

BRAIN INJURIES:

Prevention, Rehabilitation, and Community Living



Brain injuries can result from events like falls, car crashes, attacks, sports injuries, and explosions or blasts. Avoiding these events, if possible, is an important way to help prevent brain injuries. Brain injuries can affect all parts of a person's life, including growth and development, health, emotions, relationships, employment, money and health care management, keeping a household, movement, and daily activities. If someone has a brain injury, evaluations, treatments, and supportive services are available. These services can help individuals to improve their abilities and live as independently as possible in their communities.

TRAUMATIC BRAIN INJURY

A traumatic brain injury (TBI) is an injury to the brain caused by a sudden force, blow, or jolt to the head or by an object penetrating the brain. People can get a TBI when there is some force that reaches the brain, like:

- An object hits the head, such as a bat or a fist during a fight
- The head hits an object, such as the dashboard in a car accident or the ground in a fall
- A nearby blast or explosion rapidly moves a person's head

With a TBI, the brain's normal functioning changes, and people may:

- Become suddenly confused
- Have a gap in their memory
- Lose consciousness briefly
- Go into a coma

TBI commonly damages the front parts of the brain. This happens because the brain sits inside

the skull in a way that the frontal areas of the brain are the most vulnerable to injury, regardless of where the head injury occurs. These frontal areas of the brain are vital to a person's ability to think, plan, feel, and act.

The initial severity of TBIs can be mild, moderate or severe. Most TBIs are mild and are also known as concussions. People with a mild TBI may have a period of confusion, memory loss or unconsciousness, but these symptoms may last only for a few seconds to minutes. Early symptoms of mild TBI may include: headache; confusion; dizziness; problems seeing or tolerating light; problems with hearing or ringing in the ears; loss of smell or taste; tiredness; changes in sleep; irritability; apathy; and trouble with thinking, learning, or remembering. People with a more severe TBI may have long-term headaches; nausea and vomiting; seizures; coma; dilation of one or both pupils of the eyes; slurred speech and inability to speak; problems with movement; persistent memory and emotional problems; and confusion, restlessness, or agitation.



CONCUSSION

Each year, about 75% of TBIs that are treated in a hospital or emergency department (ED) are concussions or mild TBIs. Recovery from these injuries usually occurs quickly (in 1-2 weeks), but even if early symptoms continue, most people are back to full functioning by 3 months. A small number of people (<5%) who have a single mild TBI can have some ongoing symptoms for a year or more.

People who have had more than one TBI, even a mild one, are more likely to experience persistent symptoms following their injury. Early management by an experienced clinician or team of clinicians is key to recovery. If several TBIs occur within hours, days, or weeks, the result can lead to severe problems, including coma, confusion, or even death. Thus, changing activity and behavior to prevent repeated injury is vital after an initial TBI.

The symptoms of a concussion can be hard to tell from symptoms people commonly have (such as headache, tiredness, and memory difficulties). For the first several days or even weeks, people with concussions, their family members, and even their doctors may not notice problems. The person may look fine overall, even though acting or feeling differently. The Centers for Disease Control and Prevention (CDC) discusses these symptoms on its website at http://www.cdc.gov/concussion/get_help.html. The two fact sheets, including one in Spanish, and a brochure for consumers are short and easy to read.

The Brain Injury Association of America has a toll-free number for its National Brain Injury Information Center (NBIIC), at 1-800-444-6443. This number will direct callers to information and resources available in their state.

TRAUMATIC BRAIN INJURY STATISTICS

Traumatic brain injury is a major, often avoidable, cause of death and disability in the United States. At least 5.3 million Americans are living with disabilities related to a serious brain injury. Of all the people in the U.S. who die from an injury, about 30% die from an injury that involved a TBI. TBIs are the leading cause of death and disability in people younger than 45.

**EARLY
MANAGEMENT
BY AN EXPERIENCED
CLINICIAN OR TEAM
OF CLINICIANS
IS KEY TO
RECOVERY**

PREVENTION OF TRAUMATIC BRAIN INJURY

There are many ways to reduce the chances of experiencing a TBI:

- Correctly use seat belts in a motor vehicle.
- Install and use age-appropriate car seats correctly.
- Never drive while under the influence of alcohol, drugs, or emotional distress.
- Wear a helmet when:
 - Riding a bike, motorcycle, snowmobile, scooter, or all-terrain vehicle
 - Playing a contact sport, such as football, ice hockey, lacrosse, or boxing
 - Using in-line skates or riding a skateboard
 - Batting and running bases in baseball or softball
 - Riding a horse
 - Skiing or snowboarding
- Make living areas safer by:
 - Child-proofing homes
 - Removing tripping hazards such as throw rugs and clutter in walkways
 - Using nonslip mats in the bathtub and on shower floors
 - Installing grab bars next to the toilet and in the tub or shower for older adults
 - Installing handrails on both sides of stairways
 - Improving lighting throughout the home
 - Exercising regularly, under a doctor's guidance, to improve lower body strength and balance

The CDC has a number of educational programs on preventing brain injury for people of all ages at: <http://www.cdc.gov/TraumaticBrainInjury/index.html>. Among the programs are several about sports injury and concussion that target school audiences. CDC also offers an online program for professionals and consumers that provides information about preventing TBI among older adults at <http://www.cdc.gov/traumaticbraininjury/seniors.html>.

The National Institutes of Health (NIH) has a website for older adults about causes of, risks for, and prevention of falls. Please see <http://nihseniorhealth.gov/falls/aboutfalls/01.html>.



Falls are the leading cause of TBIs for children and older adults. Falls cause 55% of the TBIs in children younger than 14. Falls cause 81% of TBIs in older adults. In 2010, about 2.5 million hospital ED visits, hospitalizations, or deaths were related to TBI in the United States. Among TBI-related deaths in 2006–2010:

- Men were about three times more likely to die than women.
- Death rates were highest for people age 65 years and older and falls were the leading cause of death for persons age 65 years or older.
- Motor vehicle crashes were the leading cause of TBI deaths for children and young adults (age 5-24).
- Assaults were the leading cause of TBI death for the youngest children (age 0-4).



RESTING

AFTER A CONCUSSION OR
TRAUMATIC BRAIN INJURY IS
VERY IMPORTANT

RECOVERY FROM TBI

Health care workers can assess the severity of an initial TBI and the symptoms that occur afterwards. Over time, they can test specific areas of functioning, such as speech and language, cognition, behavior, and physical skills. These help in understanding the effects of a TBI and the types of services a person needs.

For most people, the milder a person's initial TBI, the better recovery over time. However, even a mild TBI can have a more complicated recovery for someone who has not healed from a previous one or has had other things happen to the brain (such as psychological stress or alcohol abuse). Recovery is best during the first weeks and months after the injury and more gradual after 3-6 months.

The rate of recovery from the injury is usually related to how severe it is. People with mild injuries tend to recover more quickly than those with moderate to severe injuries. Those with moderate to severe injuries may have a prolonged period of confusion and inability to function. Those with severe injuries may have long periods of initial unresponsiveness (coma). People can take longer to recover when they have had a previous TBI, even if that previous injury were a mild TBI. Recovery may be slower among adults over age 55.

Sometimes people have problems that persist and affect their lives after a TBI. The extent of these problems and the impact on a person's life depend on how severe the injury is, where the injury is located, the health of the person at the time of injury and the person's age. Problems that persist over time may eventually limit some of a person's abilities.

Among non-fatal, TBI-related injuries in 2006–2010:

- Men had higher rates of hospitalizations and ED visits than women.
- Hospitalization rates were highest among people age 65 years and older.
- Falls were the leading cause of TBI-related ED visits for almost every age group.
- Assault was the leading cause of TBI-related ED visits among persons 15–24 years.
- Rates of ED visits were highest for children age 0-4 years.

Researchers estimate that the economic cost of TBI in 2010, including medical costs, was \$76.5 billion. The costs of TBIs related to death and hospital use were responsible for about 90% of total TBI medical costs.

DISABILITIES

Disabilities are typically related to changes and limitations in:

- Cognition
- Emotion and behavior control
- Communication
- Sensation
- Motor function

People who have had a TBI of any severity commonly have problems at first with cognition, which can include trouble remembering things, thinking of the right word, learning new information, problem solving, concentrating, initiating activities, organizing, making decisions, and doing more than one thing at a time (multi-tasking).

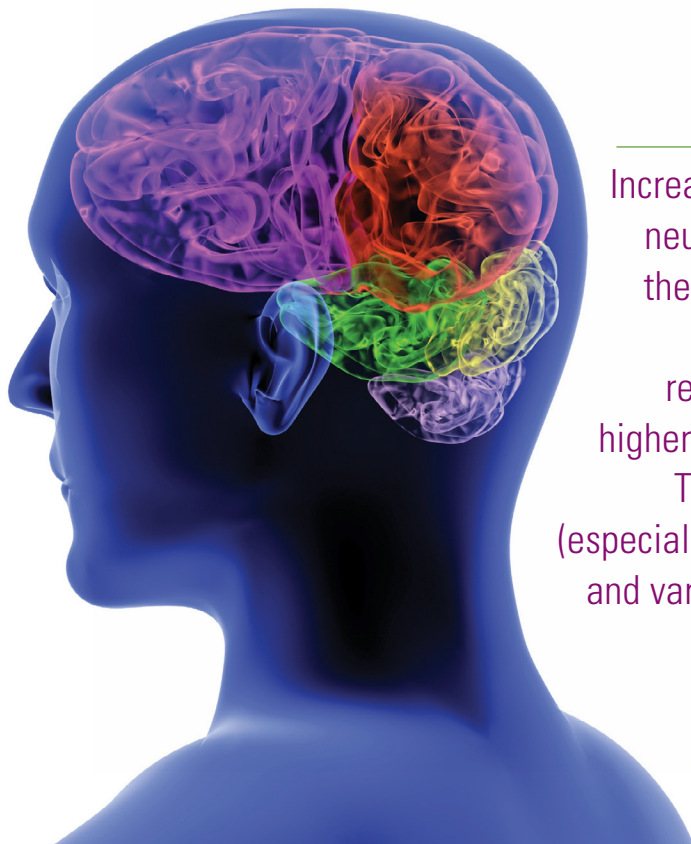
Some people who have a TBI may have emotional or behavioral difficulties such as depression, apathy, anxiety, anger, confusion, sleep disruption, changes in controlling behavior, and

mood swings. These difficulties may lead to impulsiveness and lack of self-control, violence, or inappropriate sexual activity.

Communicating with others can be a problem for those with TBI. Some may have difficulty with understanding, speaking, writing, and interpreting non-verbal signals, such as body language and the emotional cues of others. These problems can lead to miscommunication, confusion, and frustration for persons with TBI and for those who spend time with them.

Some people who have experienced a TBI have problems with vision and hand-eye coordination or movement. They may bump into or drop things, or feel unsteady.

Some people with TBI may need medicine to help them cope with the mental and physical health problems they may experience. They are more likely to experience side effects from their medicine than those without TBI.



Increasingly, research supports the idea that long-term neurologic conditions can develop after a TBI. While these problems are rare and more commonly seen in those with more severe initial injuries and with repeated injuries, everyone should be aware of the higher risks and of the importance of preventing further TBIs. These neurologic conditions include epilepsy (especially after penetrating injuries), Parkinson's disease, and various forms of dementia, like Alzheimer's disease.



REHABILITATION

After experiencing a moderate or severe TBI, people may need to be in a hospital until their medical condition improves. Some people need additional care after they leave the hospital, due to the effects of the TBI. Rehabilitation services can help people to restore or improve their ability to manage their lives and health care; stay involved with family, friends, and community; live at home; carry out daily activities; and find a job.

There are many choices for rehabilitation. People can receive these services at home, in hospitals, rehabilitation centers, day programs, supported living programs, or other places. Persons with TBI, their families, and their medical teams should work together with their health insurers to identify the best rehabilitation setting.

Trained rehabilitation professionals can test a person's abilities related to cognition, communication, language, behavior, movement,

and management of their lives to develop a rehabilitation plan. Rehabilitation programs can involve many specialists, depending on the type of help a person needs. The rehabilitation plans can involve physical therapy, occupational therapy, speech and language therapy, physiatry (physical medicine), nursing, psychology, psychiatry, and social support. Initial treatment plans are frequently modified in response to a person's progress.

Rehabilitation can also identify ways to help people carry out tasks and daily activities. For example, a person may need reminders and timers to help with taking medicine or eating. Labels may be used to aid in remembering where food, clothes, dishes, and other things are. Written reminders can be used to organize days and help with how to prepare food, shop, and do other activities. For example, a person may not remember how to make a sandwich, or when to make or eat the sandwich.

The Brain Injury Association of America (BIAA) has a list of rehabilitation facilities across the country that can help people who are looking for care after a TBI at <https://secure.biausa.org/OnlineDirectory/Directory/SearchType4.aspx>



REHABILITATION SERVICES CAN HELP PEOPLE TO RESTORE OR IMPROVE THEIR ABILITY TO MANAGE THEIR LIVES, INCLUDING STAYING INVOLVED WITH FAMILY, FRIENDS, AND COMMUNITY.



A PERSON'S BRAIN CAN
**CONTINUE TO CHANGE
YEARS AFTER**

A MODERATE OR SEVERE
TRAUMATIC BRAIN INJURY

LIVING WITH A TRAUMATIC BRAIN INJURY

People who experience TBIs that result in long-term health effects or disabilities can live productive, quality lives in their communities. Some government programs can help people and their families with health and long-term services and supports. Medicare generally covers health and rehabilitation for older adults and adults with disabilities who cannot work (<http://www.medicare.gov/>). Medicaid generally covers health and rehabilitation services, plus help with daily activities for those who qualify – primarily people of all ages with low incomes and limited assets (<http://www.medicaid.gov/>). Since states control who gets Medicaid services and the type and amount of services available, programs vary across the country. The Administration for Community Living has information about services and supports for people who experience disability at <http://www.acl.gov/>. The U.S. Veterans Health Administration can provide certain health and long-term services and supports to veterans with TBI who qualify (<http://www.va.gov/health/>). In addition, many groups are doing research that may help people with TBIs and their families.

Someone who has a disability due to aging or a disease or injury other than TBI may also have a TBI. A study of adults in one state found that almost 40% of community-living adults who reported having a disability also reported that they had had at least one TBI with loss of consciousness sometime in their life.

There is growing evidence that a TBI is not just an isolated event; instead, a person's brain can continue to change years after a moderate or severe TBI. Some people continue to improve, while others may get worse. Few stay the same. Healthy brain habits are good for everyone, but especially smart for someone who has already experienced a TBI. Meet regularly with your health care team, and take care of your health. For example:

- Eat a healthy diet that is low in salt, solid fats, and simple sugars
- Avoid drinking alcohol
- Get active and stay active every day
- Find time every day to relax and meditate
- Sleep 7-8 hours each night
- Learn new things every day
- Connect with your family, friends, and communities

ADDITIONAL RESOURCES

The Administration for Community Living

(ACL) has a Brain Health Resource, which provides basic information about current, evidence-based information and resources related to brain health: http://www.acl.gov/Get_Help/BrainHealth/Index.aspx

ACL's National Institute on Disability, Independent Living, and Rehabilitation

Research (NIDILRR) funds the Model Systems Knowledge Translation Center (<http://www.msctc.org/>) along with the Traumatic Brain Injury Model Systems Center (<http://www.msctc.org/tbi/model-system-centers>). They offer consumer-friendly fact sheets, videos, and narrated slideshows on many topics related to TBI. For more general information on TBI: <http://www.msctc.org/tbi/factsheets/Understanding-TBI>. For other topics such as balance, vision, and fatigue: <http://www.msctc.org/tbi/factsheets>.

The Centers for Disease Control and Prevention (CDC)

has websites and online programs on a variety of TBI-related topics, as well as links to support organizations: <http://www.cdc.gov/traumaticbraininjury>.

The Departments of Defense and Veterans

Affairs (VA) support the Defense and Veterans Brain Injury Center (DVBIC), which serves active duty military and veterans with brain injury. Call toll-free at 1-800-870-9244 or visit DVBIC at <http://dvbic.dcoe.mil>.

The Air Force supports the TBI center at the Center of Excellence for Medical Multimedia (CEMM). The website contains interactive learning opportunities about TBI treatment and care at <http://www.traumaticbraininjuryatoz.org/>.

The Health Resources and Services

Administration (HRSA) manages a TBI program that provides some funds for resources and protection systems for people with TBI and their families. More information about this program is at <http://mchb.hrsa.gov/programs/traumaticbraininjury/>.

The NIH's National Institute of Neurological Disorders and Stroke (NINDS)

has a toll-free phone number (1-800-352-9424) that people can call for information about neurological disorders and conditions such as traumatic brain injury. Information also is available at the NINDS website, <http://www.ninds.nih.gov/>.

WETA, a Public Broadcasting Service member station in Washington, D.C., maintains <http://www.brainline.org/>, a compendium of videos and printed material about living with TBI.

NOTES: Scientists and clinicians in CDC, NIDRR (now NIDILRR), NIH and VA reviewed the information in this brochure in 2015. References to non-federal government sources or sites on the internet are provided as a service and do not constitute or imply endorsement of these organizations or their programs by ACL or the U.S. Department of Health and Human Services. ACL is not responsible for the content of pages found at these sites. URL addresses were current as of the date of this publication.

