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School Psychology Institute

Part I: An Introduction to TBI

Part II: Updates on Evaluation Instrument

Part III: Join SLP Institute (Andrew Shanock, Ph.D.)

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Part I

An Introduction to TBI



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Agenda

- Anatomy of the Brain and its Functions
- Background and History of TBI
- Manifestations of TBIs
- Impact of TBI on School Functioning
- NC Policies Regarding TBI
- New Online Curriculum



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Anatomy of the Brain



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Neuron

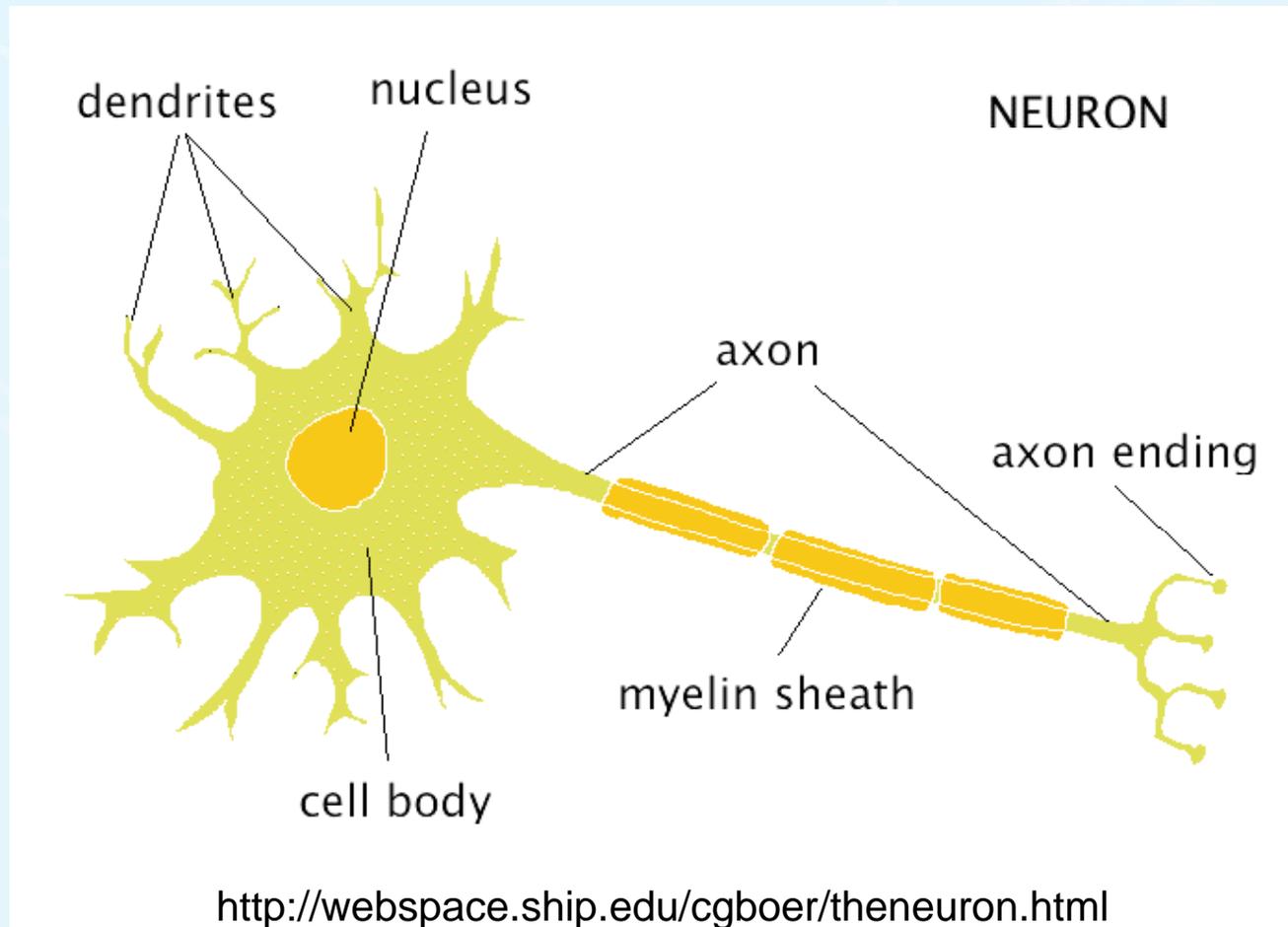
- Basic cellular structure which transmits nerve impulses throughout a complex network of interconnecting brain cells
- Neurons can be modified by experience, and they are said to learn, remember, and forget as a result of experiences
- Four well-defined parts:
 - Cell body
 - Dendrites (receive impulses from other neurons)
 - Axons (conduct nerve impulses away from the cell body)
 - Axon terminals (synapses)
- “Estimates of the number of nerve cells in the human brain and central nervous system range from 10 billion to 50 billion, and up to 75 billion in larger brains” (Gaddes and Edgell, 1994).

Gaddes, W.H. & Edgell, D. (1994). Learning disabilities and brain function: A neuropsychological approach (3rd ed.). New York: Springer-Verlag.



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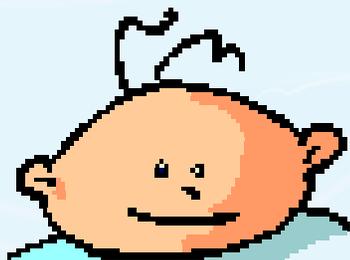
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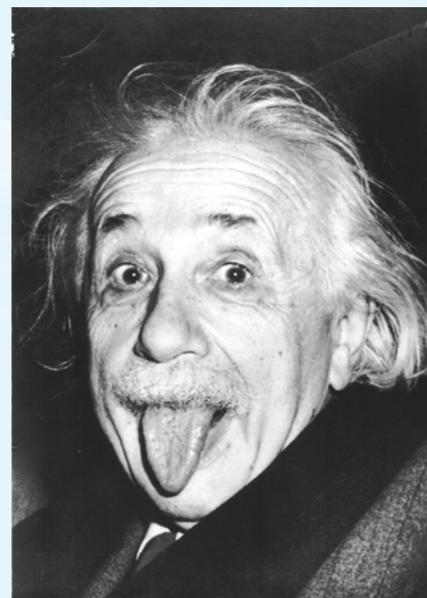
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Neuronal Development



to



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Prenatal

- Fastest rate of brain growth occurs prenatally – 250,000 brain cells/minute!
- More susceptible to teratogenic influences
- An individual's full quota of neurons is reached by six months gestation
- Adult features at birth but not mature
- Maternal stress, malnutrition, poor health, age of mother, substance abuse = poorer outcomes



Post-natal

- Neural structures increase in complexity
- Brain gets heavier:
 - 400 grams @ birth
 - 850 grams @ 11 months
 - 1100 grams @ 36 months
 - 1350 grams @ 15 years
 - Continues to  through age 60

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Pruning

- “We are what we repeatedly do. Excellence therefore is not an action but a habit.” (Aristotle)



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Central Nervous System

- Brain Stem
- Cerebellum
- Cerebrum
- Forebrain
- Cortical Regions
- Subcortical Regions



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Damage to CNS

- Brain Stem
- Cerebellum
- Cerebrum
- Forebrain
- Cortical Regions
- Subcortical Regions

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Peripheral Nervous System

- Spinal Cord
- Cranial Nerves
- Peripheral Nerves



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Damage to PNS

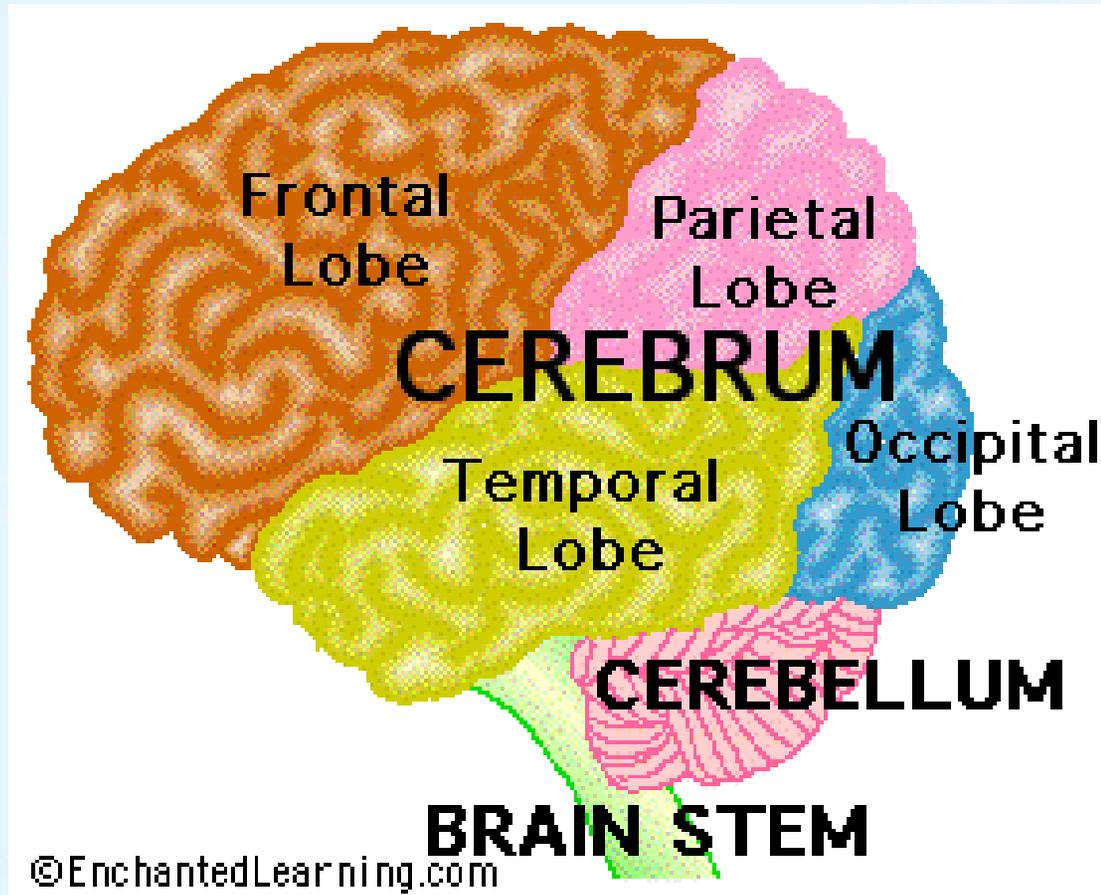
- Spinal Cord
- Cranial Nerves
- Peripheral Nerves



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Frontal Lobes

- Largest region
- Functions:
 - Planning, organization , efficiency, self-monitoring and regulation, abstract thinking, metacognition abilities, language expression, formation of plans and strategies, reflection, and directing and sustaining attention
- Left frontal lobe highly related to speech and language functioning





Parietal Lobes

- Sensory information
 - Touch
 - Pressure
 - Pain
 - Temperature
- Sensory information and memory
- Somatosensory Cortex
- Internal state information with external world needs



Temporal Lobes

- Memory (visual and auditory)
- Visual item recognition (faces, auditory agnosia)
- Auditory processing (verbal and nonverbal)—
Wernicke's area
- Hearing
- Emotion
- Language functions



Occipital Lobes

- Visual sensation and perception
- Areas help in perception of shapes and colors

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Damage to Lobes

- Frontal
- Parietal
- Temporal
- Occipital



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Brain Injury





What is a TBI?

- National Brain Injury Association
 - Traumatic Brain Injury (TBI) is defined as an insult to the brain, not of degenerative or congenital nature, but caused by an external force, that may produce a diminished or altered state of consciousness, which results in an impairment of cognitive abilities or physical functioning. It also can result in the disturbance of behavioral or emotional functioning. These impairments may be either temporary or permanent and cause partial or total functional disability or psychosocial maladjustment.
 - Acquired Brain Injury (ABI) is an injury to the brain that is not hereditary, congenital, or degenerative (e.g., stroke, anoxia).

Brain Injury of American Board of Directors, 2011: (<http://biausa.org>)



What is a TBI?

- National Institutes of Health
 - Traumatic Brain Injury (TBI) occurs when a sudden physical assault on the head causes damage to the brain. The damage can be focal—confined to one area of the brain, or diffuse—involving more than one area of the brain.

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Acquired Brain Injuries

Traumatic Brain Injuries

Penetrating

Non-penetrating

Other Brain Injuries:

- Congenital brain injuries
- Strokes
- Hydrocephalus
- Tumors
- Multiple Sclerosis
- Brain infections
- Toxic substances

Traumatic and Non-Traumatic injuries may produce similar outcomes





Types of TBI Injuries

- Penetrating (Open) Head Injuries
 - Depressed skull fracture
 - Crushing injuries
- Non-penetrating (Closed) Head Injuries
 - Acceleration injuries (e.g., a stationary brain suddenly stops)
 - Deceleration injuries (e.g., a moving brain suddenly stops)
 - Torqueing/Rotational injuries (e.g., a brain is twisted on the brainstem)
 - Diffuse Axonal Injury (e.g., shearing and tearing of axons)

<http://biausa.fyrian.com/about-brain-injury.htm#types>



Prevalence of TBI

- Approximately 1.7 million people sustain a TBI annually, with 75-80% being a “mild TBI”
- Approximately 1.4 million are treated and released from hospital emergency departments for TBI each year
- Another 275,000 are hospitalized and survive, with about 80,000 sustaining some type of long-term disability
- Approximately 52,000 die following a TBI
- The number of people who sustain a TBI and receive no medical care is unknown.

US Center for Disease Control. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths, 2002-2006



TBI in Children

- Of all pediatric injury cases in the US, about 25% are related to brain injury
- Approximately 500,000 children, ages birth to 14 years, go to emergency departments for TBI each year
 - This translates to 1 in every 500 students
- Mild injuries likely are under-reported, and we are only beginning to establish incidence rates for shaken baby syndrome

US Center for Disease Control. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths, 2002-2006





Causes of TBI

- Falls are the leading cause of brain injuries in children and the elderly, accounting for about 50% of all TBIs for children ages birth to 14 years
- Second leading cause is motor vehicle crashes and traffic-related incidents, and the leading cause of TBI-related deaths
- About 25% of children also sustained a TBI from colliding with moving or stationary objects
- Causes of TBI vary by age

US Center for Disease Control. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths, 2002-2006





Mild TBI (mTBI)

- Reflects a lesser degree of severity, with a loss of consciousness being brief or non-existent
- Early symptoms may include:
 - Headaches, blurred vision, dizziness, nausea, vomiting, agitation, drowsiness, seizures, attention disruption, increased irritability
- Many symptoms resolve in most individuals within 6-12 months
- Many go undiagnosed and unrecognized
- Even in mild TBI, symptoms should not be ignored
- Neuroimaging procedures typically do not find neurological damage, but multiple microscopic injuries can lead to significant neuropsychological and neurobehavioral impairments

Hooper, S. (In press). Assessment practices and procedures in children and adolescents with traumatic brain injury. Wake Forest, NC: Lash and Associates.



Mild TBI (mTBI)

- A mTBI also referred to as a concussion
- A concussion is a type of mTBI caused by a bump, blow, or jolt to the head, or even a blow to the body that causes the head to move rapidly, that can change the way the brain works.
- Most concussions occur without a loss of consciousness, and typically are not life threatening. However, they can cause significant impairment

Hooper, S. (In press). Assessment practices and procedures in children and adolescents with traumatic brain injury. Wake Forest, NC: Lash and Associates.



Mild TBI (cont'd)

- Signs and symptoms include ANY changes in behavior, such as:
 - Cognitive impairments (e.g., reduced attention, slow processing speed, diminished memory)
 - Physical symptoms (e.g., headaches, blurry vision, dizziness, balance problems, fatigue, sensory sensitivity)
 - Emotional symptoms (e.g., irritability, anxiety)
 - Sleep difficulties (e.g., more or less sleep, trouble falling asleep)
 - Not “feeling like themselves”
- Persistent symptoms following the concussion are often referred to as Post-Concussive Syndrome
- There are raising concerns that cumulative neurological damage will occur from subsequent concussions, even if separated by months or years



Mild TBI and Sports

- mTBI can occur from any type of blow to the head, but there is a strong relationship to sports-related injuries
- Estimated 300,000 sports-related mTBIs
- Tend to occur more frequently in contact sports, such as football, hockey, soccer, etc.
- Relationship of mTBI to sports injuries has contributed to significant policy changes in how athletes are managed at all levels of play from preschool to professionals
- Currently, 44 states have enacted youth sports concussion-related laws

http://www.safekids.org/safety-basics/safety-guide/sports-safety-guide/take-action/State-Concussion_Laws_Overview.html



Gfeller-Waller Concussion Act

- Act was drafted and implemented to protect the safety of student athletes in NC and was signed into law on June 16, 2011.
- Three major areas of focus:
 - Education
 - Emergency action
 - Postconcussion protocol implementation and clearance/return to play or practice following concussion

<http://gfellerwallerlaw.unc.edu/GfellerWallerLaw/gwlaw.html>



Risk of TBI

- The risk is highest among adolescents, young adults, and those younger than 5 and older than 75 years
- Males are more than twice as likely as females to sustain a TBI, with a rate of about 59%
- After one brain injury, the risk for a second injury is **three** times greater
- After the second injury, the risk for a third injury is **eight** times greater

US Center for Disease Control. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths, 2002-2006





Outcomes of TBI

- Outcomes vary greatly depending on the cause (e.g., firearms vs. falls)
- TBI is the most frequent cause of death and disability in children and adolescents (over 41% of all child deaths)
- Over 30,000 children have permanent disabilities following a TBI

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Manifestations of TBI

(What does a TBI look like?)



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- Neurocognitive Functions
 - Motor
 - Sensory perceptual
 - Attention
 - Language
 - Visual processing
 - Memory and learning
 - Executive functions
- Related Domains
 - Intellectual
 - Achievement
 - Reading, writing, arithmetic
 - Skill vs. performance deficits
 - Adaptive behaviors
 - Social-emotional
 - Psychosocial environment
 - School
 - Family
 - Social

Hooper, S. (In press). Assessment practices and procedures in children and adolescents with traumatic brain injury. Wake Forest, NC: Lash and Associates.



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Motor Functioning

- Gross motor strength
- Basic fine-motor speed
- Complex fine-motor speed
- Motor coordination and planning
- Spatial-based movement
- Oral-motor
- Balance



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Sensory-Perceptual Abilities

- Tactile, visual, and auditory modalities
- Modalities of olfaction (8% of injuries) and taste are tapped less routinely, although olfaction can be disrupted in many TBIs, particularly with a frontal lobe injury
- Likelihood of having a smell or taste disorder increases with severity of TBI

Hooper, S. (In press). Assessment practices and procedures in children and adolescents with traumatic brain injury. Wake Forest, NC: Lash and Associates.





Attention

- Alertness and arousal
- Selective or focused attention
 - Modality specific
- Selective attention (vigilance)
- Span of attention
- Hemi-neglect (ignoring one side of the body)

Hooper, S. (In press). Assessment practices and procedures in children and adolescents with traumatic brain injury. Wake Forest, NC: Lash and Associates.

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Receptive Language

- Phonemes
- Word or phrase comprehension
- Vocal tone and prosody
- Speed of processing
- Pragmatics (social meaning of language)

Hooper, S. (In press). Assessment practices and procedures in children and adolescents with traumatic brain injury. Wake Forest, NC: Lash and Associates.



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Expressive Language

- Communicative intent
- Oral-motor fluency
- Naming
- Word or phrase repetition
- Organization of output (e.g., spontaneous vs. confrontational speech)
- Vocal tone and prosody
- Pragmatics (social use of language)



Visual Processing

- Visual recognition (faces, colors, objects)
- Visual discrimination
- Visual closure
- Visual-spatial
 - 2-dimensional
 - 3-dimensional
- Visual organization and planning
- Visuoconstructive abilities
- Visual problem solving and efficiency

Hooper, S. (In press). Assessment practices and procedures in children and adolescents with traumatic brain injury. Wake Forest, NC: Lash and Associates.



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Memory and Learning

- Memory can be explained by modality
 - Most commonly mentioned in the literature are visual memory and auditory memory
 - Memory is tied to other senses (e.g., tactile, gustatory, and olfactory)
- Time dimension
 - Immediate vs. delayed recall
 - Short-term vs. long-term recall
 - Recent vs. remote memory
 - Working memory
 - Meta-memory
- Memory encoding
- Memory retrieval
 - Free recall vs. recognition
 - Automatic Memory (e.g., writing your name)
 - Episodic vs. non-episodic Memory
 - Declarative vs. Procedural Memory



Executive Functions

- Ability to maintain an appropriate problem-solving set for attainment of a future goal
 - Intention to inhibit a response or to defer it to a later, more appropriate time
 - Strategic plan of action sequences
 - Mental representation of the task
- Planning, organization, inhibition, self-monitoring, and flexibility of strategies contingent on feedback
- Working memory



Medical/Physical Outcomes

- Problems from injuries
 - Physical stamina can be less
 - Motor dysfunction or deficits
 - Vision problems
 - Loss of smell or taste
 - Speech impairments
 - Somatic complaints (e.g. headaches)
 - Seizures (within two years of injury)
- Response to problems
 - May require specialized equipment that could be foreign to schools, friends, work sites, etc.
 - May require pharmacological agents for problems with behavior, attention, seizures, bowel/bladder, headaches, spasticity, and emotions
 - Medications may create negative, synergistic effects



School and Vocational Outcomes

- School and Vocational Outcomes
 - Problems initiating and completing work
 - Slowed work pace
 - Increased impulsivity
 - Trouble navigating physical surrounding, especially in new settings
 - Decreased productivity
 - Confusion and increased stress
 - Resistance to change – even if routine
 - Trouble with maintenance and generalization
 - Distractible and poor task persistence
 - Resentment of special assistance



Social-Behavioral Outcomes

- Presence of an acquired brain injury places individuals at greater risk for developing a new psychiatric disorder (about five times expectancies)
- Loss of friends and social circles
- Increased affective problems and their regulation
- Increased impulsivity
- Increased agitation
- Denial, poor perspective taking, or increased awareness of deficits

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Social-Behavioral Outcomes (cont'd)

- Secondary problems (e.g., family, lowered self-esteem)
- At-risk for substance use/abuse (which, in turn, will slow the neurological recovery process)
- Comparison by survivor/others to pre-injury level of functioning
- Premature return to school/work
- Poor understanding of TBI and recovery
- Unrealistic predictions
- Tendency to use disability



Key Predictors of Outcomes

- Constant medical, developmental, psychological, vocational, and academic vigilance is required over the course of recovery
- Age at Time of Injury
 - Younger children at greater risk for subsequent learning difficulties
 - Difficulties seen in the loss/change of functions and in recovery
 - Recovery depends on capacity of the developing brain to evolve alternate coping strategies
- Premorbid functioning levels (e.g., presence of pre-injury difficulties in the child and/or family)
- Type of injury (penetrating vs. nonpenetrating; localized vs. generalized damage)
- Medical complications (brain edema, post-traumatic seizures, intracranial pressure)
- Injury severity (duration of PTA, depth of coma)—seems to hold the most weight in terms of prognosis for recovery
- Rate of recovery – the faster the better
- Gender does not influence recovery
- SES does not directly influence recovery – although clinical intuition may suggest otherwise

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Educational Policy





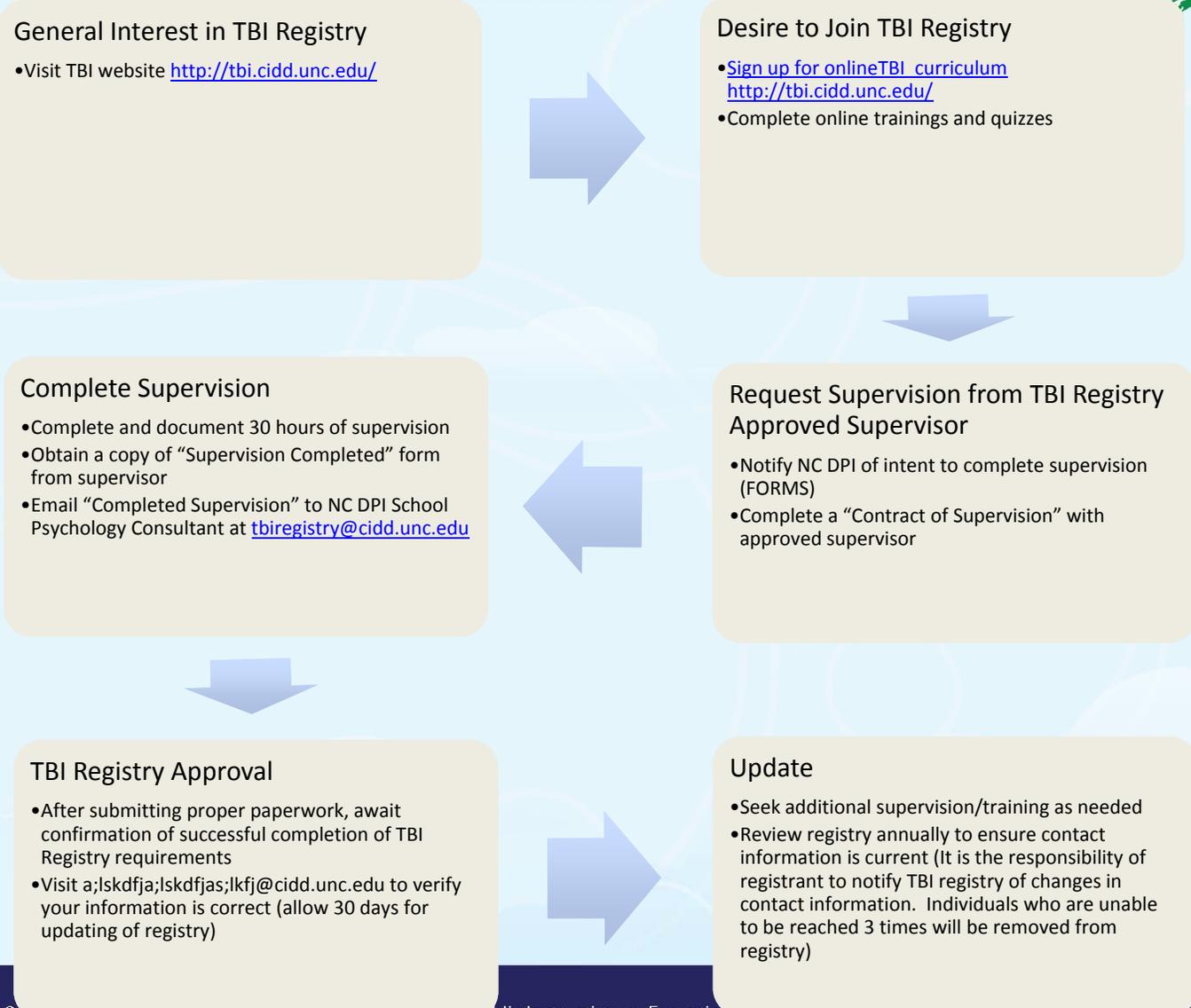
Online Curriculum

- Modules are now:
 - Free
 - Easily accessible at any time, and
 - Can be completed at participant's convenience
- Modules located at: <http://tbi.cidd.unc.edu>
- 30 hours of supervision with pediatric neuropsychologist on the Registry of Approved Supervisors is still required
- Successful completion of curriculum and supervision result in psychologist being added to Registry of Approved Providers (TBI Registry)
- LEAs can still request \$1000 reimbursement for supervision for each school psychologist trained

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TBI Flowchart



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Part II

School Psychology Evaluation Instrument Updates

