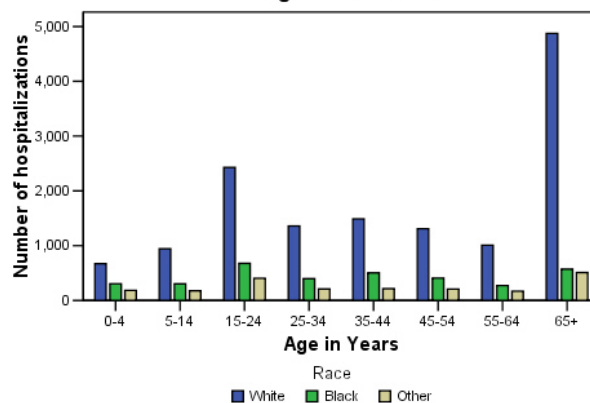


Figure 3. Traumatic Brain Injury Deaths by Age and Sex Virginia 1999-2003

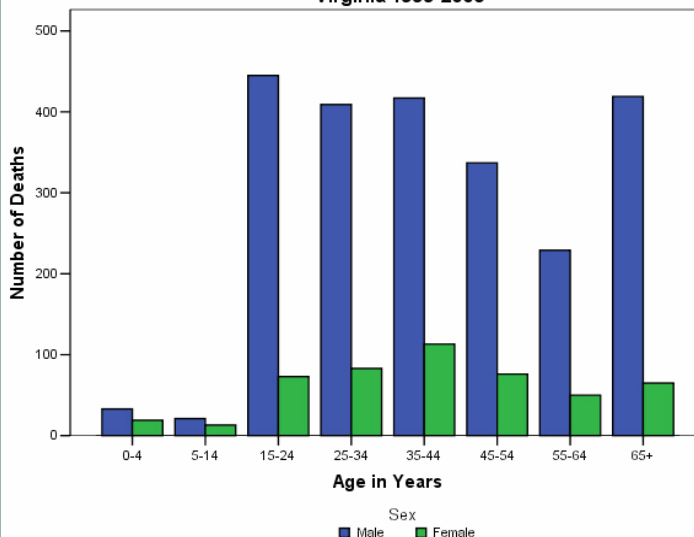
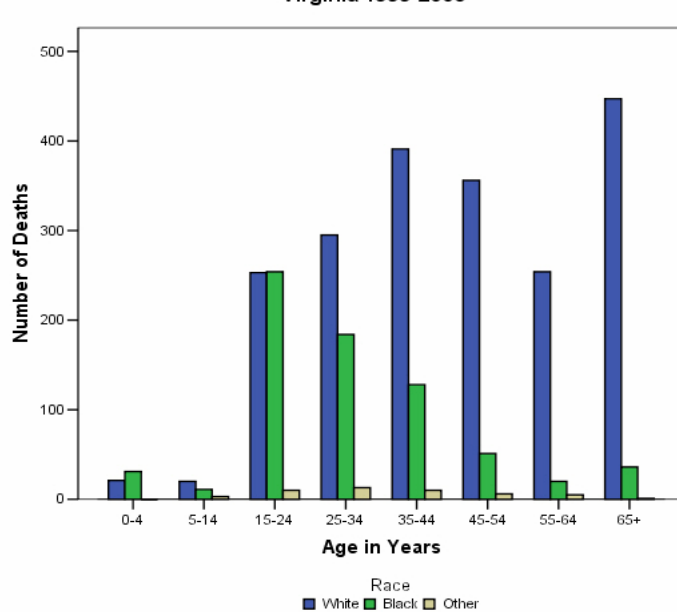


Figure 4. Traumatic Brain Injury Deaths by Age and Race Virginia 1999-2003



Overall TBI

The hospital discharge and mortality data were combined to examine the spectrum of traumatic brain injury in Virginia. The highest fatality rates for TBIs resulted from gunshot wounds, followed by MVT Unspecified and MVT pedestrian injuries. See Table 1.

Although more TBIs occurred to adolescents and young adults in Virginia, the highest rates of TBI are in infants (less than 1 year of age) and in the elderly – especially those older than 70 years of age. See Table 2.

Fall is the leading mechanism of TBI for infants, children, and adults over the age of 45.

Bicycling accounted for 17% of TBI for children ages 5-14, and pedestrian injuries accounted for another 12% of TBI in this age group.

The number of motor vehicle crash-related TBIs peaked in the 15-24 year age group; almost one-third of both injuries and fatalities occurred in this group. The case-fatality rate—the proportion of injuries that resulted in a fatality- was the highest among the elderly aged 65 and above (37% case-fatality rate).

Table 1. TBI Case-Fatality Rate for Leading Mechanisms

	Nonfatal	Fatal	Case-Fatality Rate (%)
Fall	5,350	876	14.07
MVT Occupant	3,953	970	19.70
Struck by, against	1,238	89	6.71
MVT Pedestrian	493	227	31.53
Transport, other	483	114	19.10
Pedal cyclist, other	309	26	7.76
MVT Motorcyclist	297	121	28.95
MVT Unspecified	239	882	78.68
MVT Pedal cyclist	143	26	15.38
Firearm	130	2,522	95.10

Table 2. TBI Rates by Age Group, Virginia 1999-2003

Age Group	TBIs	Rate per 100,000
< 1yr.	565	117.08
1-4 yrs.	658	34.89
5-9 yrs.	676	27.63
10-14 yrs.	839	33.20
15-19 yrs.	2,340	94.87
20-24 yrs.	2,137	85.32
25-29 yrs.	1,389	56.94
30-34 yrs.	1,393	51.62
35-39 yrs.	1,526	51.29
40-44 yrs.	1,527	51.08
45-49 yrs.	1,372	50.44
50-54 yrs.	1,214	50.00
55-59 yrs.	1,009	52.54
60-64 yrs.	902	62.43
65-69 yrs.	959	82.04
70-74 yrs.	1,182	116.19
75-79 yrs.	1,407	168.91
80-84 yrs.	1,480	263.11
85+yrs.	1,920	416.96
Total	24,495	68.09

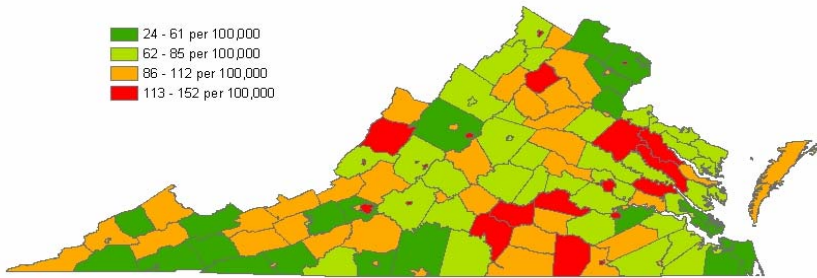
Over 90% of intentional TBI-related deaths (suicide or homicide) involved the use of a firearm.

95% of TBI-related firearm injuries resulted in a fatality

GEOGRAPHY

The maps display the geographic distribution of the five-year rates in TBI across the Commonwealth of Virginia. Maps for TBI rates, TBI death rates and TBI hospitalization rates are presented. All rates are crude rates.

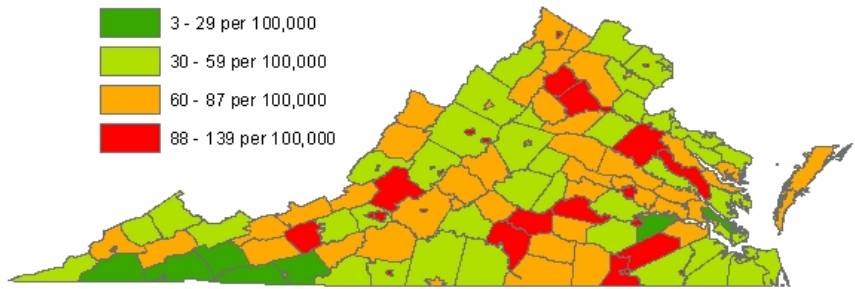
TBI Rates by Locality



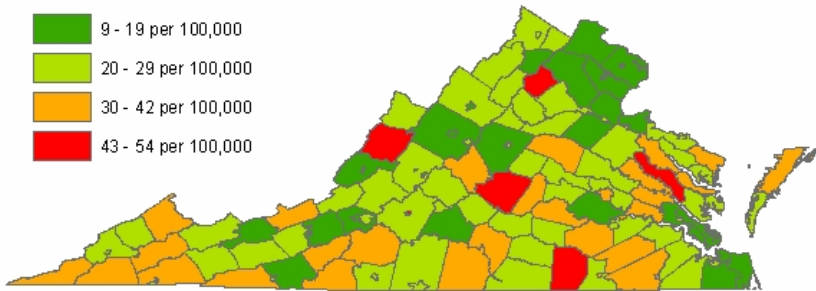
The state TBI injury rate is 68.1 per 100,000 population

The state TBI hospitalization rate is 54.4 per 100,000 population

TBI Hospitalization Rates by Locality



TBI Death Rates by Locality



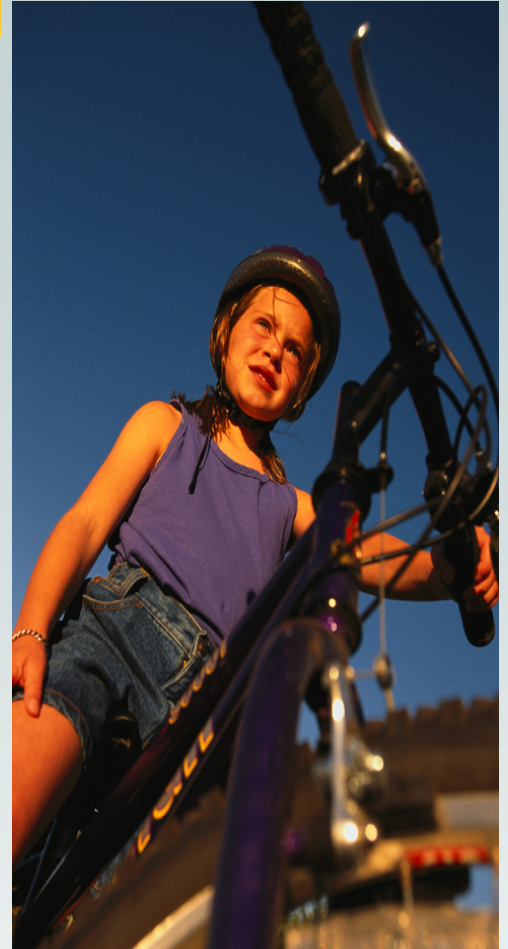
The state rate for TBI death is 19.1 per 100,000 population.

PREVENTION

Traumatic Brain Injury is an important public health problem for the Commonwealth. TBIs from both intentional and unintentional acts **can be** prevented.

Bicycling injuries account for a large percentage of TBI in children. Wearing a properly fitted bicycle helmet reduces the risk of brain injury by approximately 90%. According to survey data, only half of Virginia's children between 5 and 15 always wear their helmets⁶. These tips should be kept in mind:

- A bicycle helmet should fit comfortably and snugly
- The helmet should sit level on the head about two finger widths above the eyebrows
- The side adjuster buckles should form a "V" directly under the ear lobe
- Only two fingers should fit between the chin and the strap
- Helmets should be labeled as meeting the Consumer Product Safety Commission (CPSC) standard for bicycles
- Replace helmets that are over 5 years old, and always replace a helmet after a crash



TBI injuries in older adults are often caused by falls. According to survey data, one-third of Virginians over the age of 45 who recently fell sustained an injury⁷. To prevent falls, older adults should:

- Keep bathroom lights on
- Install hand rails along both sides of the stairs
- Use non-slip mats in the tub or shower
- Avoid loose rugs
- Remove clutter
- Keep wires behind furniture
- Gait training or balance training, along with muscle strengthening can help to prevent falls.
- Have a pharmacist review all medications

Falls are also a leading cause of TBI in infants and children. To help prevent TBIs in this age group:



- Never leave babies alone on any furniture
- Install gates at top and bottom of stairs until children can climb up and down safely
- Move chairs, cribs, beds, and other furniture away from windows
- Safely secure windows with window guards or window stops
- Modify slippery surfaces and remove hazards whenever possible

Motor vehicle crashes are a major cause of TBI in all age groups. Virginia law requires all children under the age of 6 to be properly secured in a child safety seat.

- Infants until at least 1 year old AND at least 20 pounds should be in rear-facing safety seats
- Children over 1 year old and weighing more than 20 pounds can be in forward-facing safety seats
- Children from about age 4 until at least age 8, and under 4-feet 9-inches tall, should be in booster seats
- Usually children at least 8 years old or over 4-feet 9-inches tall can correctly fit in vehicle lap and shoulder belts
- Children 12 and under should ride in the back seat of the vehicle



A majority of intentional TBI deaths involved a firearm, these injuries had a high case fatality rate. According to survey data, over one-third of Virginians keep firearms in or around their homes, and 1 in 6 are loaded and unlocked⁸!

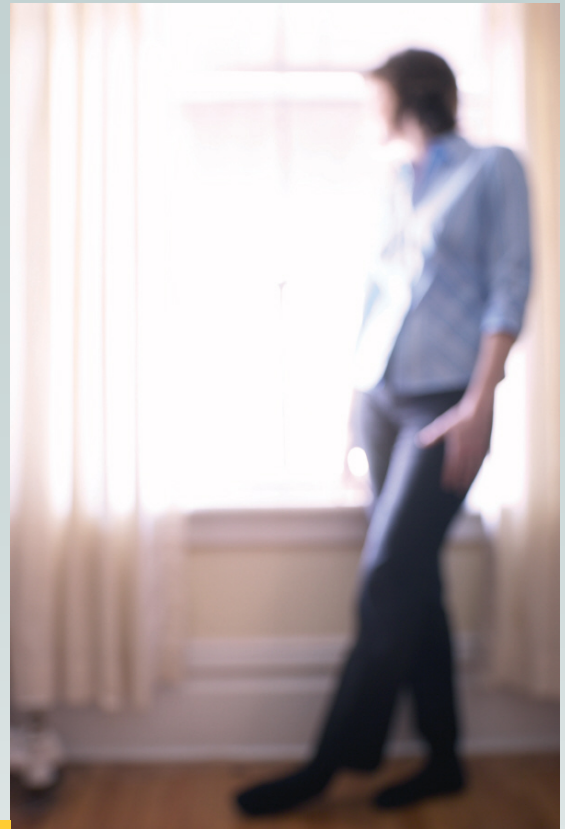


- Store firearms unloaded and locked with a firearm safe, locked box, trigger or chamber lock
- Store and LOCK ammunition in a separate place from firearms
- Remove firearms from your home if you have a depressed or suicidal family member
- Talk with your children about the risk of firearm injury in places they may visit or play

TBI caused by intentional acts of violence are mainly due to suicide attempts and incidents of intimate partner violence. In Virginia, 16% of the population has been pushed, hit, slapped, kicked, or physically hurt in any way by a partner or ex-partner.⁹

To prevent violence, we must work to change the culture that allows violence to continue.

- Learn the warning signs of depression and suicide
- Recognize the signs of healthy and unhealthy relationships
- Speak up when males say degrading things about females
- Do not support violent images in the media, including movies and video games
- Reduce access to firearms
- Know the resources for victims of domestic violence and those at-risk of suicide



CONCLUSIONS

Traumatic Brain Injury remains a public health concern in Virginia. This report demonstrates that TBI is costly, both in terms of healthcare dollars and in loss of human lives. Unfortunately, these types of injuries, as well as injuries in general, are often both portrayed and perceived as “accidents” caused by chance or carelessness rather than preventable events that can be addressed and reduced through behavior change, environmental modifications, and the innovative use of safety devices. Similarly, TBIs from an act of violence are often seen as an individual’s problem. Society often blames the victim of the violence for being a part of a violent relationship or being weak and acting on thoughts of suicide, instead of assuring that help is available and working toward a culture that does not support violence of any kind.

To change these perceptions, the Center for Injury and Violence Prevention analyzes Virginia’s injury data, develops and promotes prevention programs and policies, and provides training and community education. We promote and disseminate safety devices to at-risk populations, conduct public information campaigns and fund local prevention projects. We work collaboratively with schools and daycares, health, social service and mental health providers, law enforcement, fire and EMS providers, and a variety of other community groups across Virginia.

The Resource Center for Injury & Violence Prevention offers injury & violence prevention tip cards in English and Spanish as well as posters and videos. These materials are free of charge to residents, educators and organizations in Virginia.

For more information on injury prevention, including general information, topical information, evidence based practices and training information, please visit the CIVP website at <http://www.vahealth.org/civp>.

Sources

¹Langlois, JA, Furland-Brown, W, Thomas, KE. *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths*. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2004.

²Burns, J and Hauser, WA. (2003). The epidemiology of traumatic brain injury: A review. *Epilepsia* 44 (Suppl.10), 2-10.

³TBI case definition codes were taken from the report: Marr A, Coronado V, editors. *Central Nervous System Injury Surveillance Data Submission Standards-2002*. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2004. A hospitalization was considered to be TBI-related if any the following ICD-9 codes was in the primary, secondary or tertiary diagnosis fields: 800.0-801.9, 803.0-804.9,850.0-854.1, 950.1-950.3, 959.01 or 955.55.

⁴A death was considered to be TBI-related if any of the following ICD-10 codes was in any of the first five contributing cause of death fields: S01.0 – S01.9, S02.0, S02.1, S02.3, S02.7-S02.9, S04.0, S06.0-S06.9, S07.0, S07.1, S07.8, S07.9, S09.7 – S09.9, T01.0, T02.0, T04.0, T06.0, T90.1, T90.2, T90.4, T90.5, T90.8, or T90.9.

⁵YPLL were calculated using the National Center for Health Statistic's guidelines. See <http://www.cdc.gov/nchs/dataawh/nchsdefs/yearsofpotentiallifelost.htm> for more information.

^{6,7,8,9}From 2003 Virginia Behavioral Risk Factor Surveillance System (BRFSS) data.

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