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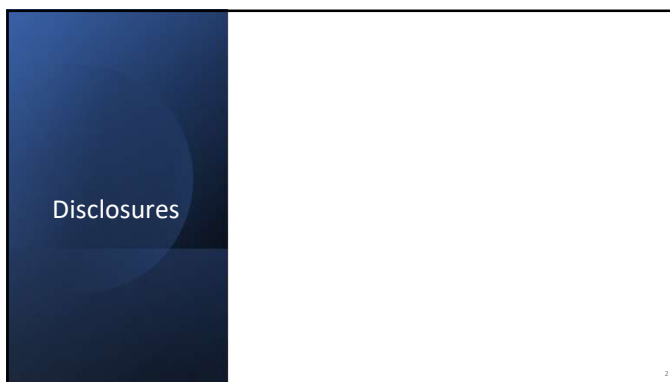
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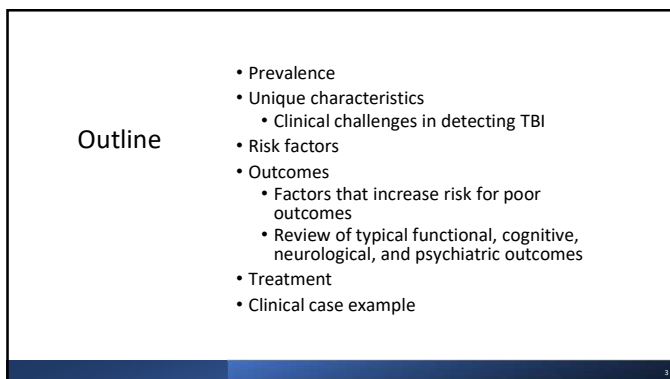
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## Which age groups are the most at risk for TBI?

Infants

Toddlers

Children

Teenagers

Young  
Adults

Middle  
Aged Adults

Older  
Adults

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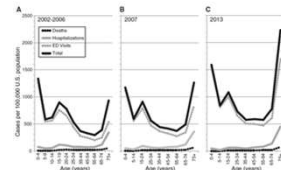
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## Prevalence of TBI in Older Adults

- 65 and older
  - By 2030, > 20% of U.S. population
  - Highest combined incidence of TBI-related ED visits, hospitalizations, and deaths
- Total TBI incidence increasing
  - Lifetime prevalence up to 40%
  - 1 in 200 adults 65-74 years
  - 1 in 50 adults 75+ years



(Gardner et al., 2018; Hwang et al., 2015; Ramanathan et al., 2012; Susman et al., 2002; U.S. Census Bureau, 2000)

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## What is the most common cause of TBI in older adults?

Motor vehicle accidents

Sports-related injuries

Falls

Assault

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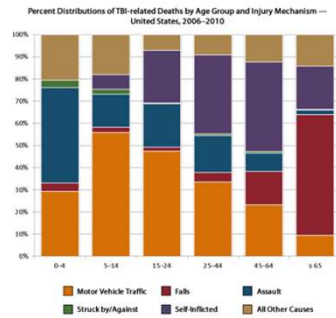
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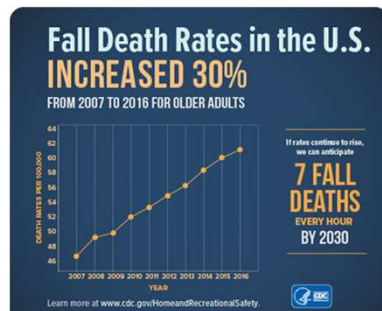
## Mechanism of Injury



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## Falls are common, and also bad

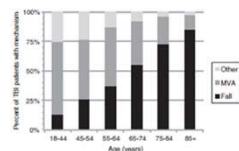
- More than 1/4 older adults falls each year, but fewer than 1/3 tell their doctor
- 1 fall = 2x risk of falling again
- 1/5 falls cause serious injury
- Older adults who have fallen may reduce ADLs out of fear of falling again



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## Distinct TBI Characteristics in Older Adults

- Falls are leading cause of TBI
- Mild TBI most common severity
- Equally common among men and women
- On average, worse functional, cognitive, and psychosocial outcomes



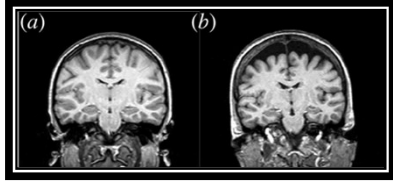
**FIG. 2.** Major mechanisms of traumatic brain injury (TBI) by age (2007–2010). Falls are shown in black, motor vehicle accidents (MVA), in dark gray, and other mechanisms, in light gray. Mechanism of TBI among older adults is predominantly falls whereas mechanism among younger individuals is predominantly MVA.

(Gardner et al., 2018; Huang et al., 2015; Ramanathan et al., 2012; Susman et al., 2002; U.S. Census Bureau, 2000)

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## Detecting TBI in Older Adults (OA)

- More challenging than in younger adults, children
- Neuroimaging



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## Detecting TBI in Older Adults (OA)

- Glasgow Coma Scale
  - May not be as useful for older adults
    - Dementia
    - Not developed for OA

**TABLE 38-2**  
**Glasgow Coma Scale**

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:		15
		Best response
		Comatose client
		Totally unresponsive
		8 or less
		3

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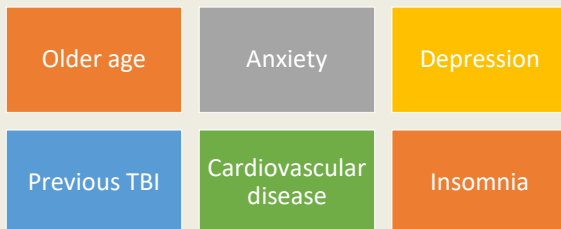
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## Identify risk factors for TBI.



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## Risk Factors for TBI



**Sustaining TBI**

- Age
- Previous TBI
- Vascular diseases
- Depression
- Impaired activities of daily living



**Falls**

- Chronic medical conditions
- Previous TBI
- Medication side effects
- Visual/Hearing impairment
- Cognitive impairment
- Gait or balance impairment

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### Risk Factors for Poor Outcomes

- Pre-existing conditions
  - Previous TBI, stroke
  - Heart disease, endocrine disorders, diabetes, lung disease, kidney disease
  - Depression
- Self-rated health and pre-injury functioning are important predictors

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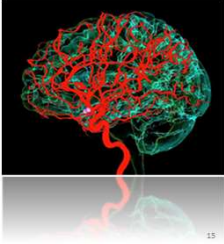
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### Impact of Head Injury on Older Adults' Brains

- More vulnerable to neurotrauma
  - Age related changes to:
    - Vasculature
    - White matter
  - Weakened musculature in neck/trunk
  - Pre-existing conditions
  - Medications



(Gardner et al., 2018)

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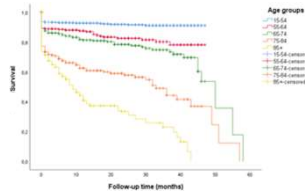
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## Outcomes of Head Injury: Mortality

- Mortality risk increases with age
  - Even with mild injury
- Short-term mortality (during initial hospitalization or rehabilitation)
  - High, especially for severe TBI
  - Most deaths followed withdrawal of care
- Long-term mortality (months to years after the injury)
  - High, partially due to expected age effects



Cheng et al., 2018

Socman et al., 2002

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## Outcomes of Head Injury: Cognitive

- Slower cognitive recovery rates affected by
  - Pre-injury comorbidities that independently increase risk for cognitive dysfunction
  - Impact of trauma/hospitalization (i.e., general deconditioning)
- Important to use age-adjusted scores in cognitive testing

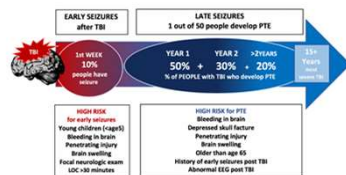


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## Outcomes of Head Injury: Neurological and Psychiatric

- Increased risk of:
  - Post-traumatic epilepsy
  - Stroke
  - Dementia
  - Depression, anxiety, and PTSD



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## Treatment

- Intensive inpatient rehabilitation works
- Takes longer, both in terms of length of stay and hours spent in therapies
- Focus on:
  - Mobility
  - Ability to travel
    - Adapting home environment
  - Socialization within the home
- Focus on removal of "excess disability"
  - Depression
  - Insomnia
  - Pain
  - Social instability



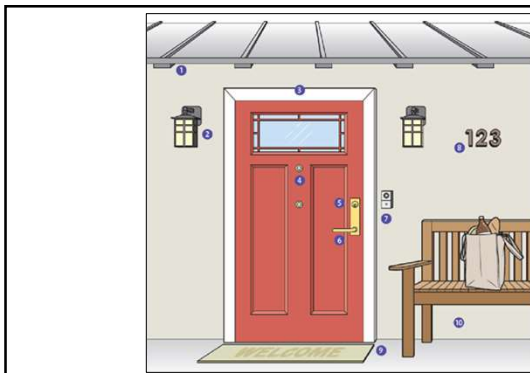
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## Treatment

- Refer for supportive psychotherapy if patient is struggling to adapt to new cognitive and functional impairments
  - May be preferable to medication due to cognitive and vestibular effects
- Involve family and caregivers in treatment plan
  - Acute changes in functioning due to TBI may lead to drastic changes in role functioning within the family
  - Educate families and caregivers about prognosis, limitations, and strategies
  - Engage families with support groups

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## Fall Prevention

- Moderate to severe TBIs tend to occur when older adults:
  - Are getting in/out of bed, using stairs, or feeling dizzy
  - Fall backwards or sideways while indoors
- Important to:
  - Monitor the physical environment
  - Routinely have vision and hearing checked
  - Increase strength, mobility, and balance
  - Use handrails
  - Avoid stairs whenever possible, especially if neurological, joint, or cognitive deficits are present and if needing to descend stairs
  - Treat heart conditions
  - Consider medication side effects and polypharmacy

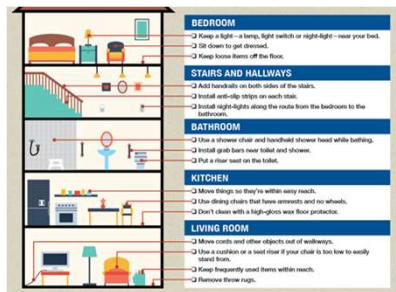


(Pruess et al., 2015; Marrone et al. 2020)

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## Fall Prevention in the Home



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## Ageism

- Older-old patients with head injury had:
  - Significantly lower rates of outpatient injury-related clinic visits
  - Significantly higher rates of rehospitalizations, home healthcare visits, and weekly hours of unpaid care from friends and family
- Provider attitudes
  - Imaging
  - Transfer to neurotrauma center
  - Review by a senior physician
- No evidence-based guidelines for treatment with older adults
  - Age cut-offs

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## Case Study

- KE: 80-year-old woman who sustained a severe TBI as a result of a car striking her while she was walking her dog
- GCS score initially 7/15, then fell to 3/15. Admitted to the ICU.
- Began to emerge from coma ~4 weeks post-injury.
- Discharged to a rehabilitation hospital ~10 weeks post-injury.
- Began to recover learning/memory abilities ~14 weeks post-injury.
- Discharged home ~5 months post-injury.
- ~10 months post-injury was swimming, reading, and caring for many of her own needs, but requiring assistance from family for others.
- ~2 years post-injury showed improved thinking speed, memory, and higher-order thinking
- This case study shows that older adults who are healthy prior to their injury can follow similar recoveries as younger patients and can benefit equally from rehabilitation services.

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## Thank you!

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