

30 Minute Lesson: Traumatic Brain Injury (TBI)

Participant Version

Lesson Summary

A traumatic brain injury (TBI) is defined as a blow or jolt to the head or a penetrating head injury that disrupts the function of the brain. The severity of such an injury may range from "mild," i.e., a brief change in mental status or consciousness to "severe," i.e., an extended period of unconsciousness or amnesia after the injury.¹ This lesson focuses on building an understanding of traumatic brain injury, particularly from an employment standpoint.

Learning Objectives

- < Build an understanding of TBI: causes, prevalence, and characteristics
- < Review information about what happens when a person gets a TBI
- < Review information about successful employment approaches for people with TBI

The Ideal Participant

- < Works with individuals with traumatic brain injury in an employment context.

Prep activities and time required

10-20 minutes, including reading the lesson, making copies of handout exercises, and organizing.

Lesson length, other requirements

30-45 minutes. Can be adjusted by eliminating or modifying exercises
Does not require an overhead or LCD projector. A flip chart or whiteboard is handy but not necessary. All handouts are ready to use, or can be modified by user to meet specific needs.

¹ <http://www.biausa.org/aboutbi.htm>

Test Your Knowledge!



1. What is the leading cause of TBI in the US?

2. What is the difference between an open and closed head injury? Which is more serious?

3. What are the three processes that injure the brain when a person experiences a TBI?

4. Which of the following are not common problems experienced by people with TBI?

- Problems with memory
- Depression
- Seizures
- Physical limitations and balance problems
- Loss of friends and other meaningful relationships

5. True or False: The left hemisphere of the brain deals more with visual activities and plays a role in putting things together

What is a Traumatic Brain Injury?

A traumatic brain injury occurs when an outside force impacts the head hard enough to cause the brain to move within the skull or if the force causes the skull to break and directly hurts the brain.



- A direct blow to the head can be great enough to injure the brain inside the skull. A direct force to the head can also break the skull and directly hurt the brain. This type of injury can occur from motor vehicle crashes, firearms, falls, sports, and physical violence, such as hitting or striking with an object.
- A rapid acceleration and deceleration of the head can force the brain to move back and forth across the inside of the skull. The stress from the rapid movements pulls apart nerve fibers and causes damage to brain tissue. This type of injury often occurs as a result of motor vehicle crashes and physical violence, such as Shaken Baby Syndrome.

What Causes TBI?

The leading causes of TBI are falls (28%), motor vehicle-traffic crashes (20%), striking the head against or being struck by something (19%), and assaults (11%). Explosions are a leading cause of TBI for active duty military personnel in war zones. ²

How Many People Experience TBI?

500,000 people are hospitalized with TBI each year and at least 50,000 experience long-term debilitating effects as a result of their injury. ³ Males are about 1.5 times as likely as females to sustain a TBI. The two age groups at highest risk for TBI are children under 5 and 15 to 19 year olds. The Centers for Disease Control and Prevention estimates that at least 5.3 million Americans currently have a long-term or lifelong need for help to perform activities of daily living as a result of a TBI. ⁴

² <http://www.biausa.org/aboutbi.htm>

³ Andrew, Jason, 2004; *Disability Handbook*, University of Arkansas

⁴ <http://www.biausa.org>

What is Anoxic Brain Injury? Is it different from TBI?

Anoxic (no oxygen) or Hypoxic (too little oxygen) Brain Injury occurs when the brain does not receive enough oxygen. Causes can include:

- Airway obstruction
- Near-drowning, throat swelling, choking, strangulation, crush injuries to the chest
- Electrical shock or lightning strike
- Trauma to the head and/or neck
- Blood loss from open wounds, artery impingement from forceful impact, shock
- Vascular Disruption
- Heart attack, stroke, arteriovenous malformation (AVM), aneurysm, intracranial surgery
- Meningitis, AIDS, intracranial tumors, metabolic disorders, certain venereal diseases, insect-carried diseases, brain tumors, hypo- or hyperglycemia, hepatic encephalopathy, uremic encephalopathy, seizure disorders
- Toxic exposure
- Illegal drug use, alcohol abuse, lead, carbon monoxide poisoning, toxic chemicals, chemotherapy (not all the time). ⁵

Depending on the area of the brain impacted, this type of brain injury can cause functional limitations that are very similar to those caused by TBI.

How is Traumatic Brain Injury Treated?

Because little can be done to reverse the initial brain damage caused by trauma, medical personnel try to stabilize an individual with TBI and focus on preventing further injury. Primary concerns include insuring proper oxygen supply to the brain and the rest of the body, maintaining adequate blood flow, limiting swelling, and controlling blood pressure.

Moderately to severely injured individuals receive rehabilitation that involves individually tailored treatment programs in the areas of physical therapy, occupational therapy, speech/language therapy, physiatry (physical medicine), psychology, and social support. Approximately half of people with severe head injuries will need surgery to remove or repair hematomas (ruptured blood vessels) or contusions (bruised brain tissue). ⁶



⁵ http://www.biausa.org/Pages/types_of_brain_injury.html

⁶ <http://www.ninds.nih.gov/disorders/tbi/tbi.htm>

What Happens with a Person Gets a TBI?

From http://www.biausa.org/Pages/types_of_brain_injury.html and <http://www.tbiguide.com> by Dr. Glen Johnson

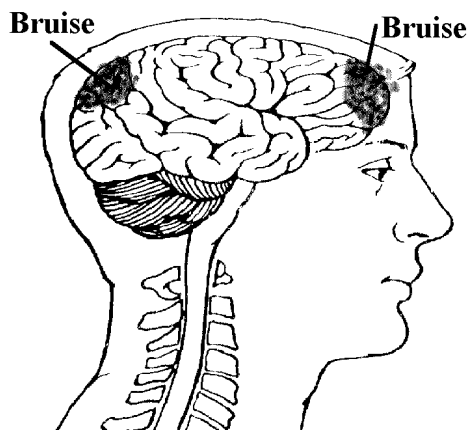
Three separate processes work to injure the brain: *bruising (bleeding), tearing, and swelling.*

Bruising (Bleeding)

If a person is driving a car at 45 miles per hour and is struck head-on by another car traveling at the same rate of speed, the person's brain goes from 45 miles per hour to zero in an instant. The soft tissue of the brain is propelled against the very hard bone of the skull. The brain tissue is "squished" against the skull and blood vessels may tear.

A major problem is that there is no room for this extra blood. The skull, being hard and brittle, does not expand. So the blood begins to press on softer things--like brain tissue. Brain tissue is very delicate and will stop working properly or may even die off. With large amounts of bleeding in the brain, the pressure will make critical areas of the brain stop working. Areas that control breathing or heart rate could be affected, and a life or death situation could develop within hours of the accident.

There is also an "odd" thing that the brain goes through during a car accident. The brain, which is very soft, is thrown against the front part of the skull, which is very hard, and



bruising can happen. But the injury process is not over. The brain, and rest of the body, fly backward. This bouncing of the brain first against the front of the skull and then against the back of the skull, can produce bruises in different parts of the brain. Thus people can have a bruise not only where their foreheads hit the steering wheel, but other areas of the brain as well. Doctors call this a "contra coup" injury. (*"Coup" is pronounced "coo"*)

Tearing (Diffuse Axonal Injury)

At some point in time, we've all played with the food "Jell-O". If you put a thin cut in a square of Jell-O with a knife and let it go, the Jell-O will come back to shape if you jiggle it. The Jell-O will look perfectly good up until the time you go to lift it up, and there will be the slice. The brain has a consistency slightly firmer than Jell-O, but the same effect applies. In the case of the car accident, the brain is thrown forward, then bounced backward. In this forward/backward motion, the brain can be torn. The brain can also be torn by the effects of "energy". If you take a block of ice and hit it with a hammer

(assuming you don't completely shatter the ice), you will see little cracks in the ice. Energy from the hammer has been transferred to the ice, producing the web-like cracks. Tearing in the brain is very serious. Tearing in the brain "cuts" the wires that make the brain work. One of the problems with tearing is that it happens on a microscopic level (the brain has about 100 billion of these "wires"). This tearing may not show up on typical medical tests.

Swelling

If I drop a bowling ball on my foot, my foot will turn "black and blue" due to blood leaking under the skin. But my foot will also do something else--it will swell up. The body realizes that the foot has been injured and sends agents to heal the injured area. The problem with the brain is that there is no extra room and the pressure begins to build up. This pressure pushes down on the brain and damages structures in the brain. If there is too much pressure, this can stop important structures that control breathing or the heart rate. Sometimes, doctors will install a "relief valve" (intra-cranial pressure monitor or ICP) to let off the excess pressure.



Open vs. Closed Head Injury

Not too long ago, doctors made the distinction between open and closed head injury. In a open head injury, the skull is fractured and doctors assumed this would produce a severe head injury. In closed head injury, the skull is not broken and doctors assumed these produce less severe injuries. Wrong! In closed head injury, pressure builds up and damages brain tissue. If you fracture the skull, you may let off excess pressure thus saving the brain from further damage.

Levels of Brain Injury

Emergency personnel typically determine the severity of neurological injury to the brain by using an assessment called the Glasgow Coma Scale (GCS) to. The terms Mild Brain Injury, Moderate Brain Injury, and Severe Brain Injury are used to describe the level of initial injury in relation to the neurological severity caused to the brain. Keep in mind that there is nothing "Mild" about a brain injury—again, the term "Mild" Brain injury is used to describe a level of neurological injury. Any injury to the brain is a real and serious medical condition.

Mild traumatic brain injury occurs when the loss of consciousness is very brief or does not occur, and testing or scans of the brain may appear normal, but there is a change in the mental status at the time of injury—the person is dazed, confused, or loses consciousness. The change in mental status indicates that the person's brain functioning has been altered, this is called a concussion.

Symptoms of mild traumatic brain injury include:

- Headache
- Fatigue
- Sleep disturbance
- Irritability
- Sensitivity to noise or light
- Balance problems
- Decreased concentration and attention span
- Decreased speed of thinking
- Memory problems
- Nausea
- Depression and anxiety
- Emotional mood swings

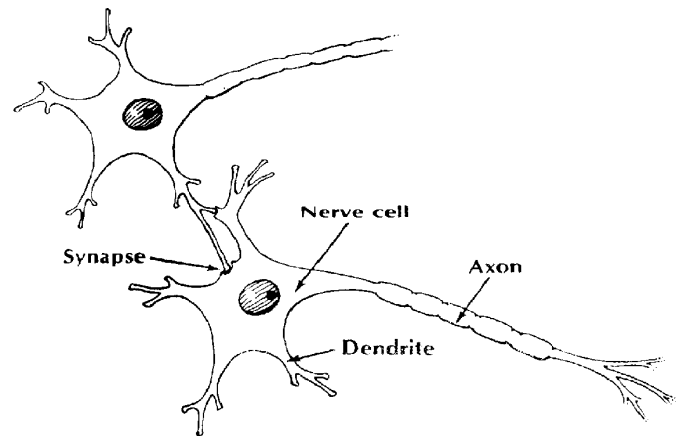
A moderate traumatic brain injury occurs when the loss of consciousness lasts from a few minutes to a few hours, Confusion lasts from days to weeks, and physical, cognitive, and/or behavioral impairments last for months or are permanent. **Severe brain injury** occurs when a prolonged unconscious state or coma lasts days, weeks or months.⁷

⁷ http://www.biausa.org/Pages/types_of_brain_injury.html

The human brain weighs only three pounds but is estimated to have about 100 billion cells. It is hard to get a handle on a number that large (or connections that small). Let's try to get an understanding of this complexity by comparing it with something humans have created--the entire phone system for the planet. If we took all the phones in the world and all the wires (there are over four billion people on the planet), the number of connections and the trillions of messages per day would NOT equal the complexity or activity of a single human brain. Now let's take a "small problem"--break every phone in Michigan and cut every wire in the state. How long would it take for the entire state (about 15 million people) to get phone service back? A week, a month, or several years? If you guessed several years, you are now beginning to see the complexity of recovering from a head injury. In the example I used, Michigan residents would be without phone service while the rest of the world had phone service that worked fine. This is also true with people who have a head injury. Some parts of the brain will work fine while others are in need of repair or are slowly being reconnected.

AN ELECTRICAL AND CHEMICAL MACHINE

As previously stated, the brain consists of about 100 billion cells. Most of these cells are called neurons. A neuron is basically an on/off switch just like the one you use to control the lights in your home. It is either in a resting state (off) or it is shooting an electrical impulse down a wire (on). It has a cell body, a long little wire (the "wire" is called an axon), and at the very end it has a little part that shoots out a chemical. This chemical goes across a gap (synapse) where it triggers another neuron to send a message. There are a lot of these neurons sending messages down a wire (axon).



Each of the billions of neurons "spits out" chemicals that trigger other neurons. Different neurons use different types of chemicals. These chemicals are called "transmitters" and are given names like epinephrine, norepinephrine, or dopamine. Pretty simple, right? Well, no. Even in the simplified model that I'm presenting, it gets more complex.

IS THE BRAIN ONE BIG COMPUTER?

Let's look at the brain using a different model. Let's look at the brain as an orchestra. In an orchestra, you have different musical sections: percussion, strings, woodwinds, and so on. Each has its own job to do and must work closely with the other sections. When playing music, each section waits for the conductor. The conductor raises a baton and all the members of the orchestra begin playing at the same time playing on the same note. If the drum section hasn't been practicing, they don't play as well as the rest of the orchestra. The overall sound of the

music seems "off" or plays poorly at certain times. This is a better model of how the brain works. We used to think of the brain as a big computer, but it's really like millions of little computers all working together.

GETTING INFORMATION IN AND OUT OF THE BRAIN

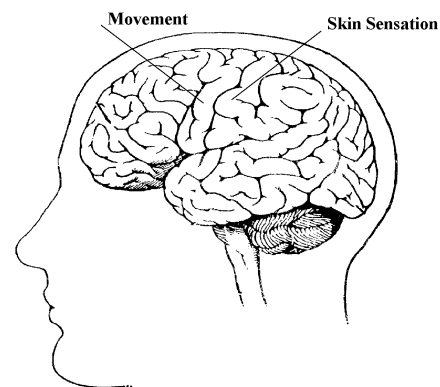
A lot of information comes in through the spinal cord at the base of the brain. Think of a spinal cord as a thick phone cable with thousands of phone lines. If you cut that spinal cord, you won't be able to move or feel anything in your body. Information goes OUT from the brain to make body parts (arms and legs) do their job. There is also a great deal of INCOMING information (hot, cold, pain, joint sensation, etc.). Vision and hearing do not go through the spinal cord but go directly into the brain. That's why people can be completely paralyzed (unable to move their arms and legs) but still see and hear with no problems.

Information enters from the spinal cord and comes up the middle of the brain. It branches out like a tree and goes to the surface of the brain.

TWO BRAINS--LEFT AND RIGHT HEMISPHERE

The brain is divided in half, a right and left hemisphere. The right hemisphere deals more with visual activities and plays a role in putting things together. For example, it takes visual information, puts it together, and says "*I recognize that--that's a chair,*" or "*that's a car*" or "*that's a house.*" It organizes or groups information together. The left hemisphere tends to be the more analytical part; it analyzes information collected by the right. It takes information from the right hemisphere and applies language to it. The right hemisphere "sees" a house, but the left hemisphere says, "*Oh yeah, I know whose house that is--it's Uncle Bob's house.*"

So what happens if one side of the brain is injured? People who have an injury to the right side of the brain "don't put things together" and fail to process important information. As a result, they often develop a "denial syndrome" and say "there's nothing wrong with me." For example, I treated a person with an injury to the right side of the brain--specifically, the back part of the right brain that deals with visual information--and he lost half of his vision. Because the right side of the brain was injured, it failed to "collect" information, so the brain did not realize that something was missing. Essentially, this person was blind on one side but did not know it. What was scary was that this person had driven his car to my office. After seeing the results of the tests that I gave him, I asked, "Do you have a lot of dents on the left side of your car?" He was amazed that I magically knew this without seeing his car. Unfortunately, I had to ask him not to drive until his problems got better. But you can see how the right side puts things together.



The left side of the brain deals more with language and helps to analyze information given to the brain. If you injure the left side of the brain, you're aware that things aren't working (the right hemisphere is doing its job) but are unable to solve complex problems or do a complex activity. People with left hemisphere injuries tend to be more depressed, have more organizational problems, and have problems using language.

MOVEMENT

The area of the brain that controls movement is in a very narrow strip that goes from near the top of the head right down along where your ear is located. It's called the motor strip. If I injure that area, I'll have problems controlling half of my body. If I have a stroke in the left hemisphere of my brain, the right side of the body will stop working. If I have an injury to my right hemisphere in this area, the left side of my body stops working (remember, we have two brains). This is why one half of the face may droop when a person has had a stroke.

HEARING AND LANGUAGE

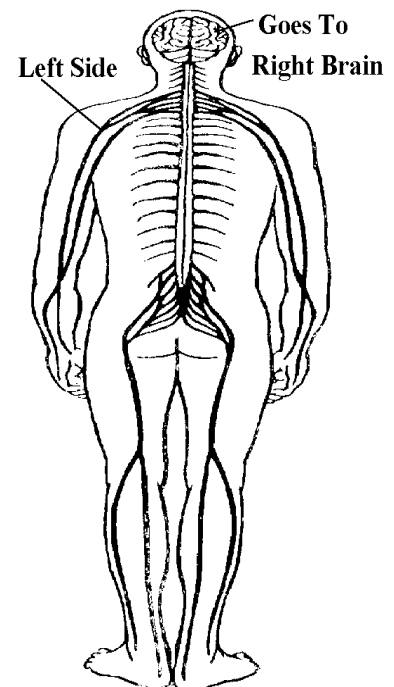
In the general population, 95 percent of people are right-handed, which means that the left hemisphere is the dominant hemisphere. (For you left-handers, the right hemisphere is dominant.) With right-handed people, the ability to understand and express language is in this left temporal lobe. If I were to take a metal probe, and charge it with just a bit of electricity, and put it on the "primary" area of my left temporal lobe, I might say "hey, I hear a tone." If I move this probe to a more complex area of the temporal lobe, I might hear a word being said. If I move the electrical probe to an even more complex area, I might hear the voice of somebody I recognize; "I hear Uncle Bob's voice." We have simple areas of the temporal lobe that deal with basic sounds and other areas of the temporal lobe that look at more complex hearing information.

The right temporal lobe also deals with hearing. However, its job is to process musical information or help in the identification of noises. If this area is damaged, we might not be able to appreciate music or be able to sing. Because we tend to think and express in terms of language, the left temporal lobe is more critical for day-to-day functioning.

The vision areas and the hearing areas of the brain have a boundary area where they interact. This is the area of the brain that does reading. We take the visual images and convert them into sounds. So if you injure this area (or it doesn't develop when you are very young), you get something called dyslexia. People who have dyslexia have problems that may include seeing letters backwards or have problems understanding what written words mean.

SKIN SENSATION

If something lands on my left hand, this information will be transmitted to the right side of my brain. It goes to the area of the brain next to the area that deals with movement. The tactile area of the brain deals with physical sensation. Movement and feeling are closely related, so it makes sense that they are next to each other in the brain. Because movement and tactile areas are located close to each other, it is not uncommon for people with a brain injuries to lose both movement and feeling in parts of their body. Remember--tactile information from the left side of the body goes to the right brain, just like movement and vision



FRONTAL LOBES--Planning, Organizing, Controlling

The biggest and most advanced part of the brain is the frontal lobe. One job of the frontal lobe is planning. In head injury, individuals with frontal lobe impairment seem to lack motivation and have difficulty doing any task that requires multiple steps (e.g., fixing a car or planning a meal). They have problems with planning.

The frontal lobe is also involved in organizing. For a lot of activities, we need to do step A, then step B, then step C. We have to do things in order. That's what the frontal lobes help us do. When the frontal lobe is injured, there is a breakdown in the ability to sequence and organize. A common example is people who cook and leave out a step in the sequence. They forget to add an important ingredient or they don't turn the stove off.

Additionally, the frontal lobes also play a very important role in controlling emotions. Deep in the middle of the brain are sections that control emotions. They're very primitive emotions that deal with hunger, aggression, and sexual drive. These areas send messages to other parts of the brain to DO SOMETHING. If you're mad, hit something or someone. If you're hungry, grab something and eat it. The frontal lobes "manage" emotions. In general, the frontal lobe has a NO or STOP function. If your emotions tell you to punch your boss, it's the frontal lobes that say "STOP or you are going to lose your job." People have often said to me "*a little thing will set me off and I'm really mad.*" The frontal lobes failed to stop or turn off the emotional system.

On the other hand, we have talked about how the frontal lobes plan activities. The frontal lobes may fail to plan for some types of emotion. For example, sexual interest involves some level of planning or preparation. Without this planning, there is a lack of sexual interest. A lack of planning can also affect the expression of anger. I've had some family members say "*You know, the head injury actually improved him, he's not such a hot-head anymore.*" If you listen very carefully, you're also going to hear "*he's not as motivated anymore.*" Remember, the frontal lobe plans activities as well as controls emotions.

Exercise:

Before you move on to the next section, brainstorm symptoms of TBI that you've seen in people you're supporting.

Common Problems Experienced by People who Have Had a TBI

- A) **Problems with Memory**
Can't remember appointments – forget what others have said – difficulty recalling details
- B) **Decreased Stamina**
Tires more easily, fatigued at the end of the day, not as energetic as before
- C) **Problems with Attention and Concentration**
Hard to do one thing for very long; reading for any length of time can be taxing; it takes longer to complete a project
- D) **Loss of Friends and Other Meaningful Relationships**
May not have the same friends that you used to; loss of significant relationships; social isolation is common; may no longer have contact with friends from work or school
- E) **Difficulty Doing More Than One Thing at a Time**
Can feel easily distracted; can't take in a lot of new information at once.
- F) **Problems with Getting Started and Following Through**
May be hard to get going each day; don't always do what you plan or say you will do; tendency not to finish things you have started; apathy
- G) **Anger and Frustration**
May feel easily annoyed and frustrated – unable to control anger – may have difficulty getting along with others – it's common for people to feel quite angry about their injury: "Why did this happen to me?"
- H) **Depression**
You may find yourself sad and down in the dumps – activity level is decreased – sleep and eating patterns may change – hard to feel good about yourself
- I) **Speech**
Knowing what you want to say but not being able to find the word – can express words but not always understand what is said to you
- J) **Physical Limitations**
Limitations in use of hands, arms, and legs – balance problems

Accommodation Ideas

from Kendra Duckworth, Job Accommodation Network (JAN)
<http://www.jan.wvu.edu/media/BrainInjury.html>

Physical Limitations:

- ✓ Install ramps, handrails, and provide handicap parking spaces
- ✓ Install lever style door handles
- ✓ Clear pathways of travel of any unnecessary equipment and furniture

Visual Problems:

- ✓ Provide written information in large print
- ✓ Change fluorescent lights to high intensity, white lights
- ✓ Increase natural lighting
- ✓ Provide a glare guard for computer monitors
- ✓ Consult a vision specialist particularly with someone who has lost part of or all of their vision

Maintaining Stamina During the Workday:

- ✓ Permit flexible scheduling, allow longer or more frequent work breaks
- ✓ Provide additional time to learn new responsibilities
- ✓ Provide self-paced workload
- ✓ Provide backup coverage for when the employee needs to take breaks
- ✓ Allow for time off for counseling
- ✓ Allow for use of supportive employment and job coaches
- ✓ Allow employee to work from home during part of the day
- ✓ Provide for job sharing opportunities
- ✓ Allow part-time work schedules



Maintaining Concentration:

- ✓ Reduce distractions in the work area
- ✓ Provide space enclosures or a private office
- ✓ Allow for use of white noise or environmental sound machines
- ✓ Allow the employee to play soothing music using a cassette player and headset
- ✓ Increase natural lighting or provide full spectrum lighting
- ✓ Reduce clutter in the employee's work environment
- ✓ Plan for uninterrupted work time
- ✓ Divide large assignments into smaller tasks and steps
- ✓ Restructure job to include only essential functions

Difficulty Staying Organized and Meeting Deadlines:

- ✓ Make daily TO-DO lists and check items off as they are completed
- ✓ Use several calendars to mark meetings and deadlines
- ✓ Remind employee of important deadlines via memos or e-mail or weekly supervision
- ✓ Use a watch or pager with timer capability
- ✓ Use electronic organizers
- ✓ Divide large assignments into smaller tasks and steps
- ✓ Assign a mentor to assist employee in determining goals and provide daily guidance
- ✓ Schedule weekly meetings with supervisor, manager, or mentor to determine if goals are being met



Memory Deficits:

- ✓ Allow the employee to tape record meetings
- ✓ Provide type written minutes of each meeting
- ✓ Use notebooks, calendars, or sticky notes to record information for easy retrieval
- ✓ Provide written as well as verbal instructions
- ✓ Allow additional training time
- ✓ Provide written checklists and use color-coding to help identify items
- ✓ Post instructions close to frequently used equipment

Problem Solving Deficits:

- ✓ Provide picture diagrams of problem solving techniques, e.g., flow charts
- ✓ Restructure the job to include only essential functions
- ✓ Assign a supervisor, manager, or mentor when the employee has questions

Working Effectively with Supervisors:

- ✓ Provide positive praise and reinforcement
- ✓ Provide written job instructions
- ✓ Write clear expectations of responsibilities and the consequences of not meeting them
- ✓ Allow for open communication with managers and supervisors
- ✓ Establish written long term and short term goals
- ✓ Develop strategies to deal with problems before they arise
- ✓ Provide written work agreements
- ✓ Develop a procedure to evaluate the effectiveness of the accommodation

Difficulty Handling Stress and Emotions:

- ✓ Provide praise and positive reinforcement
- ✓ Refer to counseling and employee assistance programs
- ✓ Allow telephone calls during work hours to doctors and others for needed support
- ✓ Provide sensitivity training to coworkers
- ✓ Allow the employee to take a break as a part of a stress management plan

**Attendance Issues:**

- ✓ Provide flexible leave for health problems
- ✓ Provide a self-paced work load and flexible hours
- ✓ Allow employee to work from home
- ✓ Provide part-time work schedule

Issues of Change:

- ✓ Recognize that a change in the office environment or of supervisors may be difficult for a person with a brain injury
- ✓ Maintain open channels of communication between the employee and the new and old supervisor in order to ensure an effective transition
- ✓ Provide weekly or monthly meetings with the employee to discuss workplace issues and productions levels

Resources on Traumatic Brain Injury

<http://www.biausa.org/>

<http://www.headinjury.com/>

www.tbiguide.com

<http://www.headinjury.com/checktbi.htm>

Hiring the Head Injured: What to Expect, Tampa General Rehabilitation Center, HDI Publishers, Houston TX <http://www.braininjurybooks.com/coping.html>

30 Minute Lesson: Feedback Form

Please let us know what you think of this product, so we can continue to better meet your training needs. Fax or mail to Laurie Ford at 6912 220th SW, Suite 105, Mountlake Terrace, WA 98043; Fax (425) 774-9303

Topic of Lesson _____

- Facilitator Version
- Participant Version
- Non-Facilitated Group Version
- Self-Study Version

1. On a scale of 1 to 5, please rate the relevancy of these materials to your job _____
(1 is worst, 5 is best)
2. On a scale of 1 to 5, please rate the positive impact of these materials on your professional skills, knowledge, and abilities (1 is worst, 5 is best) _____
3. On a scale of 1 to 5, please rate the positive impact of these materials on your organization (1 is worst, 5 is best) _____
4. What was the most useful part of the lesson?
5. What was the least useful part of the lesson?
6. How could this lesson be improved?
7. What additional topics would you like to see in a 30 Minute Lesson?