

Traumatic Brain Injuries in Early Childhood: *Recognizing, Recovering, Supporting*

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- Missouri Head Start Association
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- Missouri Department of Health and Senior Services-MO TBI Implementation Partnership Project

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- 2.) Missouri Head Start State Collaboration Office

Acknowledgement

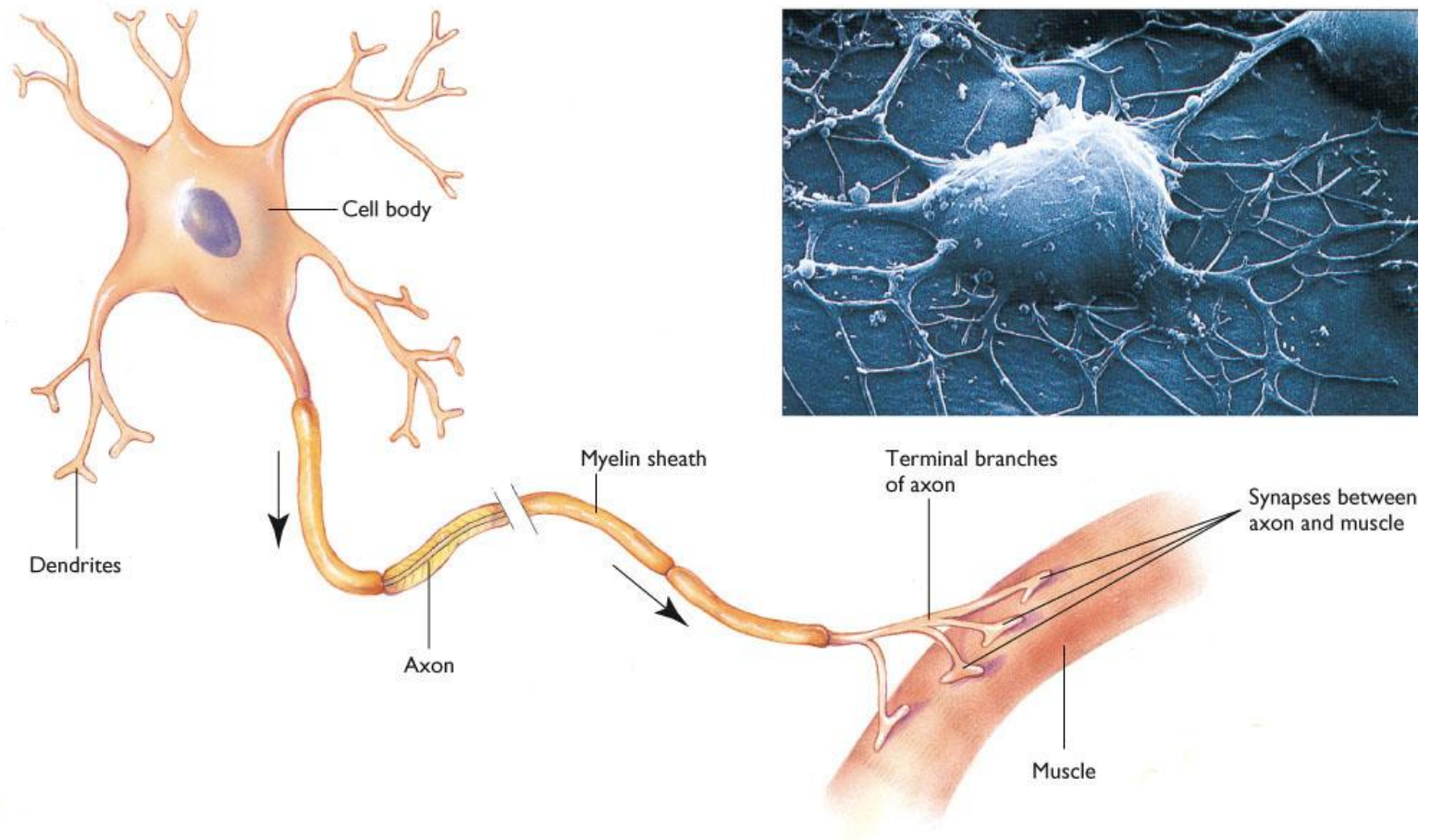
Much of the following information is adapted from “Understanding Students with Brain Injury,” a series of manuals developed by the Center for Innovations in Special Education, University of Missouri-Columbia.

Overview

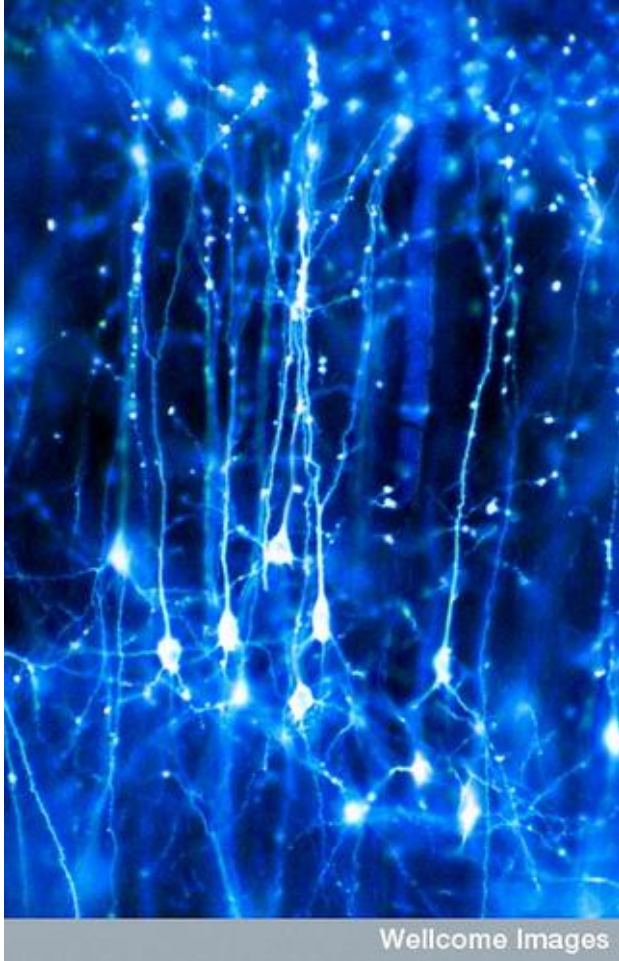
- Typical Development
- Basic Brain Anatomy
- Definition of Traumatic Brain Injury
- Mechanisms of Injury and Measuring Severity
- Recovery
- Cognitive and Behavioral Impact of TBI
- How to Help an Injured Child in Your Classroom
- What to Do if a Child is Injured In Your Care
- How to Recognize TBI in your Classroom

Typical Development and Basic Brain Anatomy

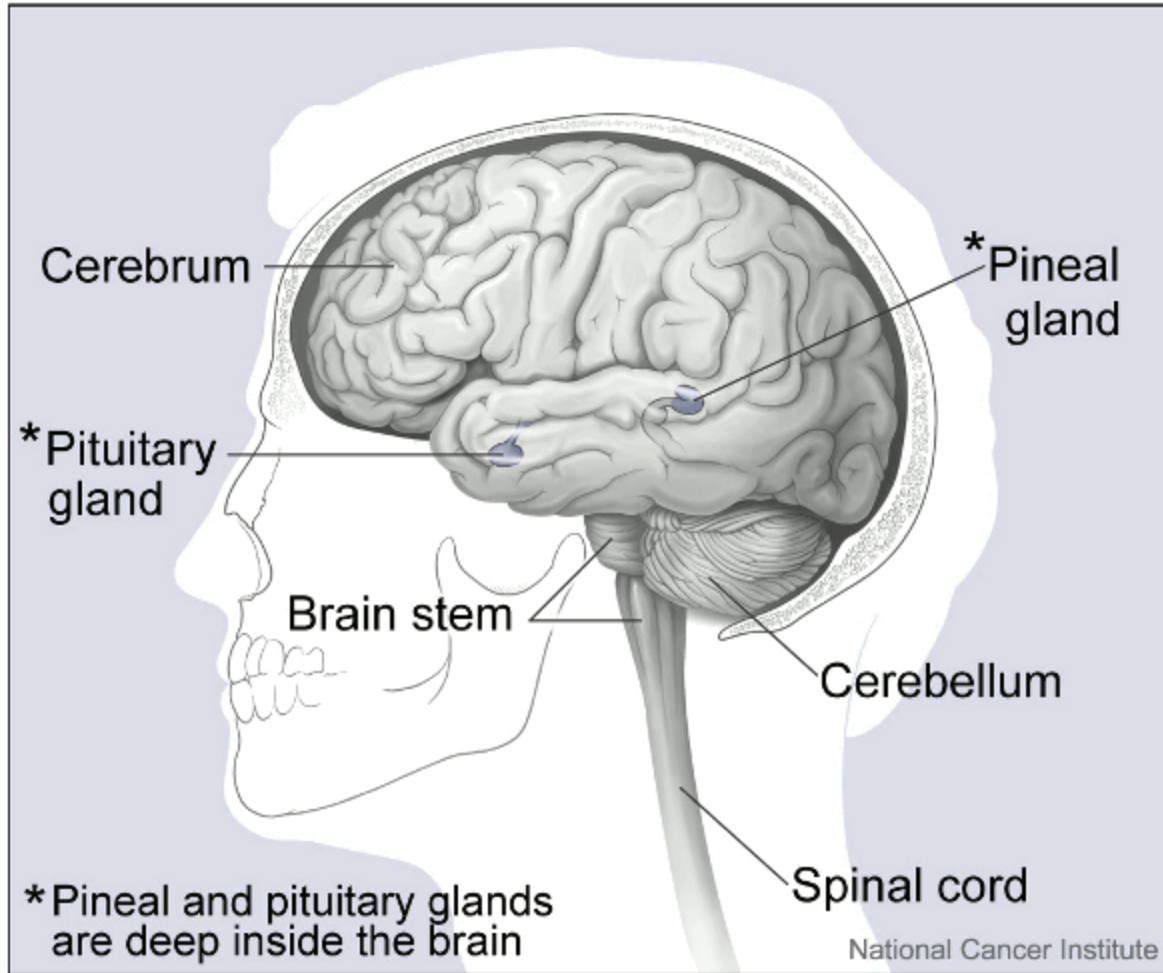
Basic Brain Anatomy



Basic Brain Anatomy

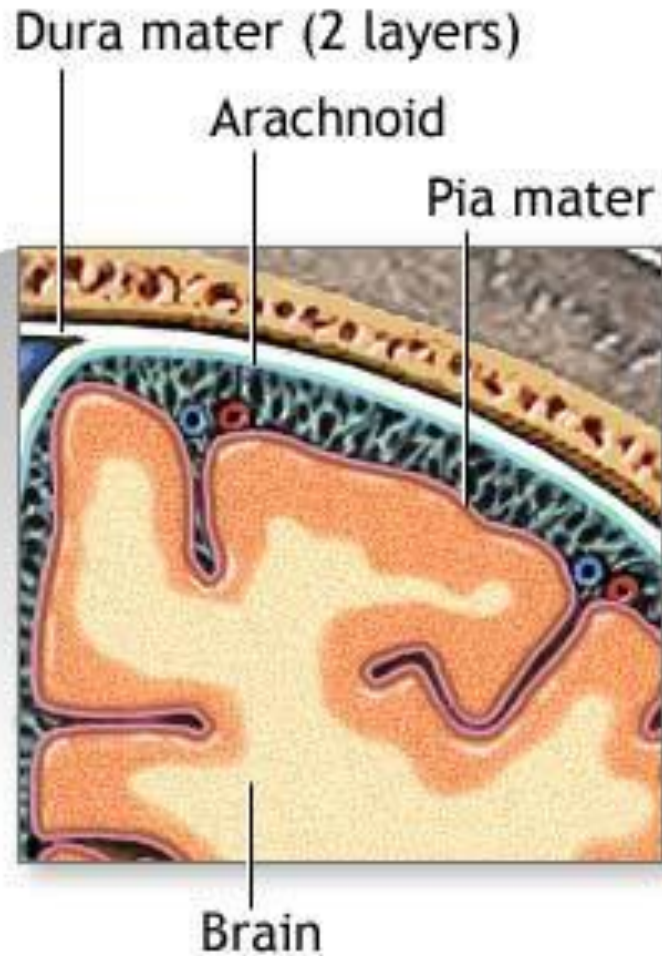


Basic Brain Anatomy



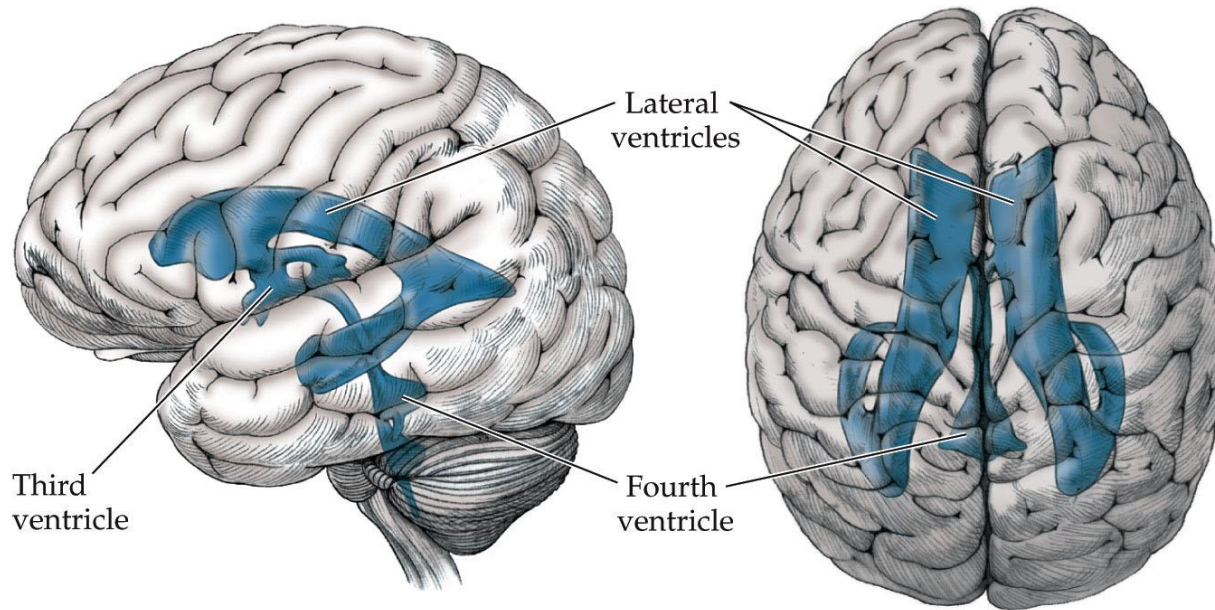
Basic Brain Anatomy

The meninges are the membranes covering the brain and spinal cord



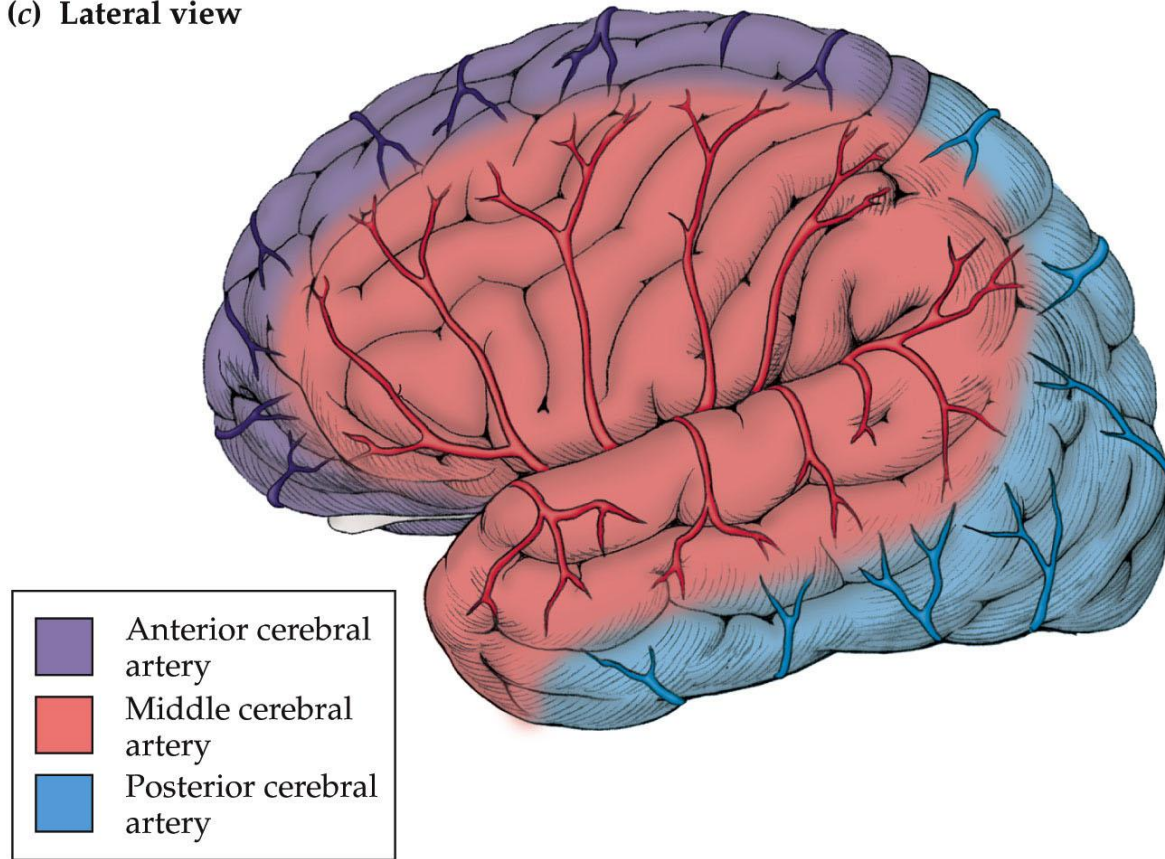
Basic Brain Anatomy

(a) Cerebral ventricles of the brain



Basic Brain Anatomy

(c) Lateral view

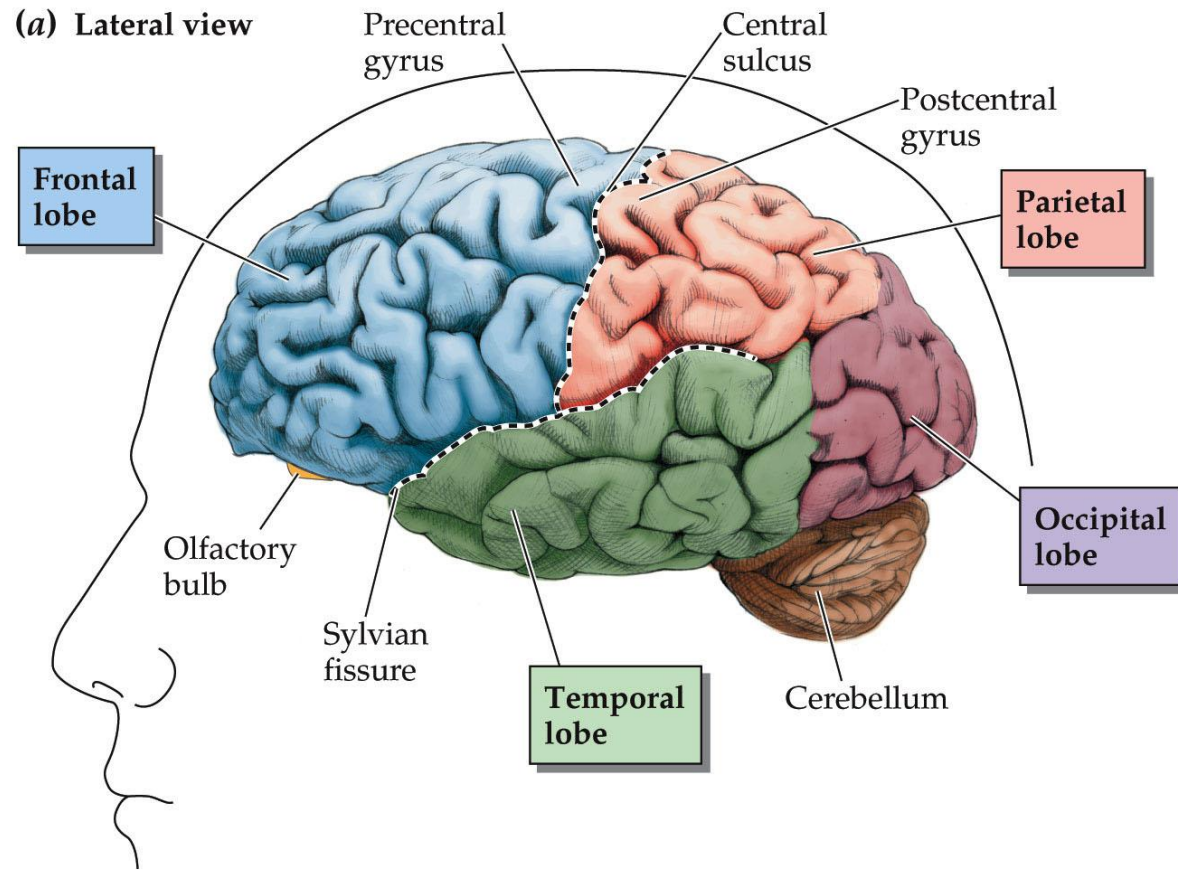


Biological Psychology 5e, Figure 2.20 (Part 3)

Basic Brain Anatomy

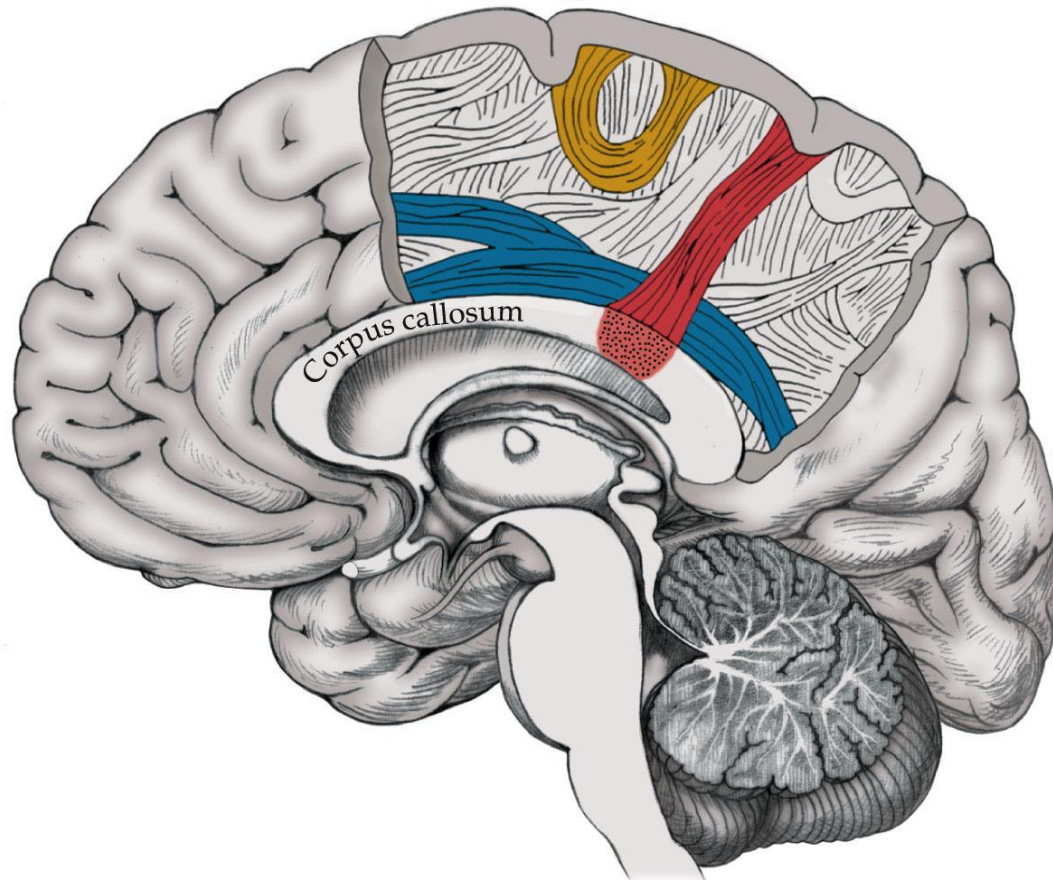
- Localized functions
- Connectivity and feedback loops
- Hierarchical organization

Basic Brain Anatomy



Biological Psychology 5e, Figure 2.12 (Part 1)

Basic Brain Anatomy



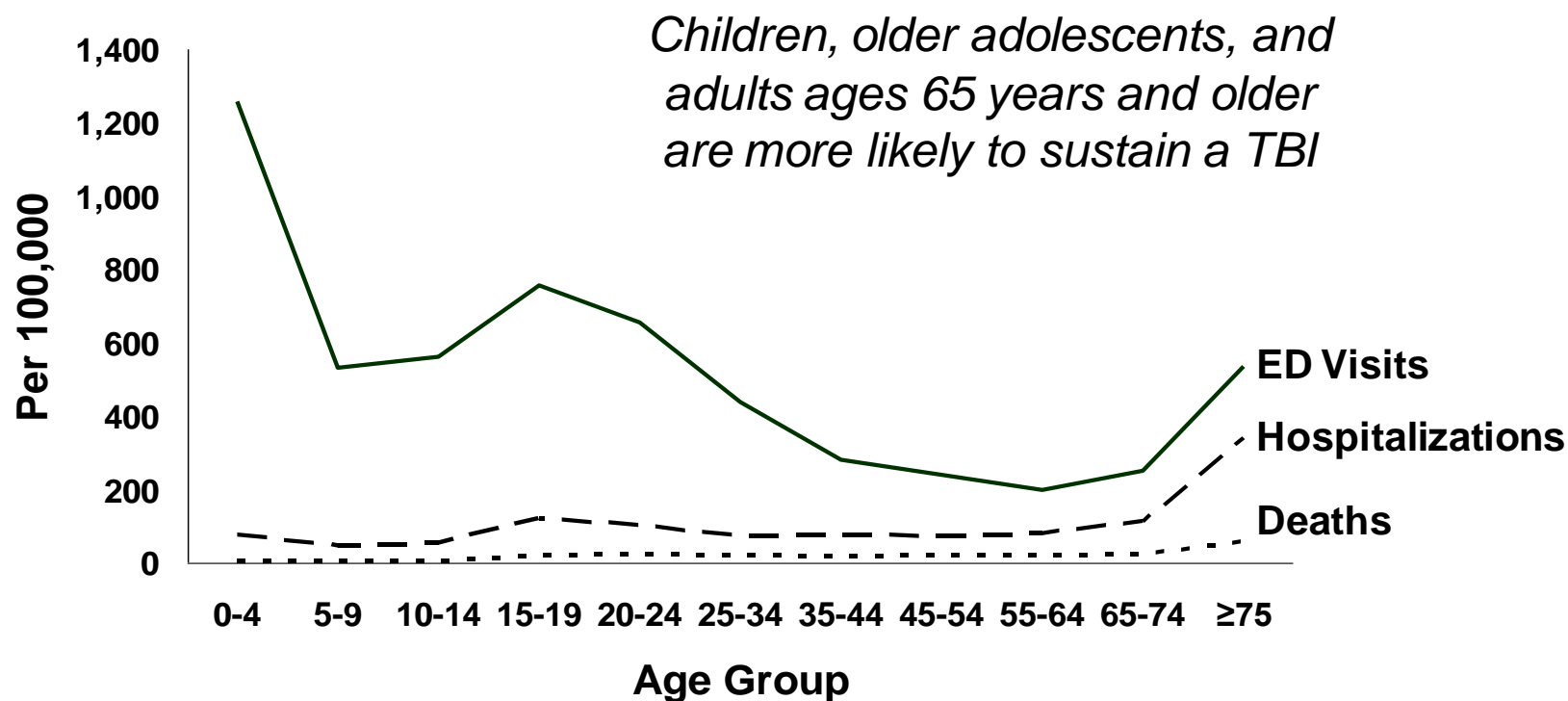
Biological Psychology 5e, Figure 2.18

Traumatic Brain Injury: Definition and Prevalence

Traumatic Brain Injury

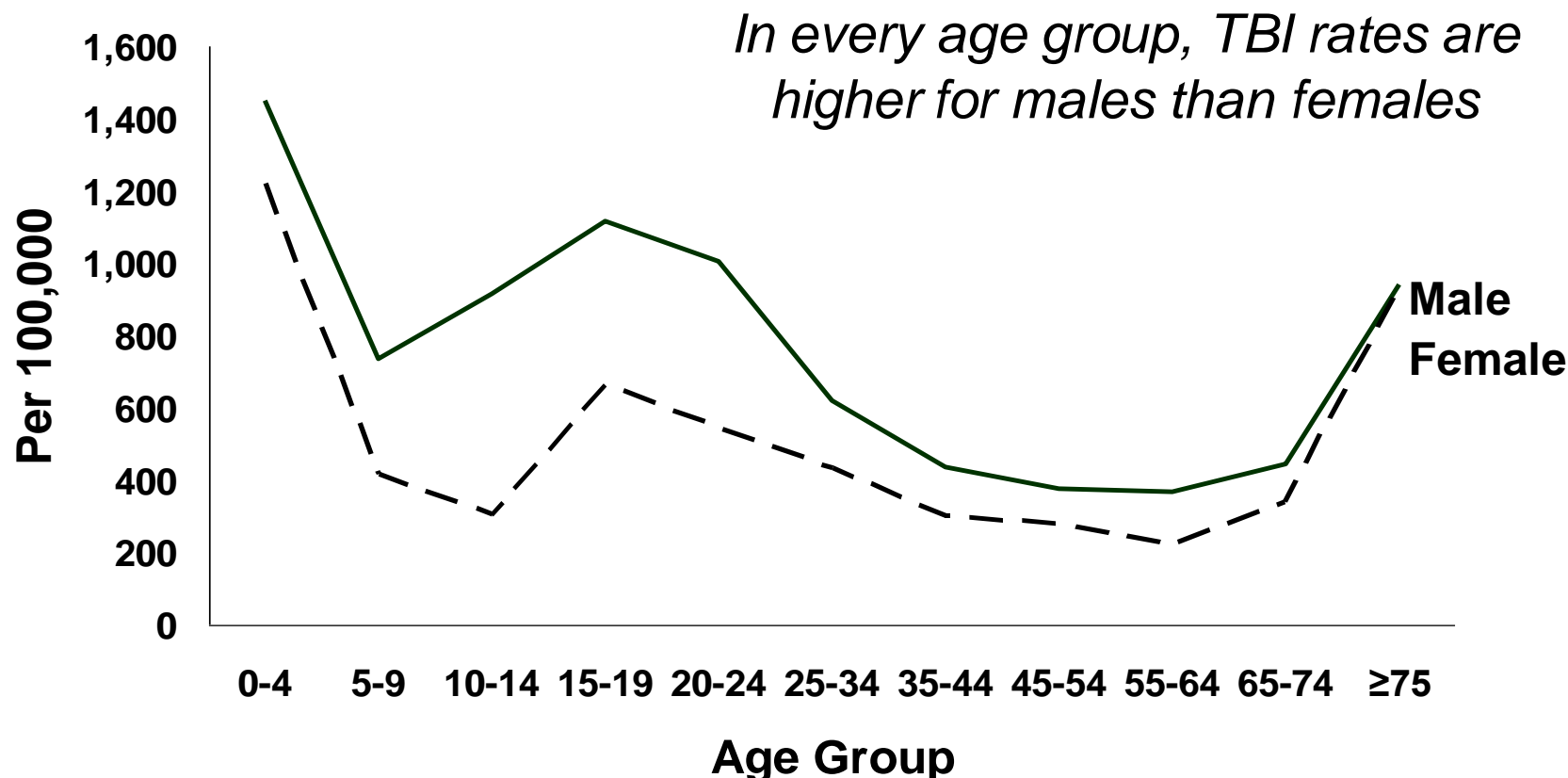
- Educational Category Defined By:
 - Acquired injury
 - Caused by an external force
 - Open or closed injury
 - Results in total or partial physical disability, psychosocial impairment, or both
 - Excludes: congenital, degenerative, or birth injuries
- Contrast with Acquired Brain Injury

Estimated Average Annual Rates of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, by Age Group, United States, 2002-2006



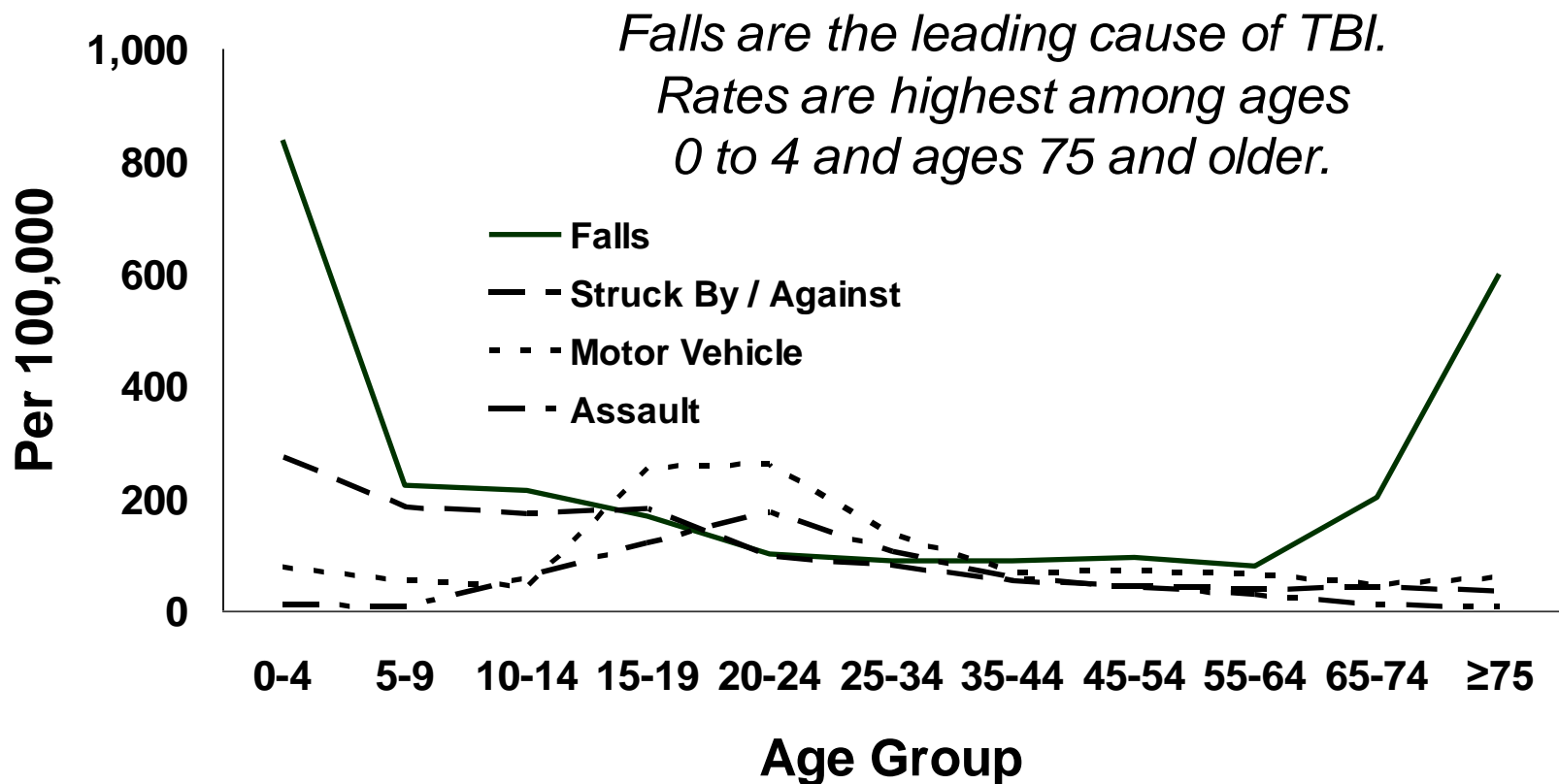
Faul M, Xu L, Wald MM, Coronado V. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths, 2002-2006. Atlanta, Georgia: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2010.

Estimated Average Annual Rates of Traumatic Brain Injury-Combined Emergency Department Visits, Hospitalizations, and Deaths, by Sex, United States, 2002-2006



Faul M, Xu L, Wald MM, Coronado V. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths, 2002-2006. Atlanta, Georgia: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2010.

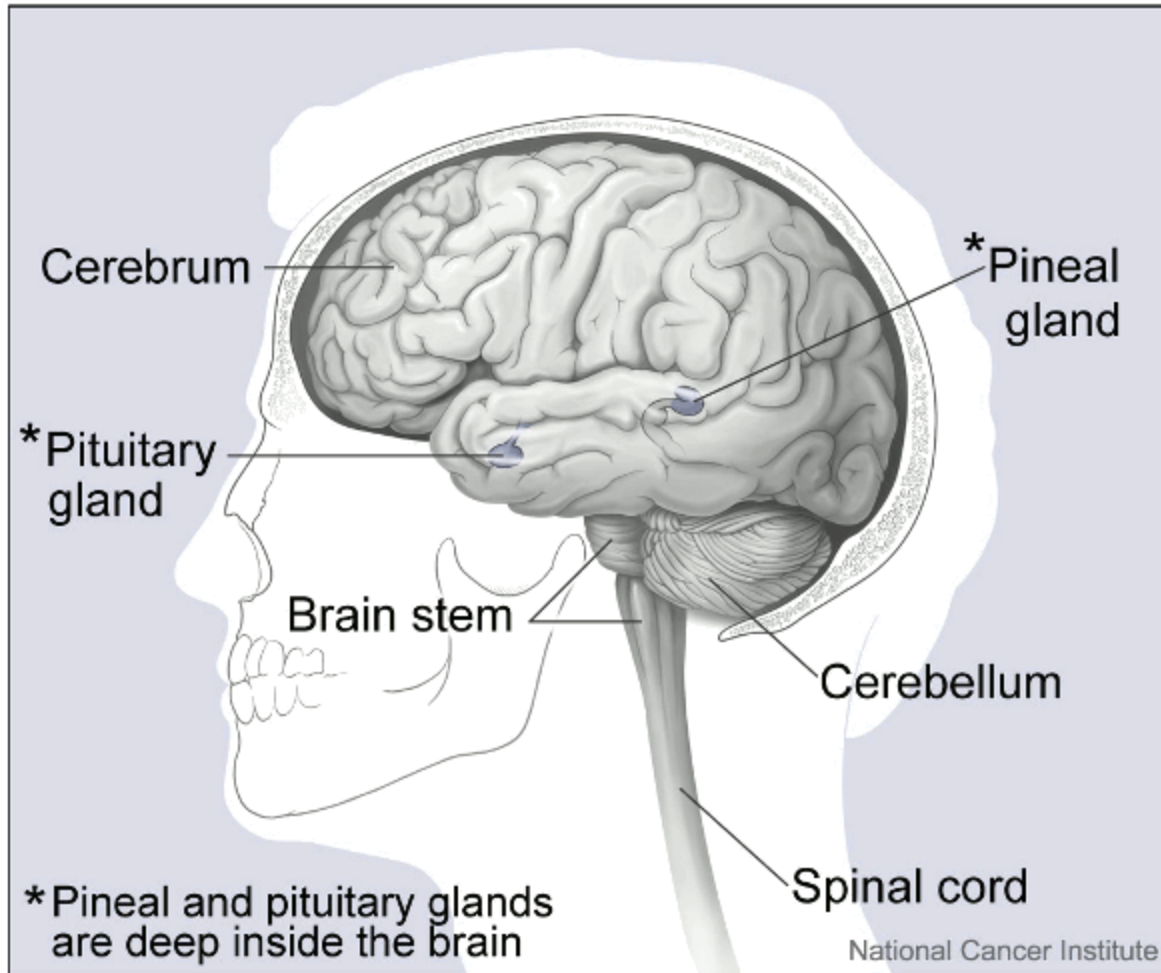
Estimated Average Annual Rates of Traumatic Brain Injury-Combined Emergency Department Visits, Hospitalizations, and Deaths, by External Cause, United States, 2002-2006



Faul M, Xu L, Wald MM, Coronado V. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths, 2002-2006. Atlanta, Georgia: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2010.

Mechanisms of Injury

Mechanisms of Injury



Mechanisms of Injury

- Primary Mechanisms
- Secondary Mechanisms

Mechanisms of Injury

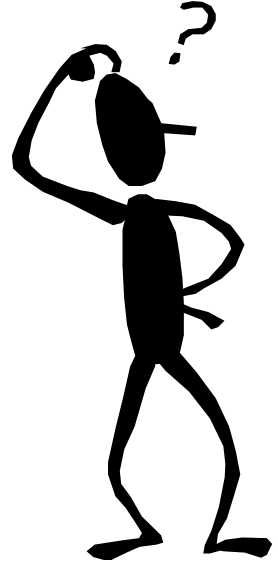
Glasgow Coma Score (also Pediatric Glasgow Coma Score)	
Eyes	Rate 1-4
Verbal	Rate 1-5
Motor	Rate 1-6

Measuring Injury Severity

Glasgow Coma Scale	
Mild	13-15
Moderate	9-12
Severe	3-8

Measuring Injury Severity

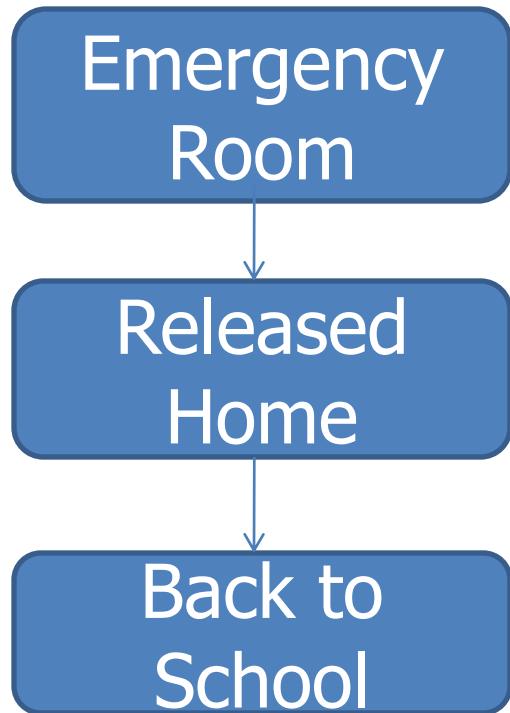
- Post-Traumatic Amnesia
 - Period of confusion following a TBI
 - Includes disorientation
 - Inability to remember continuous events occurring after the injury
- Children's Orientation and Amnesia Test (COAT)



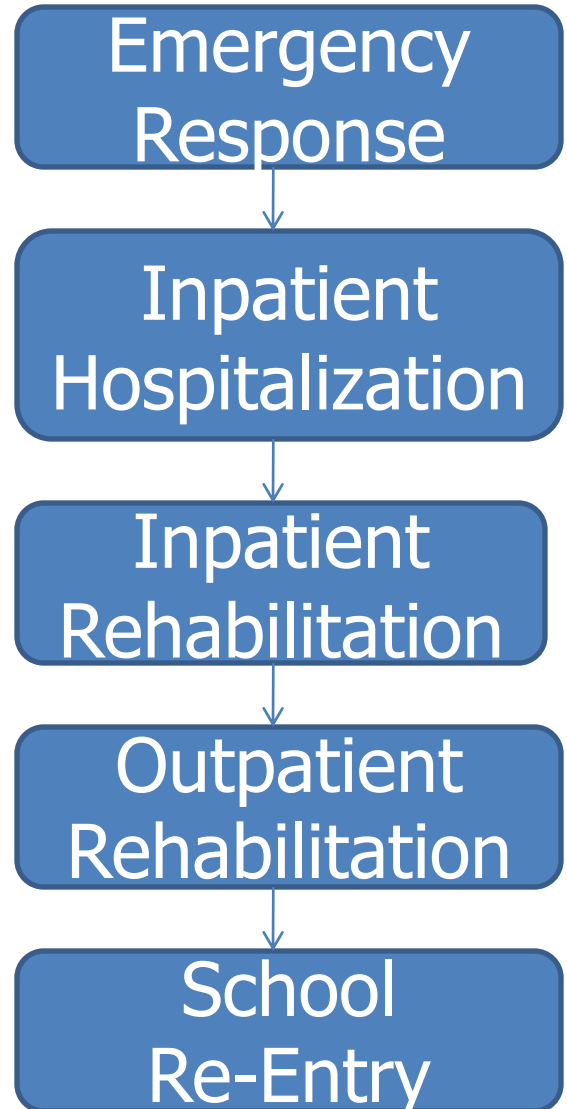
Recovery Process

Initial Recovery

Mild/Concussion



Moderate/Severe

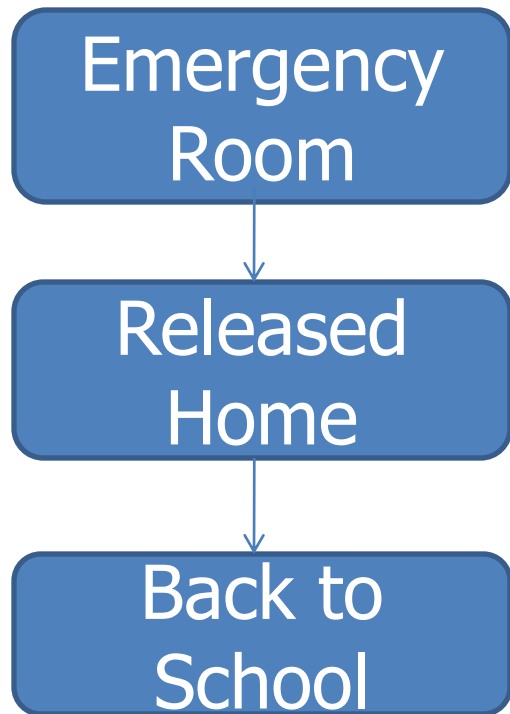


Inpatient Team Members

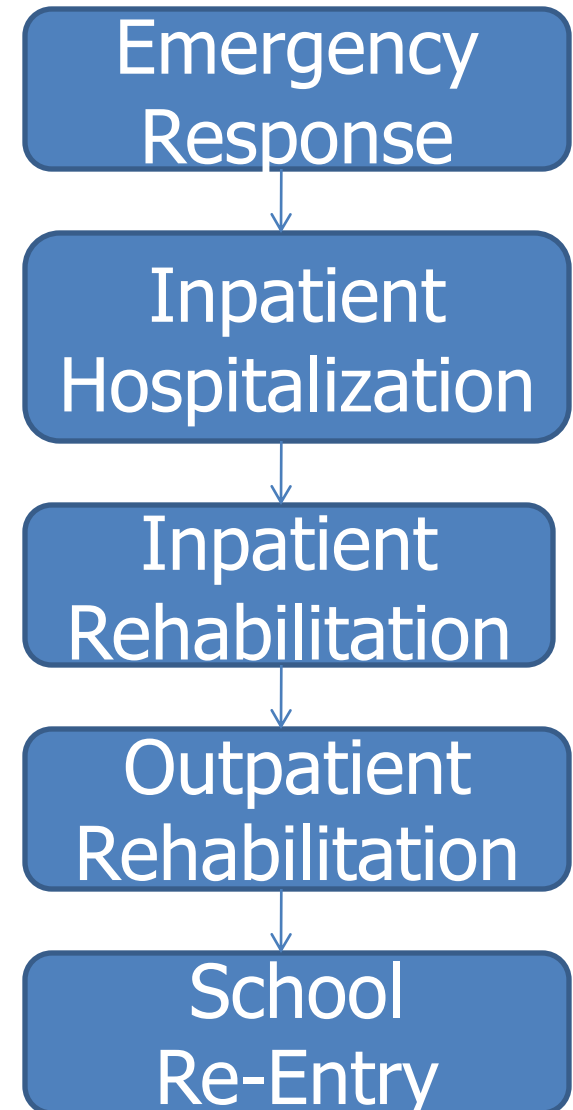
- Physicians and Nurses
- Physical Therapist
- Occupational Therapist
- Speech/Language Pathologist
- Neuropsychologist/Rehabilitation Psychologist
- Psychiatrist
- Social Worker
- Learning Specialist

Initial Recovery

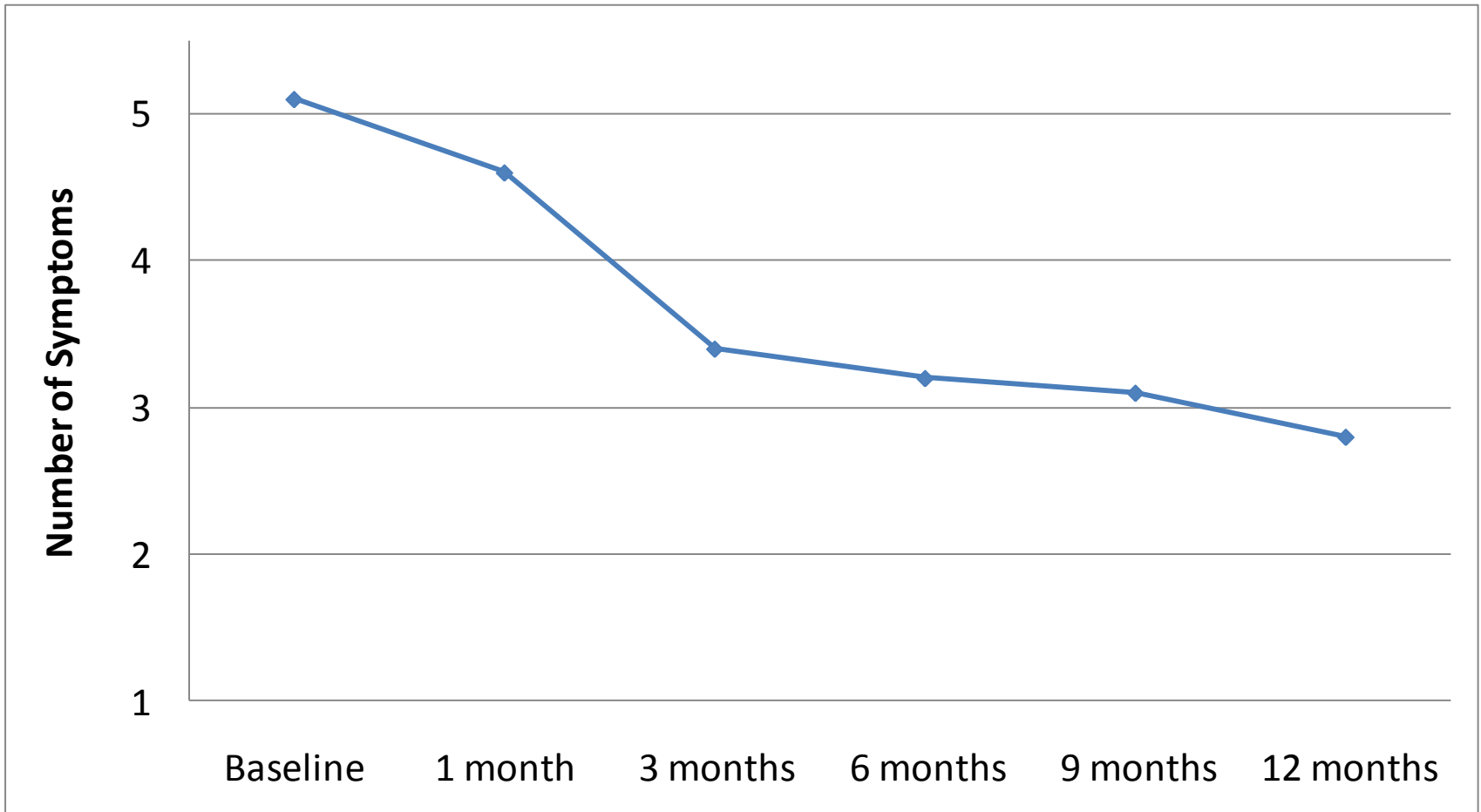
Mild/Concussion



Moderate/Severe

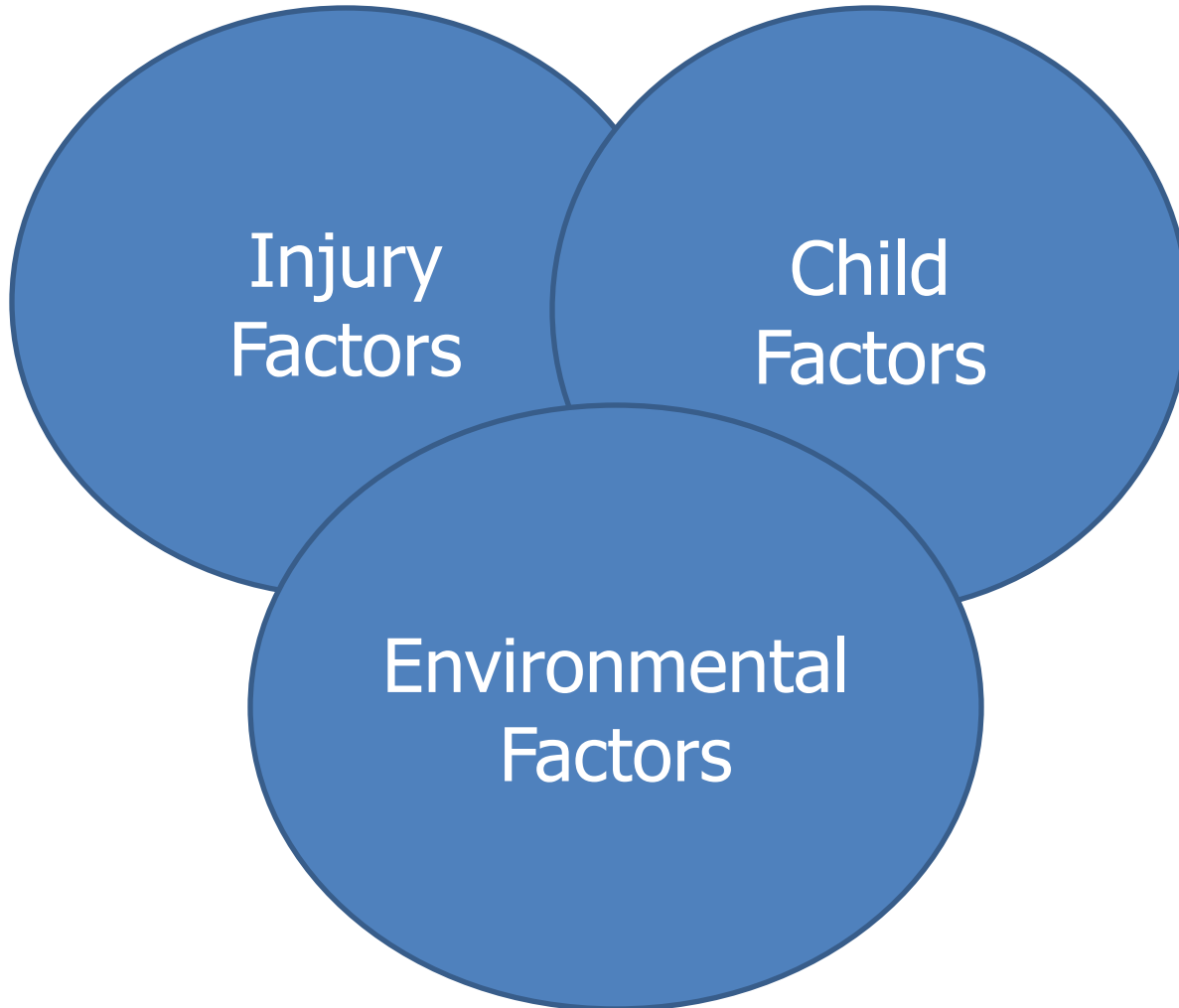


Recovery



Adapted from Taylor et al., 2010

Factors Influencing Recovery

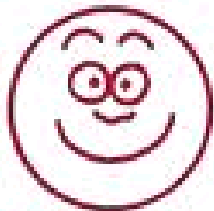


Injury
Factors

Child
Factors

Environmental
Factors

Severity of the Injury



0
No Hurt



1
Hurts
Little Bit



2
Hurts
Little More



3
Hurts
Even More

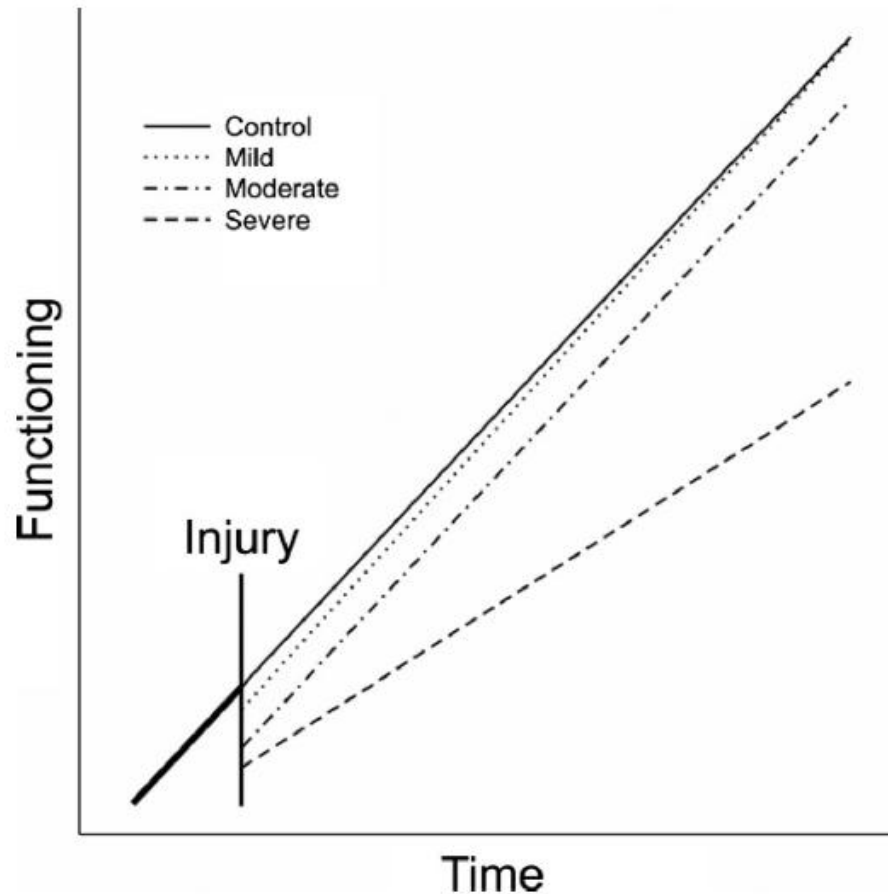


4
Hurts
Whole Lot



5
Hurts
Worst

Severity and Cognitive Recovery



Trends in neurocognitive outcomes and recovery over time

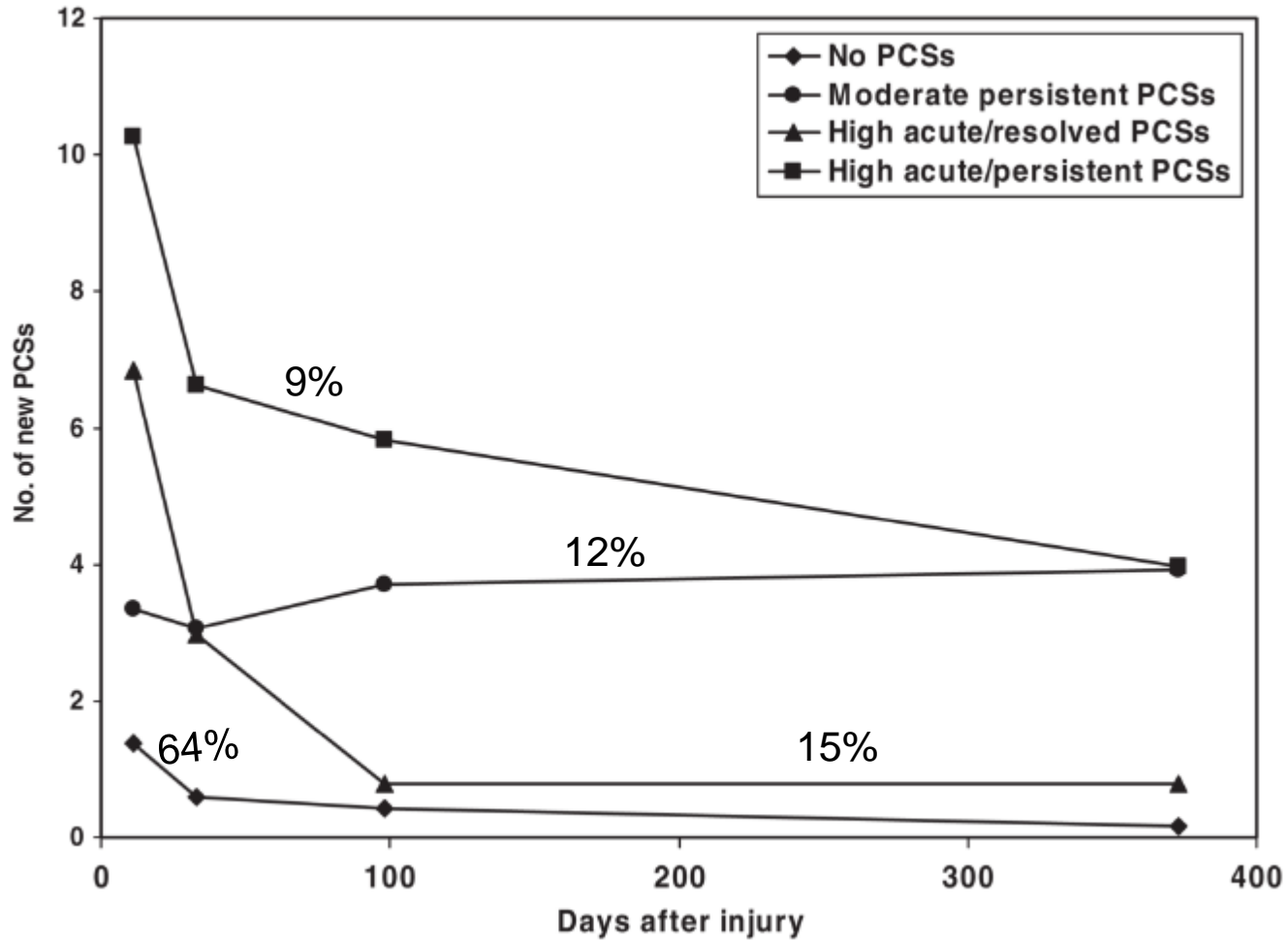
Concussion



- Headache
- Dizziness
- Fatigue
- Sleep problems
- Sensitivity to light
- Forgetfulness
- Concentration
- Mood problems

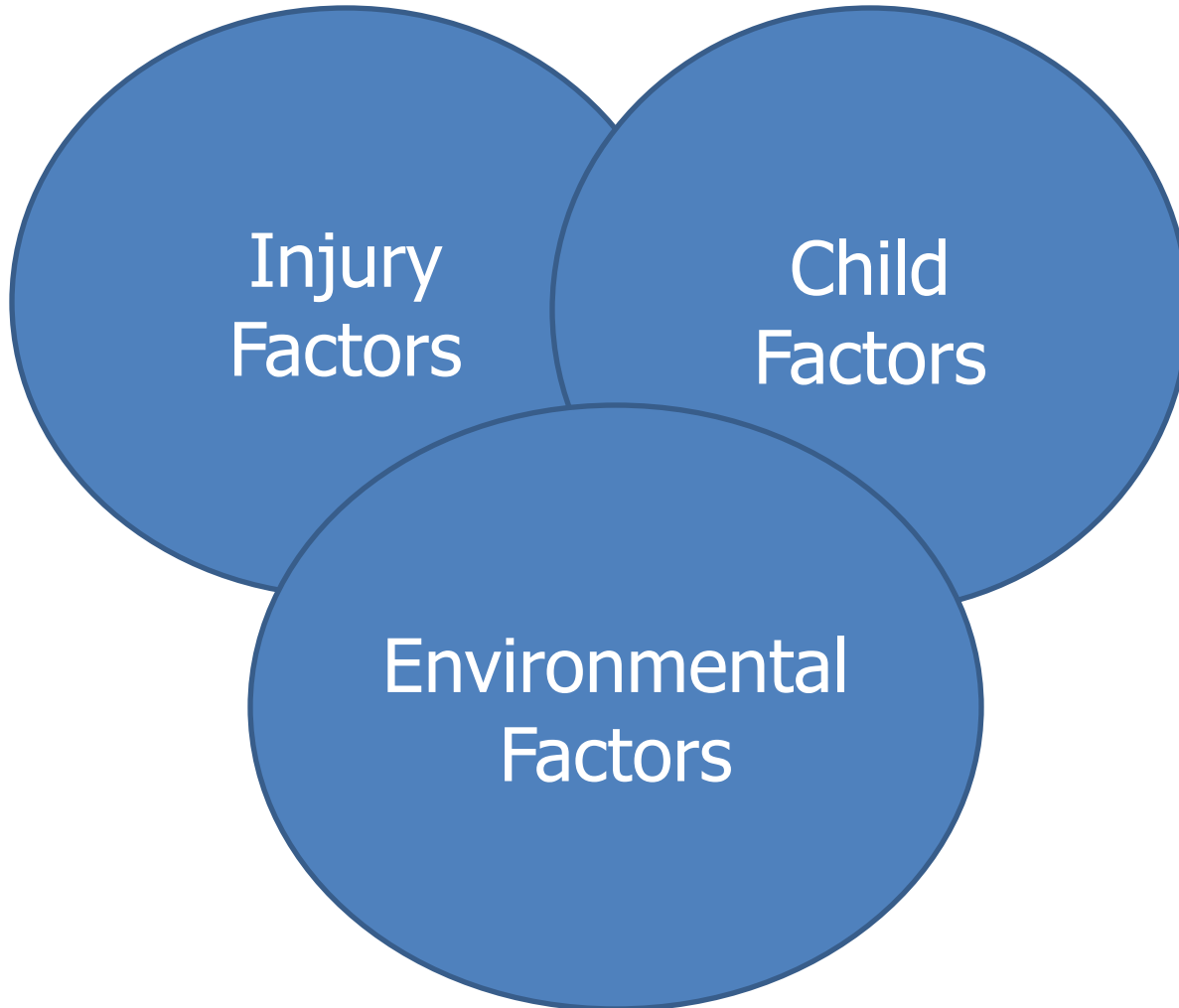
- Controversy about long-term effects
- Subset of children show significant and persisting cognitive, behavioral, emotional problems
 - Younger children
 - More serious injury
 - Worse functioning before injury
 - Worse family functioning

Post-Concussive Symptoms



From Yeates et al., 2010

Factors Influencing Recovery

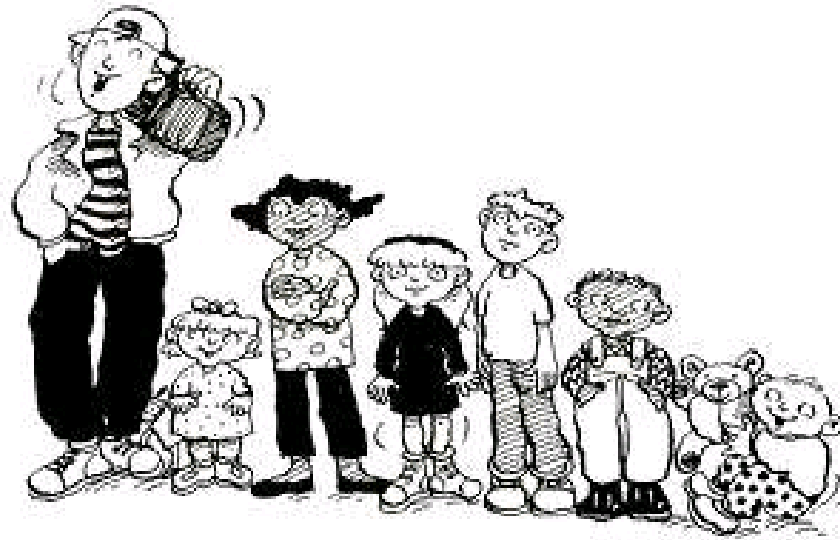


Injury
Factors

Child
Factors

Environmental
Factors

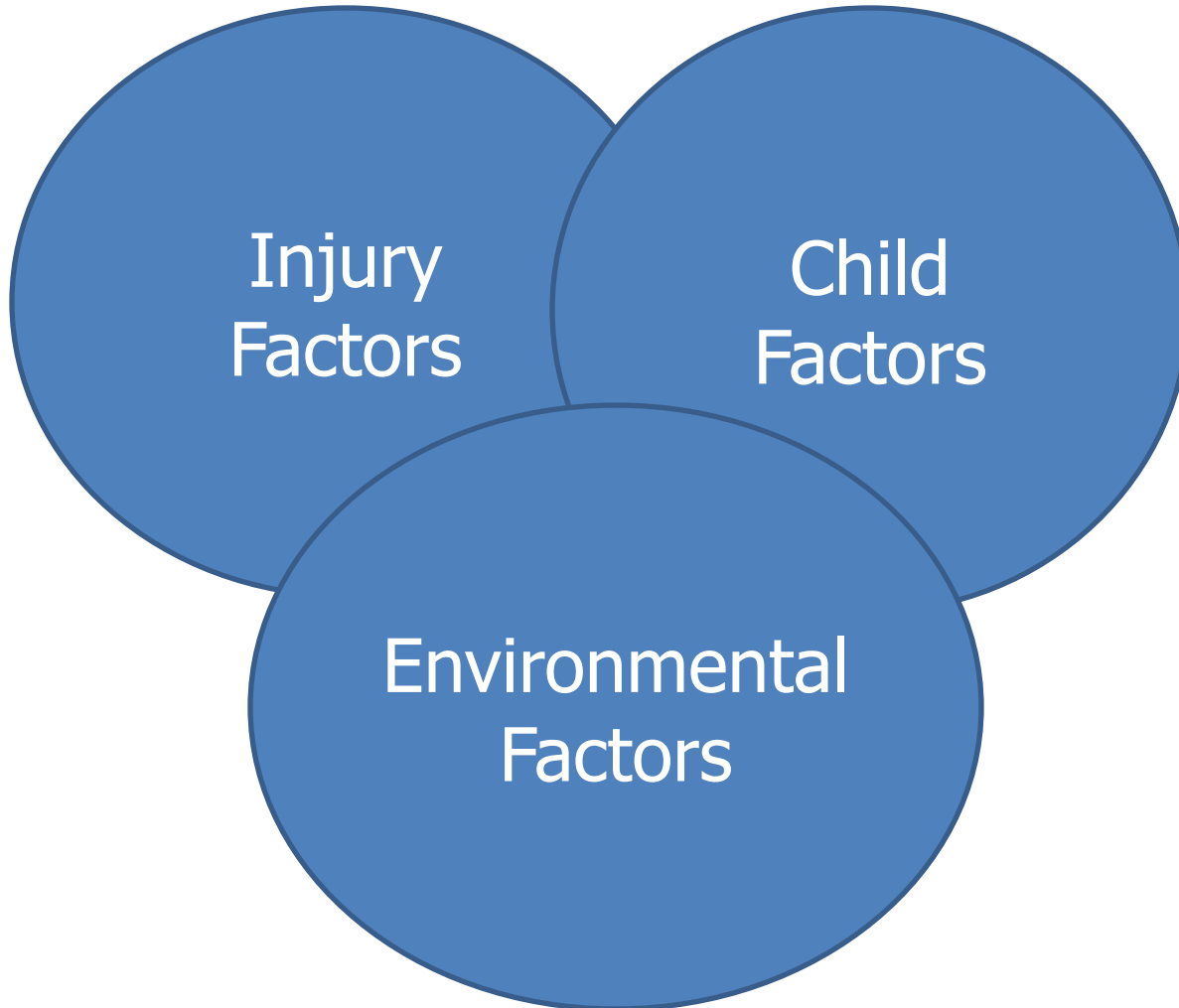
Child Factors



Child's Age

Child's Functioning
Before the Injury

Factors Influencing Recovery



Injury
Factors

Child
Factors

Environmental
Factors

Environmental Factors



Resources and
Socioeconomic Status



Family
Functioning



Support

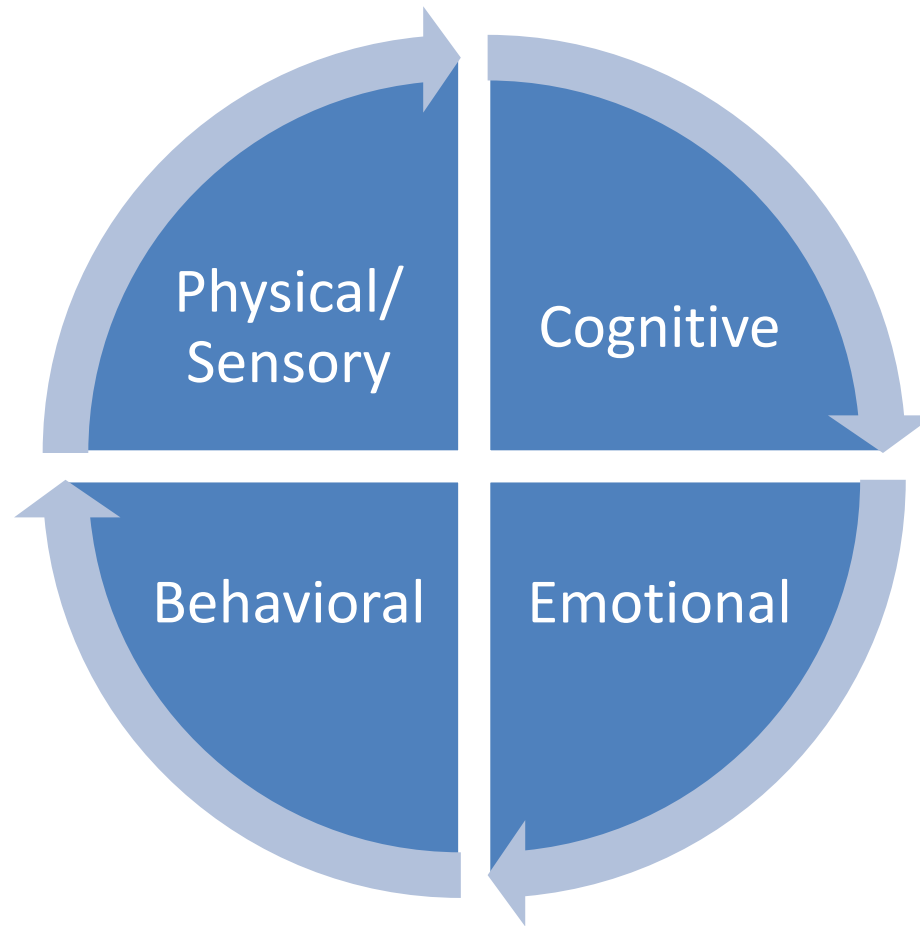


Adjustment



Cognitive and Behavioral Impact of TBI

Impact of TBI



Physical and Sensory Problems



- Fatigue and sleep problems
- Headaches
- Seizures
- Bladder/bowel problems
- Temperature regulation
- Orthopedic problems
- Vision problems
- Hearing problems
- Sensory sensitivity
- Motor problems

Cognitive Problems

Intellectual (IQ)	Memory	Attention	Executive Function	Communication	Nonverbal Communication
Verbal reasoning	Storage	Auditory attention	Working memory	Organizing verbal responses	Eye contact
Visual-spatial reasoning	Retention	Visual attention	Planning	Organizing written responses	Facial expressions
Information processing speed	Retrieval	Divided attention	Organizing	Keeping on topic	Body language
	Slower learning curve		Problem-solving	Comprehension	Gestures
			Mental flexibility	Discourse	Personal space
			Abstract thinking		Social information processing

Effects on IQ

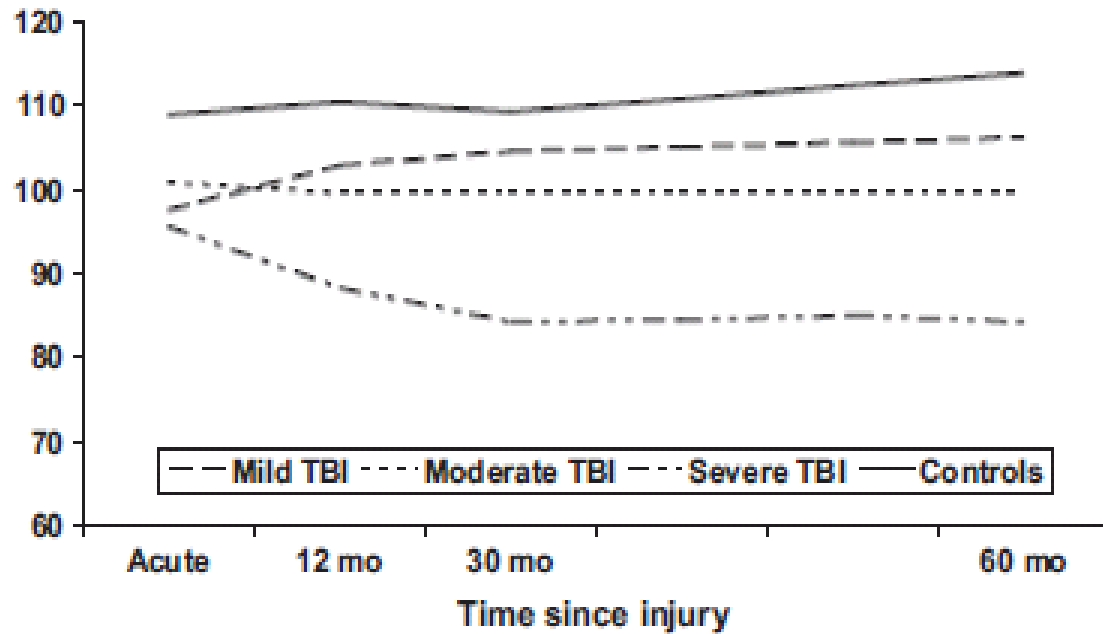


FIGURE 1
Recovery of FSIQ over the 5 years after TBI.

From Anderson, Catroppa, Morse, Haritou, & Rosenfeld, 2009

Cognitive Problems

Intellectual (IQ)	Memory	Attention	Executive Function	Communication	Nonverbal Communication
Verbal reasoning	Storage	Auditory attention	Working memory	Organizing verbal responses	Eye contact
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Behavior Problems



Impulsivity



Low Motivation



Poor Judgment

Self-Regulation



Lethargic

Emotional Problems



Depression



Anxiety

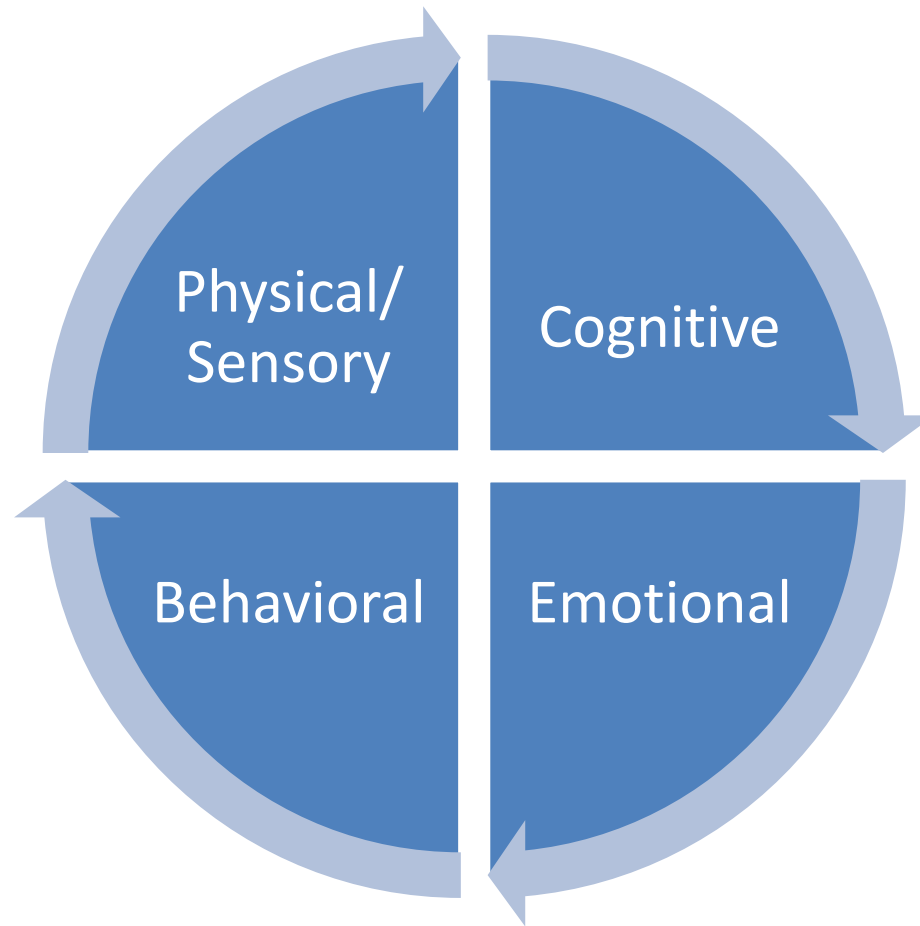
**Emotion
Regulation**

Mood Changes



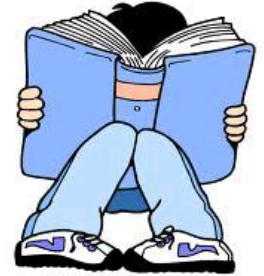
Anger and
Irritability

Impact of TBI



Academic Problems

- Reading



- Number concepts and arithmetic



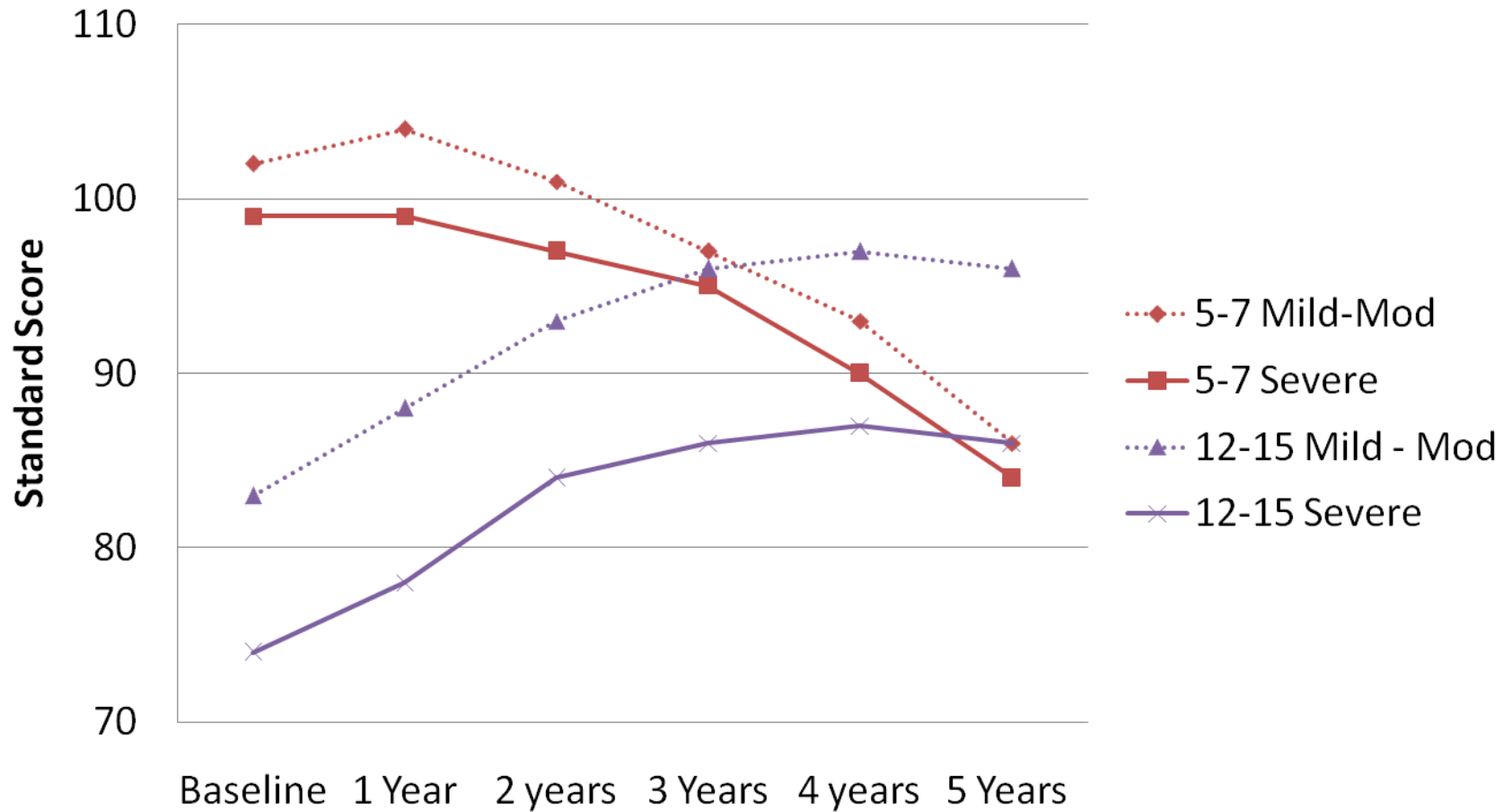
- Writing



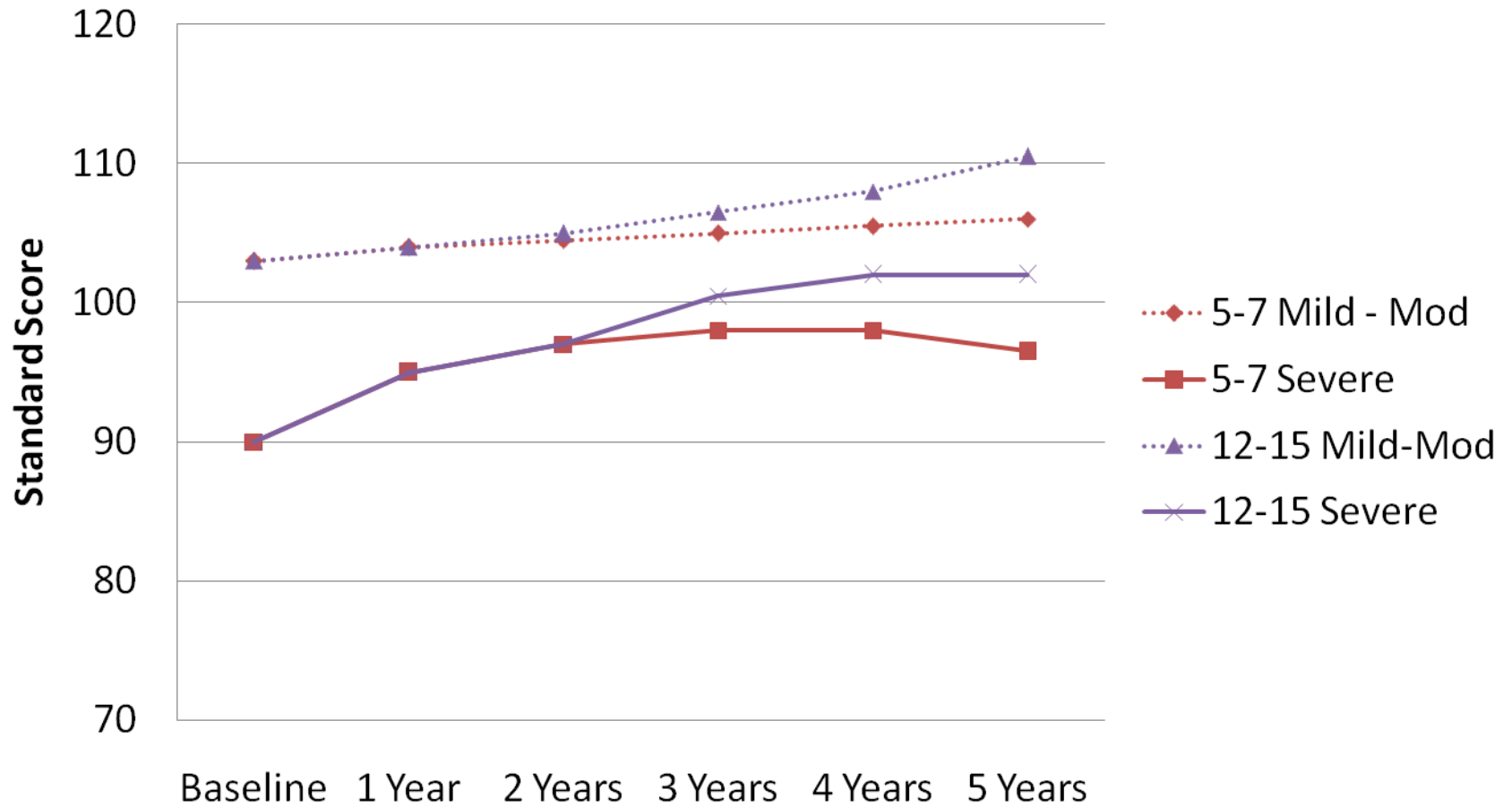
- Academic facts



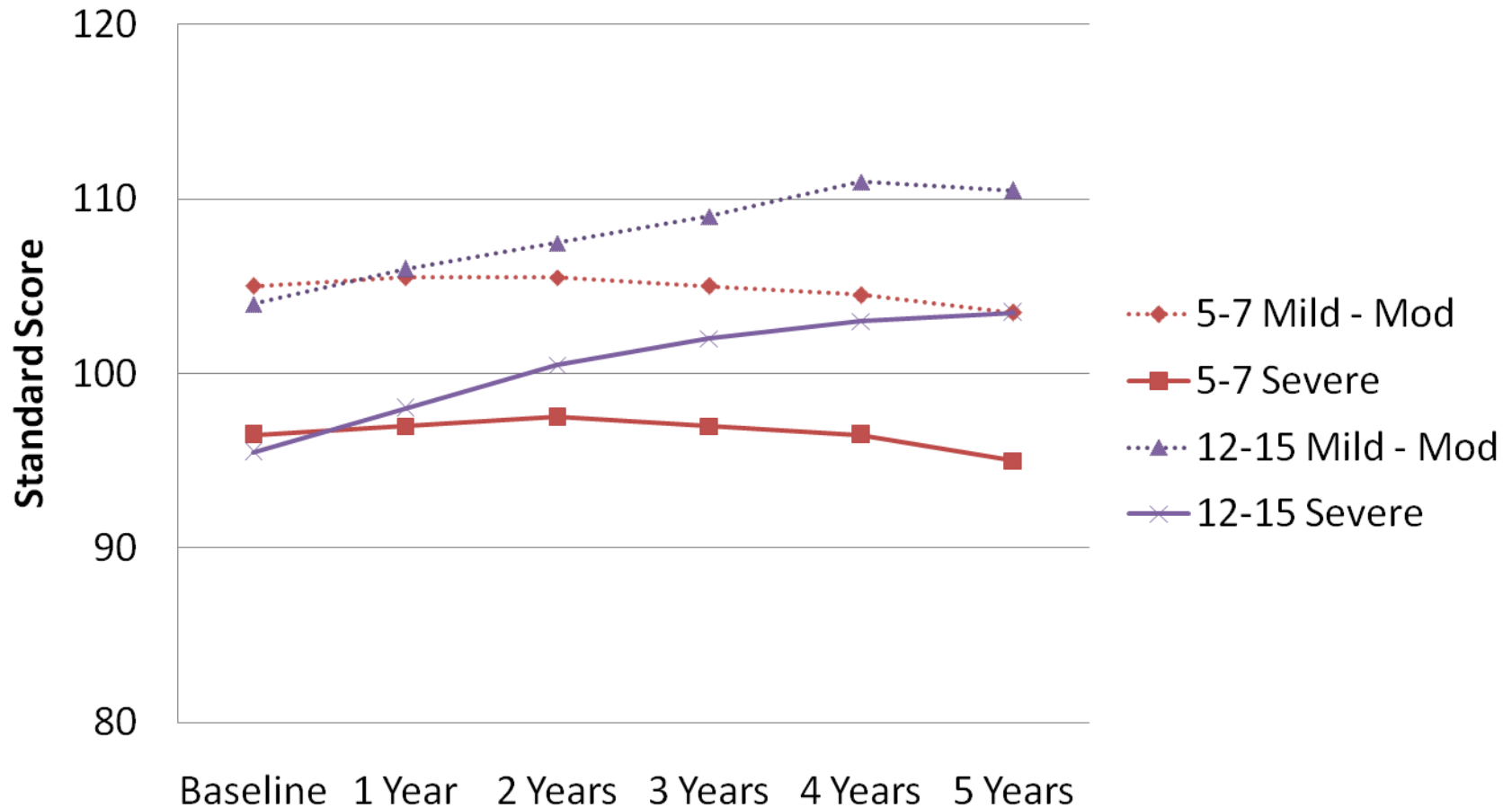
Math Achievement



Spelling Achievement



Reading Recognition Achievement



Adapted from Ewing-Cobbs et al., 2004

Social Problems



Aggression



Loneliness



Bossiness

Poor Social
Problem-Solving



Suggestibility

Adaptive Problems

Self Care



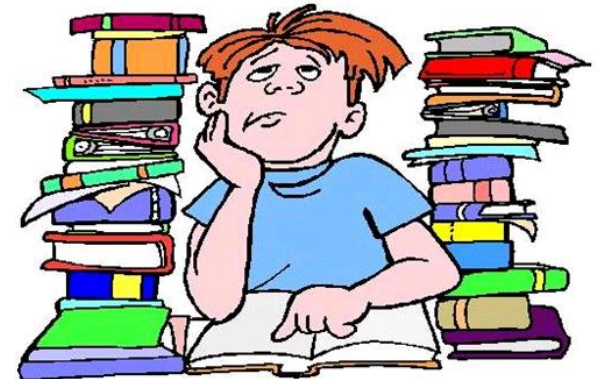
Safety Skills



Self Direction



Self-Regulation



Working with a Child with TBI

Educator's Role



- Integral team member
- Collaborate with other service providers and parents
- Frequent monitoring
- Appropriate accommodations and supports

Parent's Role



- Watchful attention
- Communicate with all providers
- Advocate for supports and services
- Provide support and encouragement
- Attend to family's well-being

Supporting the Child



Health
Plan

Structure

Behavior
Supports

Schedule

Attention,
Learning
and
Memory



Health
Plan

- Obtain needed information from child's medical providers
- Schedule medication administration
- Provide needed accommodations to address physical limitations
- Develop a written plan



Schedule

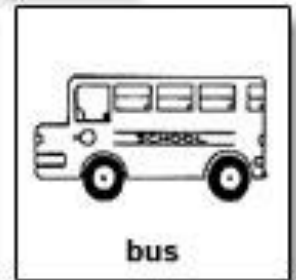
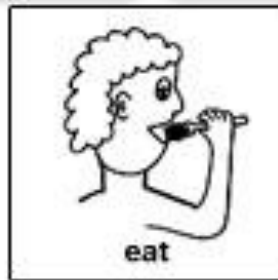
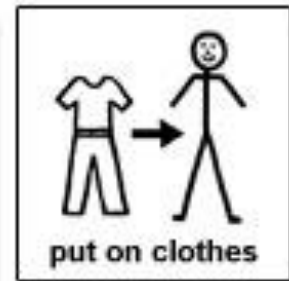
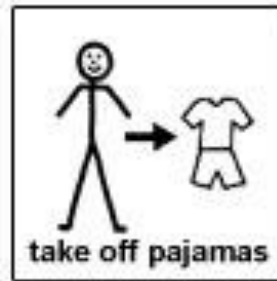
- Modified schedule
- Alternate physical and academic activities
- Scheduled breaks



Structure

- Structure
- Predictability
- Routines
 - Visual Schedule
 - Instructional Routines

Visual Schedules



Visual Schedule



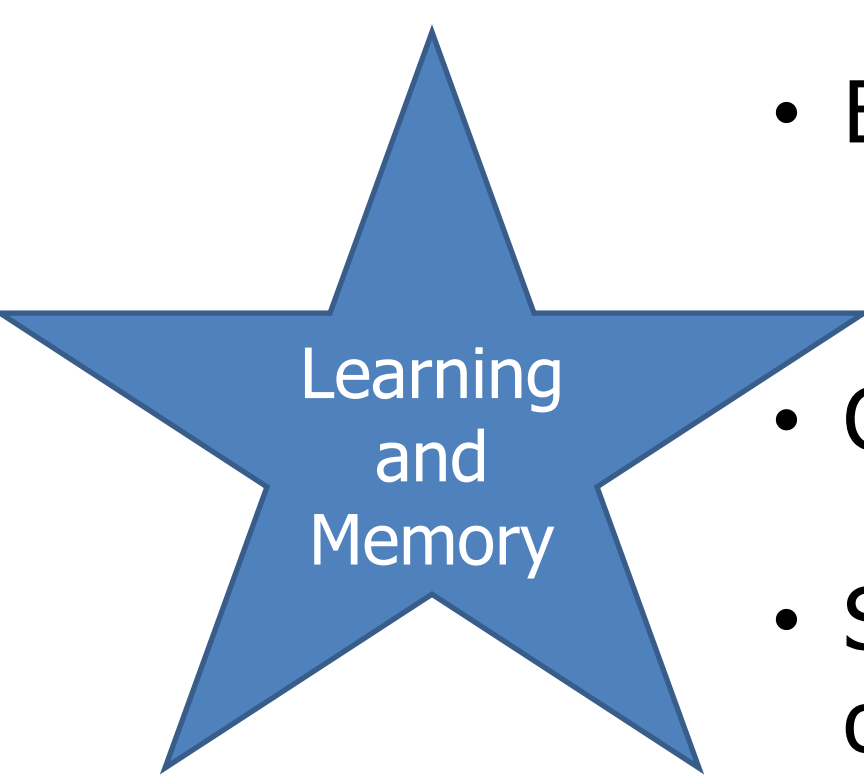
Instructional Routines

- Getting the child's attention
- Explain the activity
- Model the activity ("I'll do it")
- Children do activity with teacher ("We do it")
- Child does activity alone ("You do it")
- Teacher gives feedback
- Review



Attention

- Avoid overstimulation
 - Designated quiet space
 - Remove unnecessary materials
- Look for signs of fatigue
 - Give breaks as needed
- Keep instructions simple
- Present information in interesting, active ways



Learning
and
Memory

- Brisk Pace
 - Slower pace for new material
- Check in with child
- Small chunks of information over several days
- Frequent repetition and review
- Present information in more than one way



Behavior
Supports

- Anticipate problems and triggers
 - Transitions and changes
 - Unstructured activities
 - Time of day/fatigue
- Set up the environment for success
 - Reduce stimulation and distraction
 - Provide breaks
 - Re-direct the child
 - Give reminders and cues



Behavior Supports

- Give lots of specific positive reinforcement
 - I like how you kept your hands to yourself
 - Great job asking for help
- Formal behavior plan
 - Increase appropriate behaviors
 - Decrease negative behaviors
- Functional Behavior Assessment

Additional Supports and Services

- Individual therapy
 - Cognitive rehabilitation
 - Building coping skills
- Family counseling
 - Improving family functioning
 - Family problem-solving



When a Child Is Injured in Your Care

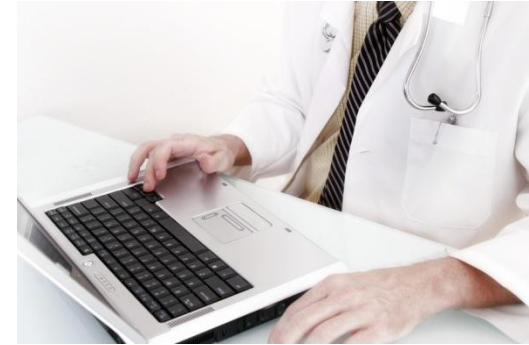
What to Do if a Child is Injured in Your Care

- Follow standard first aid procedures
- Make sure the child is evaluated by a physician



What to Do if a Child is Injured in Your Care

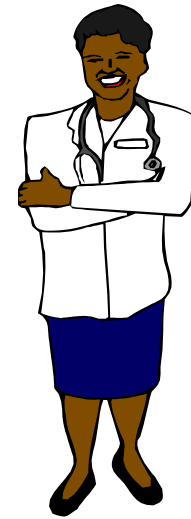
- When did the injury occur?
- What did the child hit his/her head on?
- How did it happen?
- What part of the child's head was injured?
- How did the child behave after the injury?
 - Loss of consciousness
 - Seeming dazed, confused, or disoriented
 - Periods of blank staring and/or frank seizure
 - Vomiting and/or headache
 - Irritability, fussiness
- How long did any changes in behavior last?



Recognizing TBI in Your Classroom

How to Recognize TBI in Your Classroom

- Any child who shows a change in behavioral or cognitive functioning should be evaluated
- Changes in behavior following a known head injury warrant specialty attention



How to Recognize TBI in Your Classroom

- Notable changes may include:
 - Irritability or moodiness
 - Fatigue
 - Withdrawn behavior
 - Impulsivity
 - Complaints of headaches
 - Trouble learning new information
 - Slow speed of processing

References

- Anderson, V., Catroppa, C., Morse, S., Haritou, F., & Rosenfeld, J. V. (2009). Intellectual outcome from preschool traumatic brain injury: A five-year prospective, longitudinal study. *Pediatrics*, 124, 1064-1071.
- Babikian, T., & Asarnow, R. (2009). Neurocognitive outcomes and recovery after pediatric TBI: Meta-analytic review of the literature. *Neuropsychology*, 23, 283-296.
- Ewing-Cobbs, L., Barnes, M., Fletcher, J. M., Levin, H. S., Swank, P. R., & Song, J. (2004). Modeling of longitudinal academic achievement scores after pediatric traumatic brain injury. *Developmental Neuropsychology*, 25, 107-133.
- Fau, M., Xu, L., Wald, M.M., & Coronado V. (2010). Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths, 2002-2006. Atlanta, Georgia: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.
- Taylor, H. G., Dietrich, A., Nuss, K., Wright, M., Rusin, J., Bangert, B., et al. (2010). Post-concussive symptoms in children with mild traumatic brain injury. *Neuropsychology*, 24, 148-159.
- Yeates, K. O., Taylor, H. G., Rusin, J., Bangert, B., Dietrich, A., Nuss, K., et al. (2009). Longitudinal trajectories of postconcussive symptoms in children with mild traumatic brain injuries and their relationship to acute clinical status. *Pediatrics*, 123(3), 735-743.

Resources

- Centers for Disease Control and Prevention
 - <http://www.cdc.gov/traumaticbraininjury/>
- Brain Injury Association of America
 - <http://www.biausa.org/>
- Brain Injury Association of Missouri
 - http://www.biamo.org/new_page0.aspx
- LearnNet
 - <http://www.projectlearnnet.org/>