



# TBI-BH ECHO

Traumatic Brain Injury - Behavioral Health ECHO  
UW Medicine | Psychiatry and Behavioral Sciences

# Driving after TBI

Cherry Junn, MD

University of Washington

4/7/2023



TBI-BH ECHO

# Speaker disclosures

No conflict of interest

The following series planners have no conflicts of interest:

- ✓ Jennifer Erickson DO
- ✓ Jess Fann MD
- ✓ Cherry Junn MD
- ✓ Chuck Bombardier PhD
- ✓ Cara Towle MSN RN MA
- ✓ David Minor
- ✓ Amanda Kersey PhD
- ✓ Lauren Miles



# Objectives

## Clarify

Clarify what's included in driving performance, assessment, and rehabilitation

## Identify

Identify common factors to consider when discussing safe return to driving (RTD)

## Discuss

Discuss how a person may return to driving after TBI



# Focus: Moderate and Severe

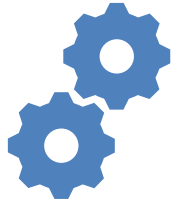
Criteria	Mild	Moderate	Severe
Structural imaging	Normal	Normal or abnormal	Normal or abnormal
Loss of consciousness	0-30 min	>30 min and <24 hours	>24 hours
Alteration of consciousness/mental state	Up to 24 hours	>24 hours; severity based on other criteria	
Post-traumatic amnesia duration	0-1 day	>1 and <7 days	>7 days
Glasgow Coma Scale (best available score in first 24 hours)	13-15	9-12	<9

# Driving: highly complex process

- ▶ Interacting within a dynamic environment
- ▶ Motor:
  - ▶ Strength, coordination, reach, postural control, tone, endurance
- ▶ Sensory
  - ▶ Vision, sensation, auditory, proprioception
- ▶ Cognitive process
  - ▶ Attention, visuospatial, learning/memory, and executive functions



# Driving: hierarchy of necessary skills and behaviors



## Operational:

Habitual or physical actions require to control the vehicle

- Accelerator or break use
- Changing gears



## Tactical:

Actions required to achieve goal-directed driving actions

- Adjusting speed or road position
- Switching on headlight or wipers



## Strategic:

Planning

- Trip planning such as which route to take
- When and whether to drive



# Many return to driving after moderate to severe TBI

- Reported rates: 32-70%
- TBI Model System Study



**Archives of Physical Medicine and Rehabilitation**

journal homepage: [www.archives-pmr.org](http://www.archives-pmr.org)

Archives of Physical Medicine and Rehabilitation 2021;102: 1568–75



---

## ORIGINAL RESEARCH

### **Return to Driving After Moderate-to-Severe Traumatic Brain Injury: A Traumatic Brain Injury Model System Study**

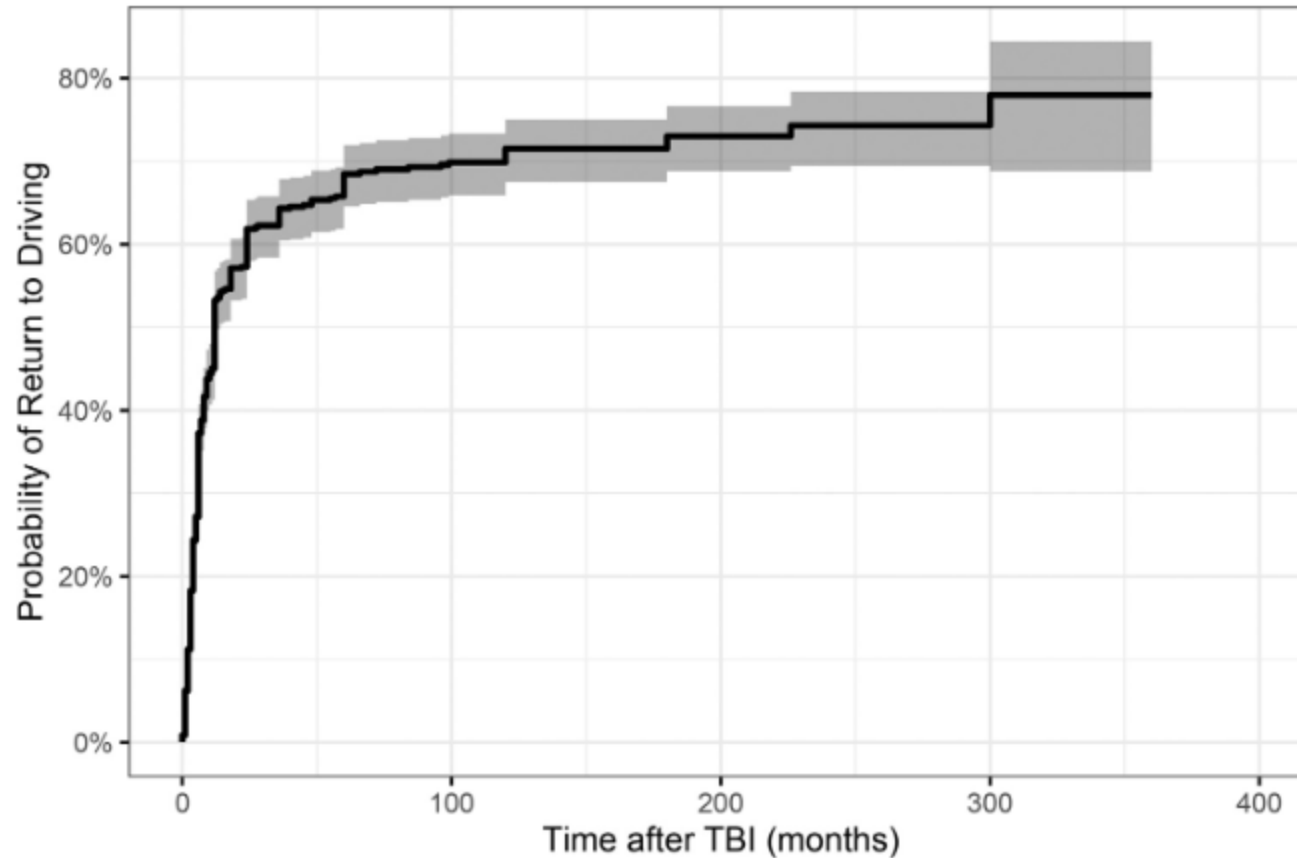


Thomas A. Novack, PhD,<sup>a</sup> Yue Zhang, PhD,<sup>b</sup> Richard Kennedy, PhD,<sup>b</sup> Lisa J. Rapport, PhD,<sup>c</sup> Thomas K. Watanabe, MD,<sup>d</sup> Kimberley R. Monden, PhD,<sup>e</sup> Laura E. Dreer, PhD,<sup>f</sup> Thomas Bergquist, PhD,<sup>g</sup> Charles Bombardier, PhD,<sup>h</sup> Robert Brunner, MD,<sup>a</sup> Yelena Goldin, PhD,<sup>i</sup> Jennifer Marwitz, MA,<sup>j</sup> Janet P. Niemeier, PhD, ABPP (RP)<sup>a</sup>



TBI-BH ECHO

# One study showed 78% returned to driving; most within 24 months postinjury



**Fig 1** Kaplan-Meier survival analysis of return to driving with gray area denoting the 95% confidence intervals.





# There are many benefits associated with successful return to driving (RTD)

---

Driving status has been associated with:

---

- higher life satisfaction, participation, employment, community reintegration

---

- having a sense of normality



# Need for more data on crash and incident risks after RTD

Evidence is equivocal regarding crash risk

One meta-analysis:

- No significant differences in risk of MVCs
- Many limitations in the study

Other studies:

- Increased serious and minor accident involvements
- More demerit points on official records compared to controls



# So what factors are associated with driving skills and RTD?

Variability in results

Limiting driving:

- Being a student or unemployed
- Having a lower family income
- Being black
- Living in an urban setting
- More severe TBI (to lesser extent)
- Seizure

Unrelated:

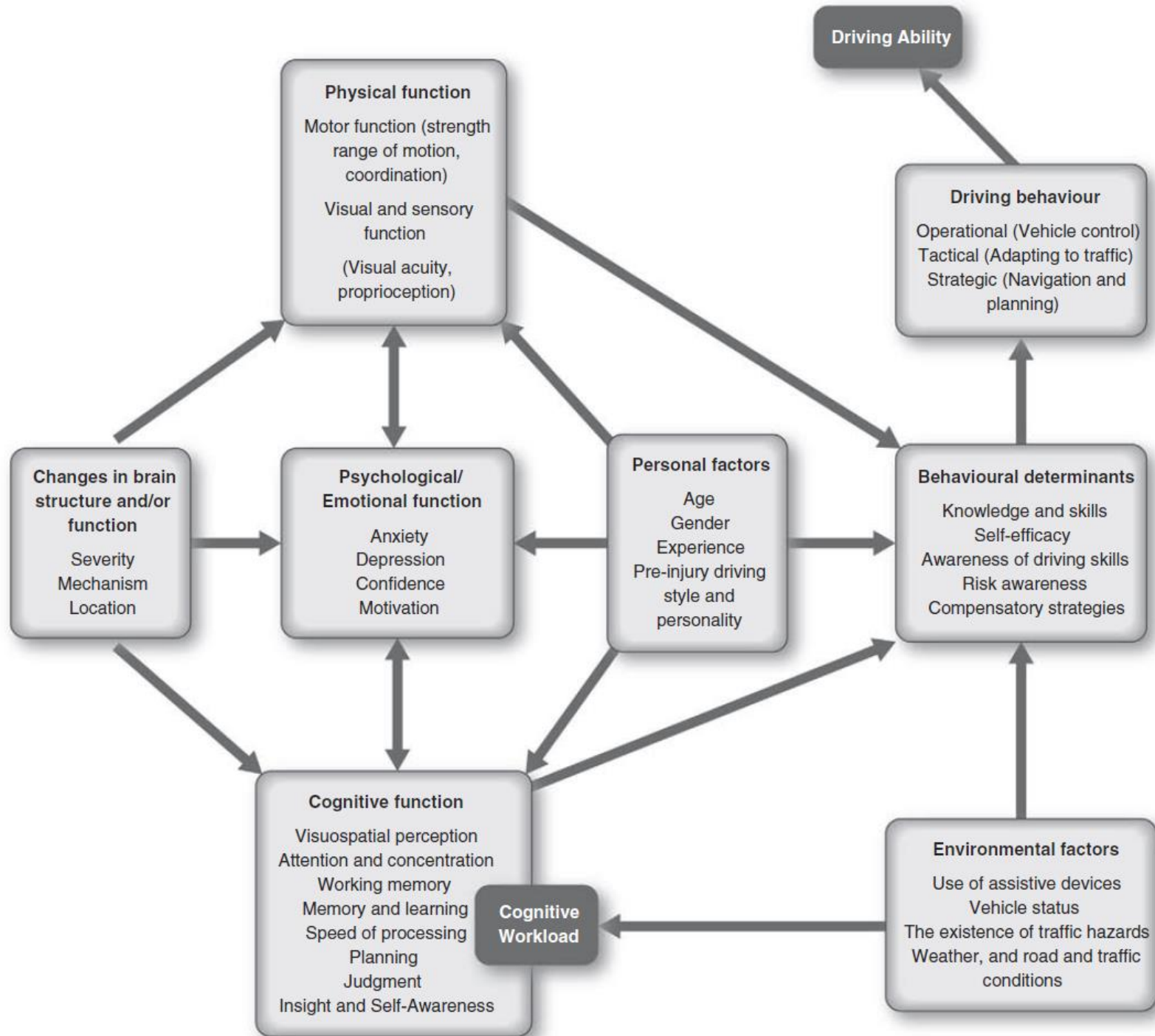
- Age, sex, education, and marital status



# What do you consider when determining driver competency?

- ▶ It's confusing:
  - ▶ Clinicians aren't always aware of laws and potential legal issues around driving
  - ▶ Inconsistent advice
  - ▶ Terminology difference in licensing authorities and clinicians





# Start with early education and goal setting about RTD

Driving is not  
a goal

Provide support  
and  
recommendation  
to aid  
community  
mobility

Driving is a  
goal

Educate patient  
and family about  
timing and need  
for assessment



# Then determine when and if an assessment is needed to RTD

No need for assessment

Recommend return to drive

Need for assessment; not ready

Support and address any relevant concerns

Review as appropriate

Assessment is needed; ready

Proceed to clinical and medical assessment



# If assessment is needed:

## Medical standard: not met

- Suspend from driving
- Provide support to help with community mobility
- Consider future reassessment

## Medical standard: met

- Proceed to driving assessment





# Comprehensive Driving Evaluation: clinic and on-road based assessment

- “gold standard” for driver evaluation:
  - Checks both tactical and operational aspects
- Includes both off and on-road assessment
- Driver rehabilitation specialists in US through the Association for Driver Rehabilitation Specialists



# If needed, undergo a comprehensive driver evaluation:

## Pass

- Return to drive

## Pass with conditions

- Return to drive with restrictions

## Unsafe; potential to improve

- Driver rehabilitation
- Reassessment

## Unsafe

- Suspension from driving
- Provision of support for community mobility
- Consider reassessment



# Driver Rehabilitation

- Off-road training programs:
  - Target specific skills (attention, speed of information processing, or perception)
- Self-regulatory practices and strategies
- Driving lessons
- Train and use of vehicle modifications or devices



# Discuss alternative modes of transportation

- Family support
- Public transport
- Private transport options (taxi, rideshare)
- Community service vehicles
- Volunteers
- Formal disability support agencies



# CASES



TBI-BH ECHO

# Case #1 - Patient Information

1. Patient year of birth: 1970
2. Patient gender: Male
3. Who is part of the patient's support network: daughter
4. Patient housing status: living alone in an apartment
5. Patient employment status: unemployed since injury. Injured while working on a ship
6. Highest level of education: associates degree
7. Current level of functioning: independent with mobility, activities of daily living
8. Pre-injury level of functioning: independent



# Case #1 - TBI History

1. What are the patient's current symptoms? - left eye blindness due to traumatic optic nerve injury
2. Date of injury - 2007
3. Mechanism of injury - object fell on his head while working on a ship and then landed backwards
4. Loss of Consciousness? - yes. Unresponsive and not consistently following commands for almost 1 month
5. Glasgow Coma Scale at Presentation - 3t
6. Severity classification of Injury - severe
7. Duration of post-traumatic amnesia -no recollection for months after his injury
8. What were the initial treatments received after injury? Admitted to trauma hospital and underwent multiple surgeries



# Case #1 - TBI History

9. Did the patient receive acute inpatient rehabilitation? - yes

10. Does the patient have seizures? - no

11. Did the patient require surgical management as part of TBI treatment? - yes

12. Previous head injuries (are there any lingering symptoms)? None

If past symptoms resolved, what is the estimated duration of symptoms: n/a





# Case #1 - TBI History

13. Current/past medical diagnoses/problems:  
cognitive deficit with apathy, depression, and  
executive dysfunction

14. Current medications

Modafinil, fluoxetine, and other medications for  
hypertension



# Case #1 - Past Psychiatric History

1. Please provide the patient's mental health hx: none prior to injury
2. Prior psychiatric medication trials: none prior to injury
3. Prior psychiatric admissions: no
4. Family psychiatric history: none
5. Please describe family psychiatric history: n/a



# Case #1 - Substance Use History

1. Please provide the patient's substance use history
  - None
2. When was the last time the patient used any substances?
  - Not applicable



# Case #1 - Lab and Rating Scale Values

1. Please enter value and date for any results you may have.
2. PHQ-9: not available
3. GAD-7: not available



# Case #2 - Patient Information

1. Patient year of birth: 1975
2. Patient gender: Male
3. Who is part of the patient's support network: sister
4. Patient housing status: living alone in an apartment
5. Patient employment status: construction prior to injury; working on returning to work
6. Highest level of education: high school graduate
7. Current level of functioning: independent with mobility, ADLs. Supervision for iADLs from sister (medical appointments and bills - she is double checking for errors which aren't any)
8. Pre-injury level of functioning: independent



# Case #2 - TBI History

1. What are the patient's current symptoms? - cognitive deficit noted on exam; impulsivity
2. Date of injury - 2015
3. Mechanism of injury - MVC; high speed single vehicle collision
4. Loss of Consciousness? - yes. Unresponsive and not consistently following commands initially for about 24-48 hours
5. Glasgow Coma Scale at Presentation - 3 then improved to 10 within 24 hours
6. Severity classification of Injury - moderate
7. Duration of post-traumatic amnesia - reports that he is not sure but can remember waking up in the ICUJ
8. What were the initial treatments received after injury? No surgery



# Case #2 - TBI History

9. Did the patient receive acute inpatient rehabilitation? - yes

10. Does the patient have seizures? - no

11. Did the patient require surgical management as part of TBI treatment? - no. But did receive surgical management for arm fracture

12. Previous head injuries (are there any lingering symptoms)? If past symptoms resolved, what is the estimated duration of symptoms: had h/o concussions without prolonged symptoms



# Case #2 - TBI History

## 13. Current/past medical diagnoses/problems:

- patient denies any symptoms or problems
- sister and family noted impulsivity and irritability, though he had these symptoms prior to his injury

## 14. Current medications

None





# Case #2 - Past Psychiatric History

1. Please provide the patient's mental health hx:
  - None. Sister reports he has always been quick to anger.
2. Prior psychiatric medication trials: none
3. Prior psychiatric admissions: no
4. Family psychiatric history:  
Mother: depression and anxiety



# Case #2 - Substance Use History

1. Please provide the patient's substance use history: n/a
2. When was the last time the patient used any substances? n/a



# Case #2 - Lab and Rating Scale Values

1. Please enter value and date for any results you may have.
2. PHQ-9: 0
3. GAD-7: 3



# Thank You



TBI-BH ECHO