Traumatic Brain Injury Recovery in Older Patient Populations at URMC

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Interim Medical Director and Division Chief of Acute Inpatient Rehabilitation at URMC

Brain Injury Rehabilitation Medicine

MEDICINE *of* THE HIGHEST ORDER

UNIVERSITY *of* ROCHESTER MEDICAL CENTER

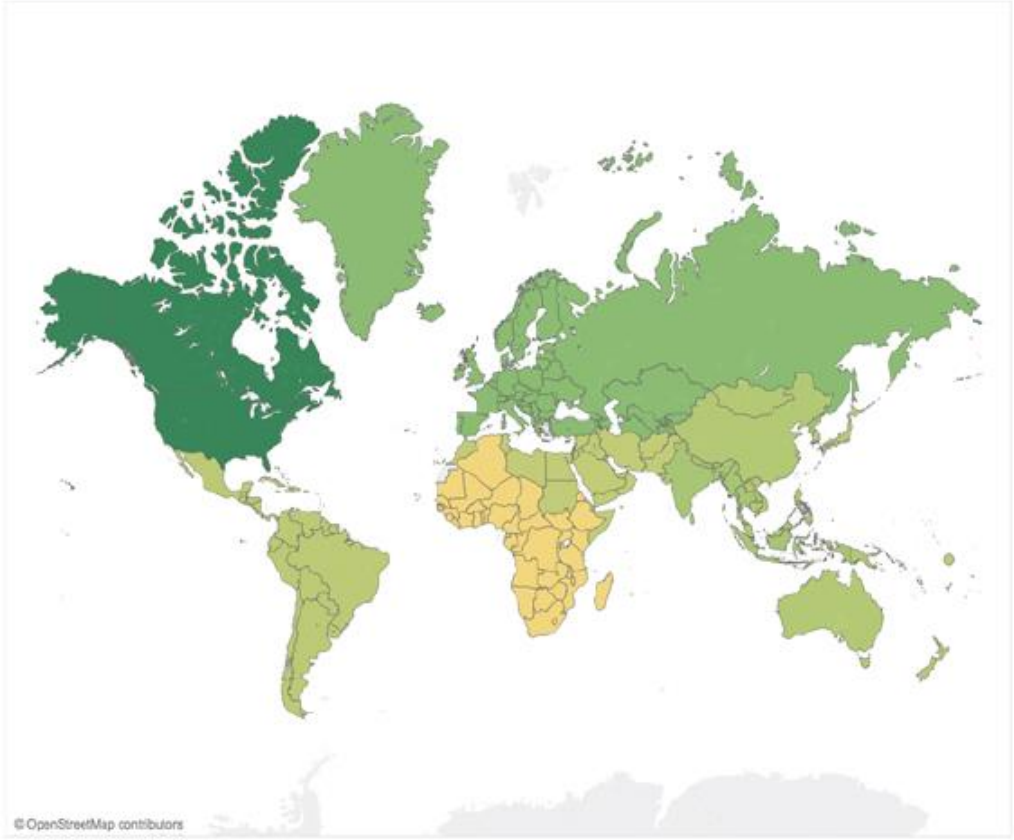
Suggested Resource

https://msktc.org/tbi/factsheets

MSKTC
SCI · TBI · BURN

Model Systems
Knowledge Translation
Center

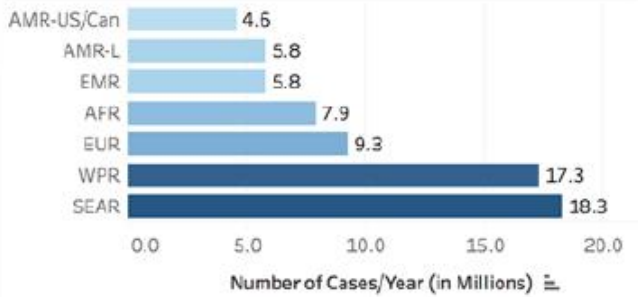
Incidence of **Traumatic Brain Injury** by WHO Region



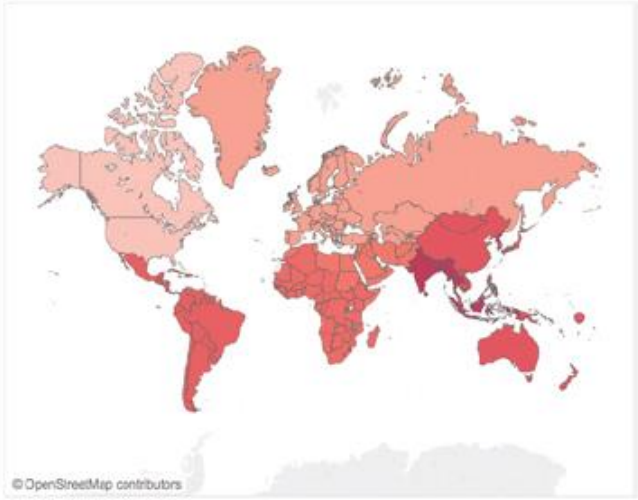
Annual Incidence (per 100,000 people)

800 — 1,300

Worldwide **TBI Burden**



Incidence of TBI from **Road Traffic Collisions**



Annual Incidence (per 100,000 people)

320.0 — 530.0

Dewan MC Park KB 2019

Outline

Disorders of Consciousness

Agitation Management (behavioral and pharmacological)

Neuro-Stimulant Medication Use

Acute Inpatient Rehabilitation at URMC

New brain injury rehabilitation unit 6-1200

What is Consciousness?

How do you know it's there?

CONSCIOUSNESS =

AROUSAL
+
AWARENESS

Coma: "Unarousable Unresponsiveness"

Hallmarks:

- Absence of spontaneous eye opening
- Absence of sleep-wake cycles

Spontaneous or stimulus-induced eye opening often reemerges, which marks the transition to…

~~Vegetative State (VS),~~ "Unresponsive Wakefulness Syndrome"

Three criteria

1. No evidence of sustained, reproducible, purposeful, or voluntary behavioral responses to visual, auditory, tactile, or noxious stimuli
2. No evidence of language comprehension or expression
3. Intermittent wakefulness manifested by presence of sleep/wake cycles (i.e., period eye opening)

Usually return to spontaneous or elicited movement, but it is always nonpurposeful/reflexive, generally don't visually track

- Includes vocalizations/facial expression

A note about "~~Permanent/Persistent"~~ ***CHRONIC***

Minimally Conscious State
"Minimally Responsive State"

Clear and reproducible evidence of:

1. Tracking (-)
2. Simple command following (+)
3. Yes/No responses (gestural or verbal) (+)
4. Intelligible verbalization (+)
5. Movements or affect that occur contingent to stimuli, not reflex
    - Laughing at a joke
    - Reaching for a call light
    - Visual tracking/fixation to salient stimuli

"Emerged from the minimally conscious state"

- Communication is consistent
- Purposeful use of at least 2 objects

Disorders of consciousness are due to failure of the arousal system

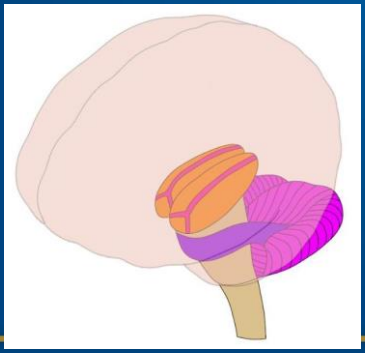
Reticular Formation:

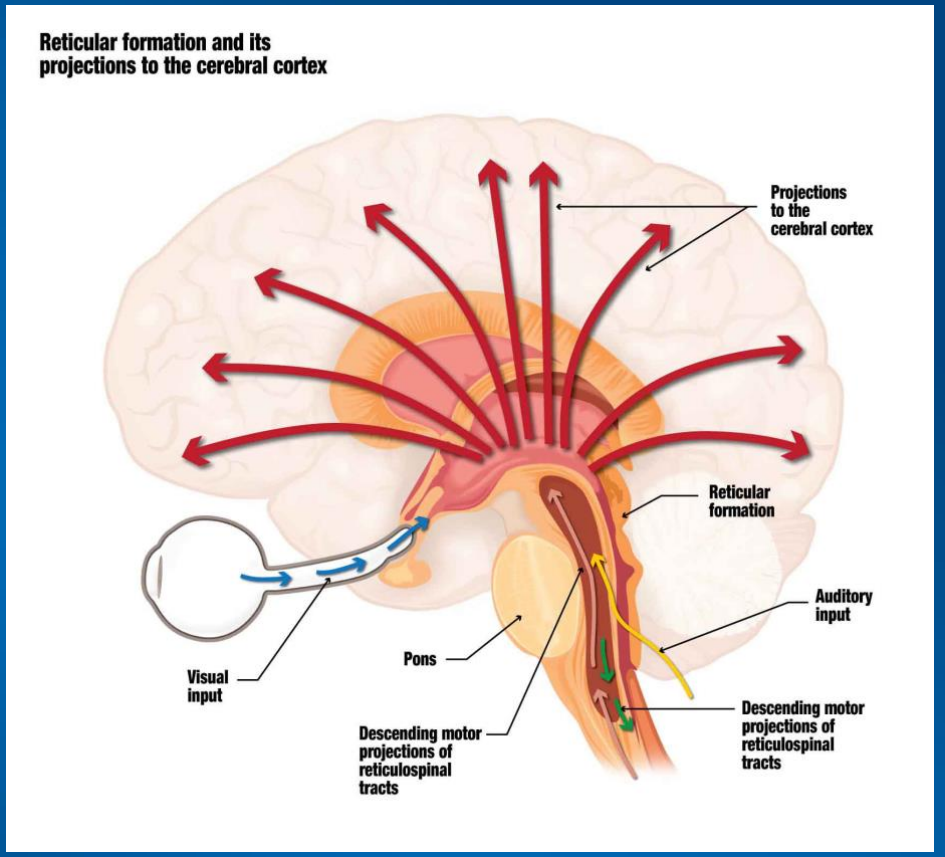
-Diffuse group on neurons within medulla and pons

-Project up to thalamus/hypothalamus/cortex, and down to spinal cord

-General awareness of movement/sensory info and arousal

-Regulation of breathing and HR





Potential Problems in the standard hospital setting

1. Attributing purposeful intent for responses that are reflexive or generalized to any form of stimulation
2. Inadequate evaluation to detect conscious behavior
    1. i.e. insufficient sampling time, **inadequate arousal**, inappropriate choice of stimuli
    2. Over/under consideration of family or other's observations of purposeful behavior
    3. Video record everything!!

High Incidence of diagnostic error

In the standard hospital setting, we're often wrong:

37% Childs et al. Neurology 1993
43% Andrews et al. BMJ 1996
41% BMC Neurology

41%

UWS or MCS?

Conscious or Unconscious?

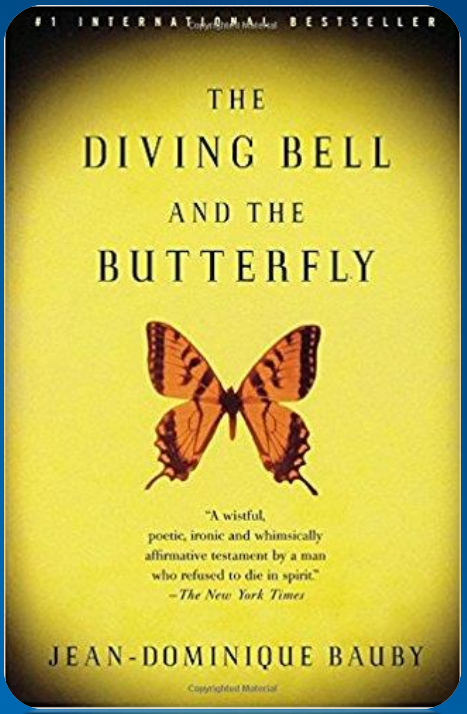
What's NOT a DOC?

Locked-in Syndrome

Posttraumatic Confusional State

- Posttraumatic Amnesia (PTA)

Brain death



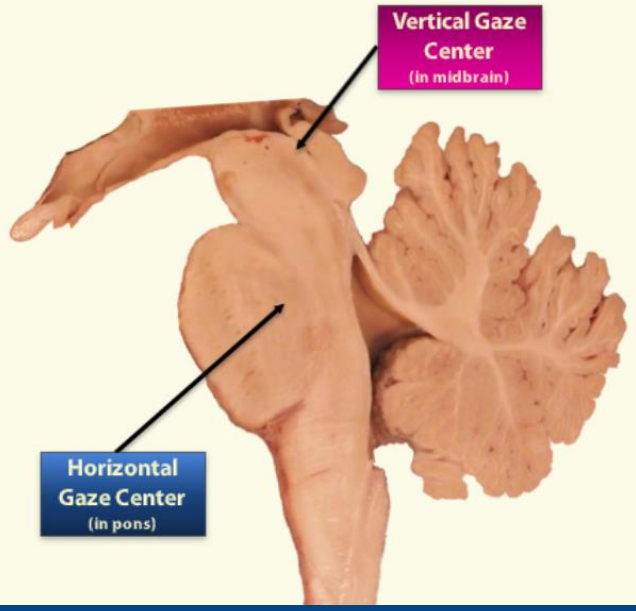
GAZE CENTERS IN PONS AND MIDBRAIN

Horizontal and Vertical Gaze

Gaze can occur in a horizontal plane (look left or right) or in a vertical plane (look up or down).

Coordinated horizontal and vertical movement of both eyes is facilitated by gaze centers in the brainstem:

- The vertical gaze center is located in the *midbrain*, specifically the midbrain reticular formation and pretectal area.
- The horizontal gaze center is located in the *pons*, specifically in the paramedian pontine reticular formation (PPRF).



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2018 AAN-ACRM-NIDILRR Practice Guideline: Disorders of Consciousness

Recommendation 2a

- Clinicians should ***use standardized neurobehavioral assessment measures*** that have been shown to be valid and reliable (such as those recommended by the ACRM) to improve diagnostic accuracy for the purpose intended (**Level B** based on importance of outcomes and feasibility).

Giacino JT Barbano R Armstrong MJ et al 2018

Coma Recovery Scale- Revised

JFK COMA RECOVERY SCALE - REVISED ©2004

Record Form

This form should only be used in association with the "CRS-R ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.

Patient:	Diagnosis:	Etiology:
Date of Onset:	Date of Admission:	

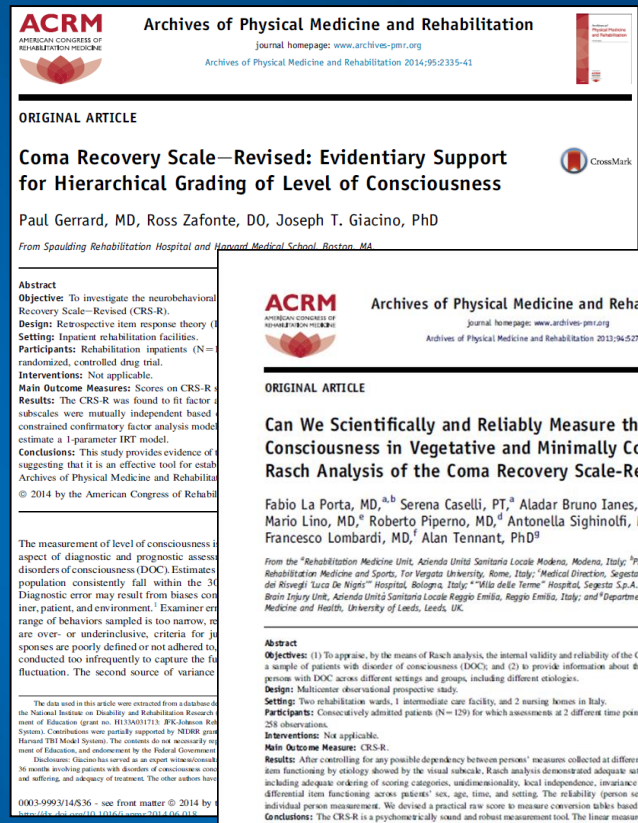
	Date														
	Week	ADM	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AUDITORY FUNCTION SCALE																	
4 - Consistent Movement to Command *																	
3 - Reproducible Movement to Command *																	
2 - Localization to Sound																	
1 - Auditory Startle																	
0 - None																	
VISUAL FUNCTION SCALE																	
5 - Object Recognition *																	
4 - Object Localization: Reaching *																	
3 - Visual Pursuit *																	
2 - Fixation *																	
1 - Visual Startle																	
0 - None																	
MOTOR FUNCTION SCALE																	
6 - Functional Object Use †																	
5 - Automatic Motor Response *																	
4 - Object Manipulation *																	
3 - Localization to Noxious Stimulation *																	
2 - Flexion Withdrawal																	
1 - Abnormal Posturing																	
0 - None/Flaccid																	
OROMOTOR/VERBAL FUNCTION SCALE																	
3 - Intelligible Verbalization *																	
2 - Vocalization/Oral Movement																	
1 - Oral Reflexive Movement																	
0 - None																	
COMMUNICATION SCALE																	
2 - Functional: Accurate †																	
1 - Non-Functional: Intentional *																	
0 - None																	
AROUSAL SCALE																	
3 - Attention																	
2 - Eye Opening w/o Stimulation																	
1 - Eye Opening with Stimulation																	
0 - Unarousable																	
TOTAL SCORE																	

Denotes emergence from MCS†

Denotes MCS *

1

(Giacino, Kalmar, Whyte, Arch Phys Med Rehabil, 2004)



ACRM

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2014;95:2335-41

ORIGINAL ARTICLE

Coma Recovery Scale—Revised: Evidentiary Support for Hierarchical Grading of Level of Consciousness

Paul Gerrard, MD, Ross Zafonte, DO, Joseph T. Giacino, PhD

From Spaulding Rehabilitation Hospital and Harvard Medical School, Boston, MA

ACRM

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2013;94:527-35

ORIGINAL ARTICLE

Can We Scientifically and Reliably Measure the Level of Consciousness in Vegetative and Minimally Conscious States? Rasch Analysis of the Coma Recovery Scale-Revised

Fabio La Porta, MD,[a,b] Serena Caselli, PT,[a] Aladar Bruno Ianes, MD,[c] Olivia Cameli, MD,[d] Mario Lino, MD,[e] Roberto Piperno, MD,[d] Antonella Sighinolfi, MD,[e] Francesco Lombardi, MD,[f] Alan Tennant, PhD[g]

From the [a]Rehabilitation Medicine Unit, Azienda Unità Sanitaria Locale Modena, Modena, Italy; [b]PhD School in Advanced Sciences in Rehabilitation Medicine and Sports, Tor Vergata University, Rome, Italy; [c]Medical Direction, Segesta SpA, Korian Group, Milan, Italy; [d]"Casa dei Risvegli 'Luca De Nigris'" Hospital, Bologna, Italy; [e]"Villa delle Terme" Hospital, Segesta S.p.A., Korian Group, Florence, Italy; [f]Severe Brain Injury Unit, Azienda Unità Sanitaria Locale Reggio Emilia, Reggio Emilia, Italy; and [g]Department of Rehabilitation Medicine, Faculty of Medicine and Health, University of Leeds, Leeds, UK.

Abstract

Objectives: (1) To appraise, by the means of Rasch analysis, the internal validity and reliability of the Coma Recovery Scale-Revised (CRS-R) in a sample of patients with disorder of consciousness (DOC); and (2) to provide information about the comparability of CRS-R scores across persons with DOC across different settings and groups, including different etiologies.

Design: Multicenter observational prospective study.

Setting: Two rehabilitation wards, 1 intermediate care facility, and 2 nursing homes in Italy.

Participants: Consecutively admitted patients (N=129) for which assessments at 2 different time points were available, giving a total sample of 258 observations.

Interventions: Not applicable.

Main Outcome Measure: CRS-R.

Results: After controlling for any possible dependency between persons' measures collected at different time points, and for uniform differential item functioning by etiology showed by the visual subscale, Rasch analysis demonstrated adequate satisfaction of all the model's requirements, including adequate ordering of scoring categories, unidimensionality, local independence, invariance ($\chi^2_{21}=27.798$, $P=.146$), and absence of differential item functioning across patients' sex, age, time, and setting. The reliability (person separation index=.896) was adequate for individual person measurement. We devised a practical raw score to measure conversion tables based on the CRS-R calibrations.

Conclusions: The CRS-R is a psychometrically sound and robust measurement tool. The linear measures of ability derived from the CRS-R total scores do satisfy all the principles of scientific measurement and are sufficiently reliable for high stakes assessments, such as the diagnosis of the level of consciousness in individual patients. Future studies are needed to directly explore the capabilities of the CRS-R measures to reduce the risk of vegetative state misdiagnosis.

Archives of Physical Medicine and Rehabilitation 2013;94:527-35

The Coma Recovery Scale-Revised (CRS-R) was proposed by Giacino et al[1] as a bedside standardized neurobehavioral assessment tool incorporating the current diagnostic criteria for vegetative state (VS), minimally conscious state (MCS), and emergence from the MCS.[2] It consists of 29 hierarchically organized items grouped into 6 subscales addressing auditory, visual, motor, oromotor/verbal,

0003-9993/13/$36 - see front matter © 2013 by the American Congress of Rehabilitation Medicine
http://dx.doi.org/10.1016/j.apmr.2012.09.035

MELIORA

ROCHESTER MEDICAL CENTER

AAN-ACRM-NIDILRR PRACTICE GUIDELINE: DISORDERS OF CONSCIOUSNESS

Recommendation Statement 2c

- Clinicians should ***attempt to increase arousal*** before performing evaluations to assess level of consciousness anytime diminished arousal is observed or suspected (**Level B** based on importance of outcomes).

Giacino JT Barbano R Armstrong MJ et al 2018

Conduct serial examinations

TABLE 1. Misdiagnosis Rates of Patients After *n* CRS-R Assessments as Compared to the Reference Diagnosis

No. of CRS-R Assessments Used for Comparison With Reference Diagnosis	Misdiagnosis (reference diagnosis based on six CRS-R assessments, n = 123)	Effect Size (r = Z/sqrt(2n))	Misdiagnosis (reference diagnosis based on seven CRS-R assessments, n = 58)	Effect Size (r = Z/sqrt(2n))
One assessment	44 (36%) Z = 5.78***	0.37	28 (48%) Z = 4.62***	0.43
Two assessments	30 (24%) Z = 4.78***	0.30	20 (34%) Z = 3.92***	0.36
Three assessments	21 (17%) Z = 4.01***	0.26	15 (26%) Z = 3.41**	0.32
Four assessments	11 (9%) Z = 2.93*	0.19	10 (17%) Z = 2.80*	0.26
Five assessments	6 (5%) Z = 2.2; n.s.	0.14	6 (10%) Z = 2.2; n.s.	0.10
Six assessments	N/A	N/A	2 (3%) Z = 1.34; n.s.	0.03

***Corrected $p < 0.0005$; **corrected $p < 0.005$; *corrected $p < 0.05$; n.s. = not significant.
CRS-R = Coma Recovery Scale-Revised; N/A = not applicable.

(Wannez et al, Annals Neurol, 2017)

JAMA Neurology | Original Investigation

Recovery of Consciousness and Functional Outcome in Moderate and Severe Traumatic Brain Injury

Robert G. Kowalski, MBBCh, MS; Flora M. Hammond, MD; Alan H. Weintraub, MD; Risa Nakase-Richardson, PhD; Ross D. Zafonte, DO; John Whyte, MD, PhD; Joseph T. Giacino, PhD

17,470 patients with TBI analyzed in this study.

- 7547 (57%) experienced initial loss of consciousness,
  - which persisted to rehabilitation in 2058 patients (12%).
  - 82% percent (n = 1674) of comatose patients recovered consciousness during inpatient rehabilitation.
  - 40% became partially or fully independent.

10 years

Prognostic Factors for Recovery from Moderate-Severe TBI

Positives

- Eyes open within 72 hours
- Age < 65 y/o (or < 55 y/o)

Severe Disability is Unlikely If:

- Post-Traumatic Amnesia < 2 months
- Can follow commands within 2 weeks

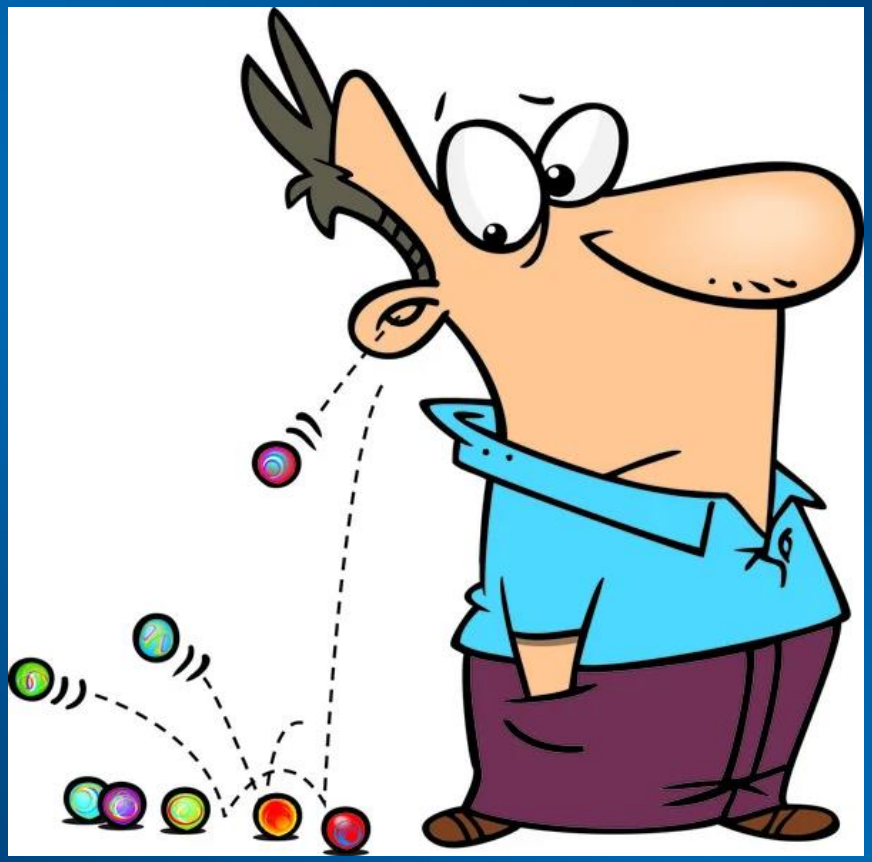
Negatives

- Other significant medical comorbidities
- Bilateral brainstem injuries

Good Recovery is Unlikely If:

- Post-Trauamtic Amnesia > 3 months
- Unable to follow commands within 4 weeks

Functional Reserve



Cognitive Problems: Delerium, Dementia, or Post-traumatic Amnesia?

Delirium: acute, transient, disturbed state of mind or consciousness

Can be associated with toxic/metabolic causes or environmental causes

Dementia: progressive or persistent loss of intellectual functioning, especially with impairments of memory and abstract thinking, and often with personality changes, resulting from organic disease of the brain

Post-traumatic amnesia (post-traumatic confusional state): transient state of confusion, disorientation, and memory loss that occurs immediately following a TBI

Rancho Los Amigos Level of Cognitive Functioning Scale

I. No Response (Comatose)

II. Generalized Response (Vegetative State)

III. Localized Response (Minimally Conscious State)

IV. Confused, *Agitated* Response

V. Confused, Inappropriate, Nonagitated Response

VI. Confused, Appropriate Response

VII. Automatic, Appropriate Response

VIII. Purposeful, Appropriate Response

ANGER, AGGRESSION, AND AGITATION

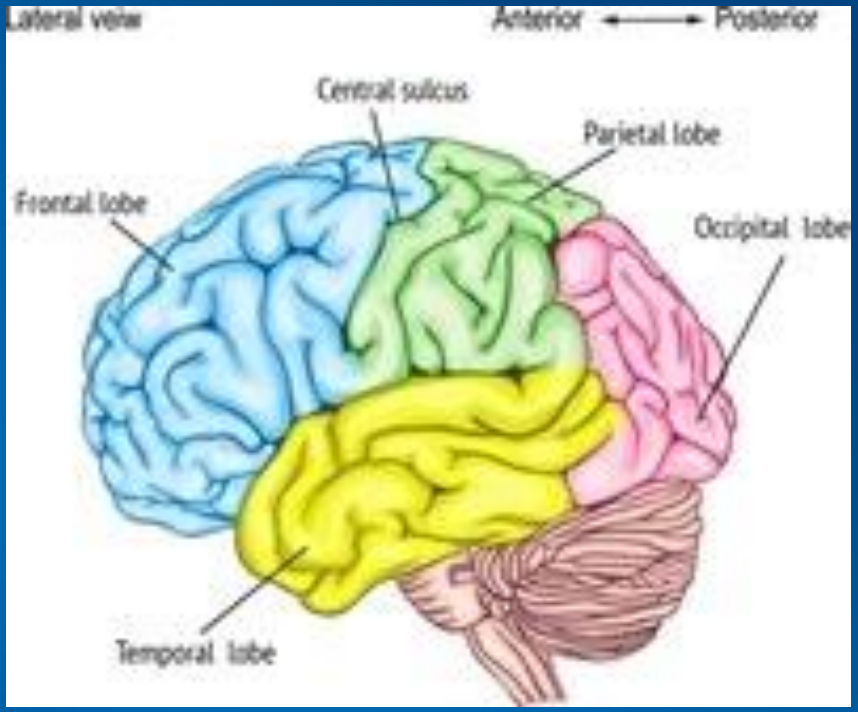

Chinese water torture?

Changes in Emotion after TBI

Attention and Concentration deficit

Memory problems due to organic brain damage

Executive function deficit

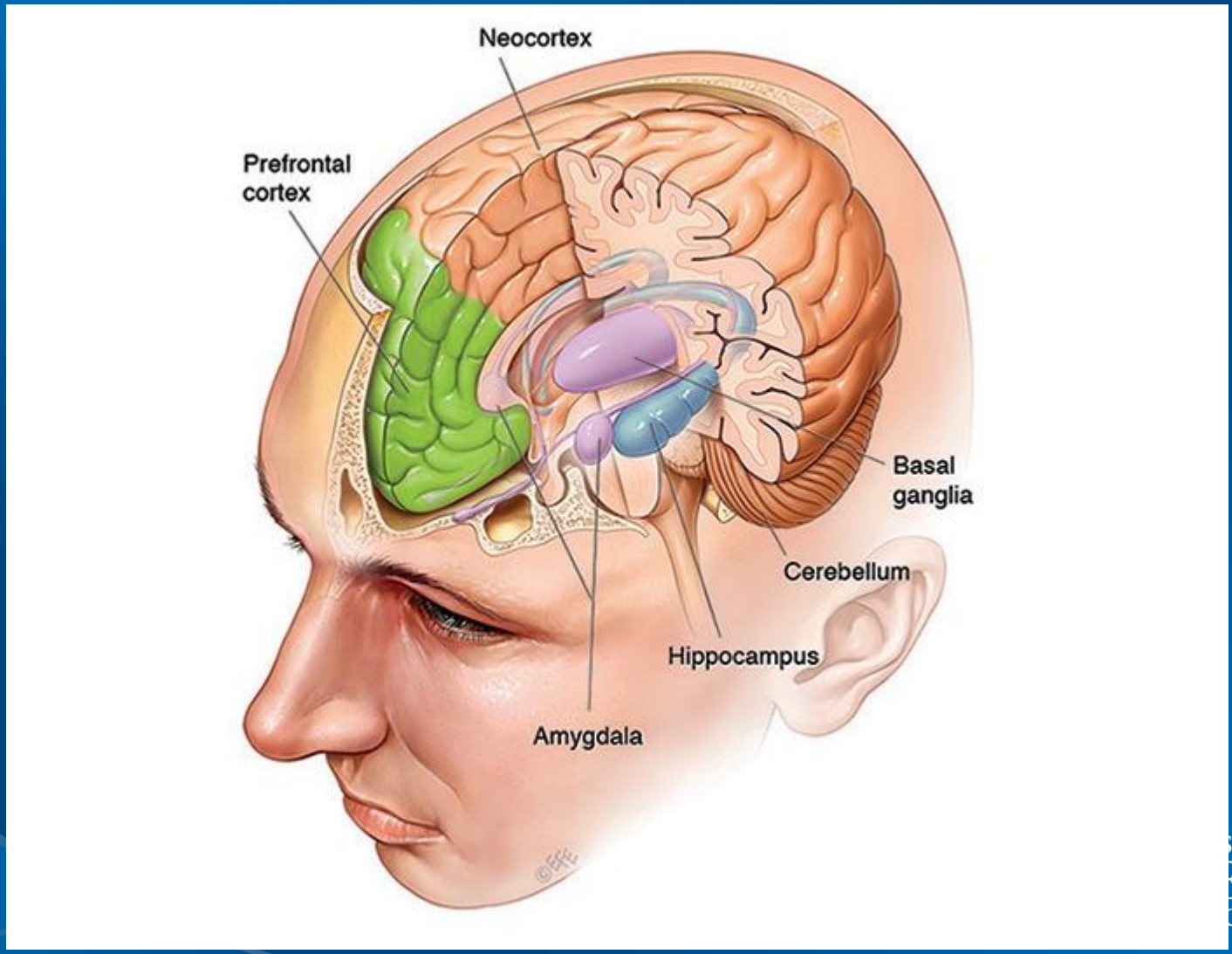


When Agitation Occurs, what is the 1st Thing to Do?

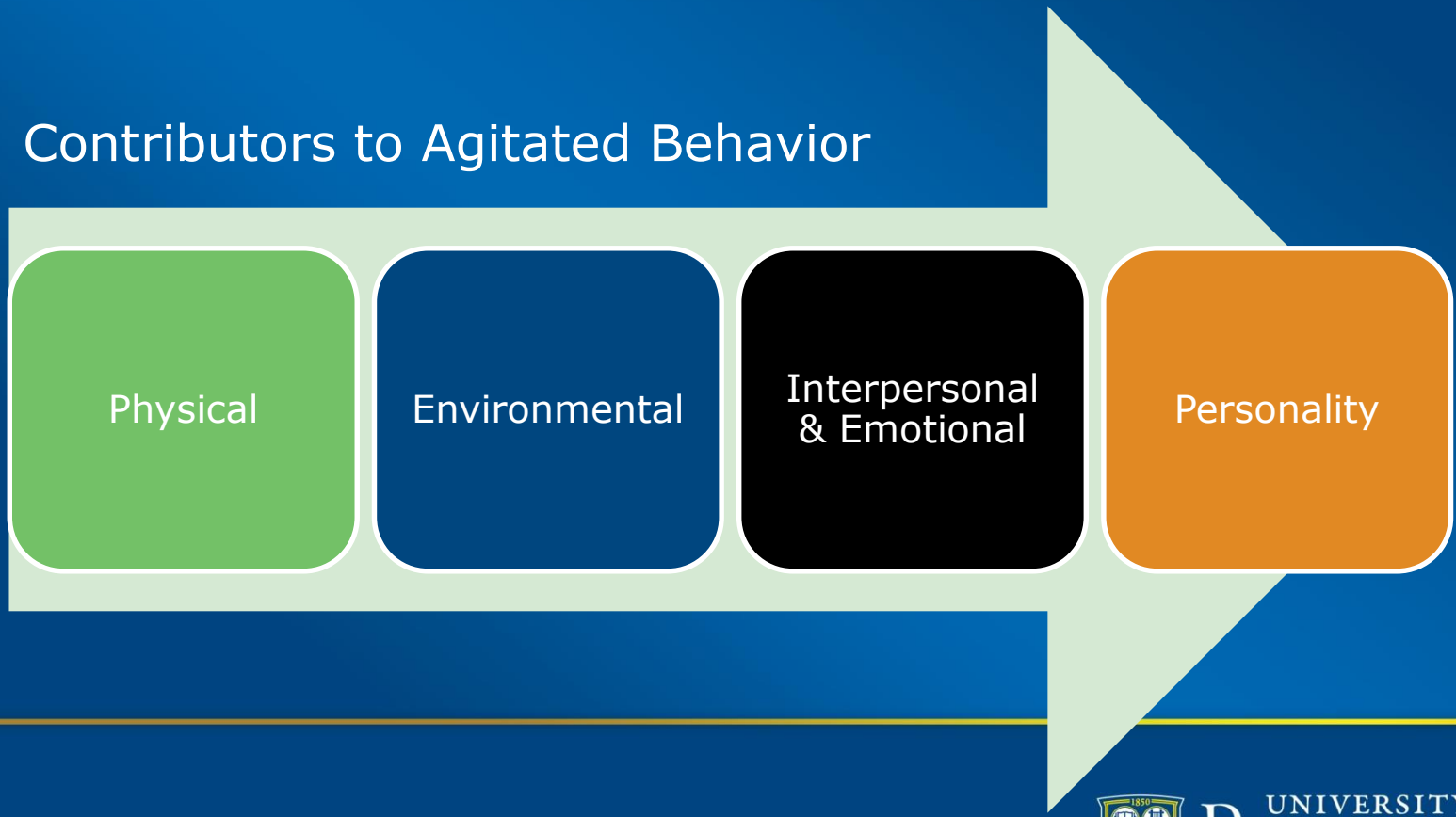
Determine the CAUSE.

True or False: Patients who are still in PTA will not remember anything.

False! Emotions!!!

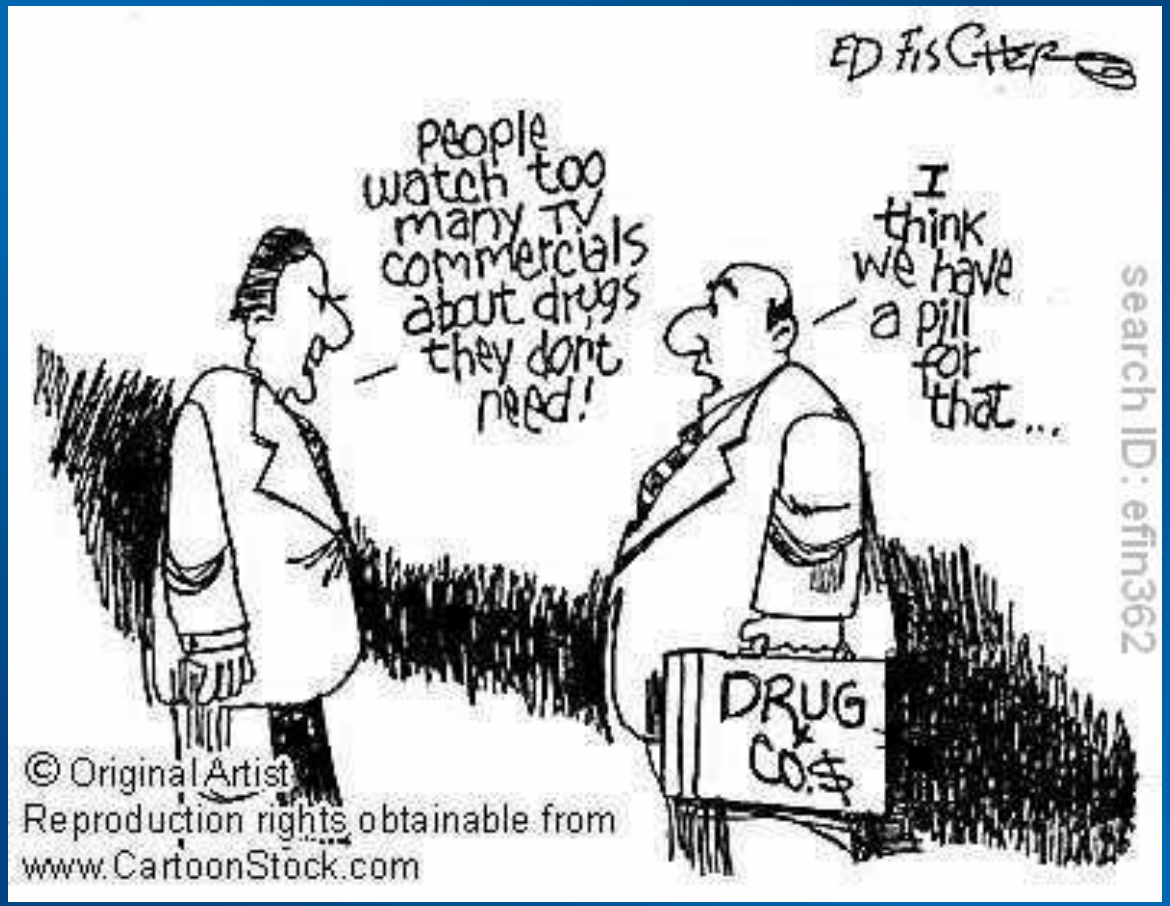


"The patient needs a behavior plan!"



Behavioral Interventions are Hard!

But Behavioral Interventions Often Lead to Better Outcomes



Characterizing agitation

Confused / Reactive	Angry / Aggressive	Emotional / Arousal
Impulsive, impatient	Uncooperative, demanding	Fearful, panicky
Short attention, easily distractible	Violent, threatening	Autonomic activation
Rocking, rubbing, self-stimulating	Self-abusiveness	Jittery, hyper-vigilant
Pulling at tubes, restraints, etc.	Explosive outbursts	Emotionally labile

Common Causes of Agitation

24-hour sleep/wake cycle disruption

Constipation

Urinary Retention

Irritating tubes/lines

Feeling hot

Un-met expectations

Care transitions

Too many visitors / too much external stimulation

The Importance of Sleep: ACGME Duty Hours Addressed Concerns of Resident Exhaustion

"What is the difference between a physician who is intoxicated and one who has not slept in 24 hours? The answer: not much.

In a landmark study, Williamson and Feyer (2000) compared volunteers who were sleep deprived and those who were intoxicated. They found that a person who has stayed awake for 24 hours functions with the same diminished cognitive skill of someone with a blood alcohol level of 0.10. This study — and many others — reveal the dangers of sleep deprivation and prolonged duty hours."

https://knowledgeplus.nejm.org/blog/acgme-duty-hours-not-the-only-big-change-in-requirements/

Common Causes of Agitation

24-hour sleep/wake cycle disorder

Constipation

Urinary Retention

Question: What are common side effects from immobility, neurologic injury, and/or opioid medications?

Urinary retention and constipation

Objective Measurement: Agitated Behavior Scale

AGITATED BEHAVIOR SCALE

Patient _____ Period of Observation:

Observ. Environ._____ From:_____ a.m. p.m._____/_____/_____

Rater/Disc._____ To:_____ a.m. p.m._____/_____/_____

At the end of the observation period indicate whether the behavior described in each item was present and, if so, to what degree: slight, moderate or extreme. Use the following numerical values and criteria for your ratings.

1 = **absent**: the behavior is not present.
2 = **present to a slight degree**: the behavior is present but does not prevent the conduct of other, contextually appropriate behavior. (The individual may redirect spontaneously, or the continuation of the agitated behavior does not disrupt appropriate behavior.)
3 = **present to a moderate degree**: the individual needs to be redirected from an agitated to an appropriate behavior, but benefits from such cueing.
4 = **present to an extreme degree**: the individual is not able to engage in appropriate behavior due to the interference of the agitated behavior, even when external cueing or redirection is provided.

DO NOT LEAVE BLANKS.

_____ 1. Short attention span, easy distractibility, inability to concentrate.
_____ 2. Impulsive, impatient, low tolerance for pain or frustration.
_____ 3. Uncooperative, resistant to care, demanding.
_____ 4. Violent and or threatening violence toward people or property.
_____ 5. Explosive and/or unpredictable anger.
_____ 6. Rocking, rubbing, moaning or other self-stimulating behavior.
_____ 7. Pulling at tubes, restraints, etc.
_____ 8. Wandering from treatment areas.
_____ 9. Restlessness, pacing, excessive movement.
_____ 10. Repetitive behaviors, motor and/or verbal.
_____ 11. Rapid, loud or excessive talking.
_____ 12. Sudden changes of mood.
_____ 13. Easily initiated or excessive crying and/or laughter.
_____ 14. Self-abusiveness, physical and/or verbal.

_____ Total Score

Score	Interpretation
<21	WNL
22-28	Mild
29-35	Moderate
>35	Severe

Tracking ABS Data

Lowest scores were while patients are in therapies (8am - 3:30pm)

- Does well with structured tasks

Highest scores were in the 3-5pm window

- Patient insistent on leaving unit, “arguing”
  - I worked a 3-11 shift last night.
  - I need to pickup my paycheck.
  - I’m done for today.

Self-Preparation

Posture: Hands visible, knees bent slightly, stand to side

Attitude: Calm, Relaxed

- "I can help"

Eye contact: Not excessive

Tone of voice: Calm, genuine.

- Like a Kindergarten teacher!

Touch: Don't touch the patient unless you have a strong rapport in that moment/permission

- Offer a handshake with an introduction and smile

Let go of your own agenda!!

Redirection / Distraction Techniques

Change topic of conversation abruptly

Explore alternative (low stimulating) activities

- Wheel/walk with the person around the room or in the hallways
- Offer food
- Offer recreational activity

Offer incentive to correct problem

- e.g., "Let's head to the kitchen (or cafeteria) and get a snack."

Recruit the help of your colleagues nearby

- "Have you met Dr. X yet?"

When to Intervene

What is the patient doing?

- Is the patient's behavior **unsafe** towards themselves or others?

OR

- Is the patient's behavior **unusual** for the setting?

Safety!

NOT Like the Movies

Emergence from Disorder of Consciousness

Emergence from Post Traumatic Amnesia

Medications for Agitation

If treating the underlying cause doesn't work:

1. Trazodone, quetiapine, mirtazapine, hydroxyzine
2. Olanzapine >>> haloperidol
3. ~~Diazepam~~

To prevent agitation from occurring:

1. Propranolol
2. Divalproex (valproic acid)
3. Lamotrigine

Neuro-Stimulants, Will They Help?

Maybe

Depends on the ***reason*** for the agitation

Sometimes, stimulating medications exacerbate the situation

Neurostimulants, When to Consider

- Arousal
- Awareness
- Concentration/Attention
- Memory
- Impulsivity

Clinically…

1. Address sleep

Wean all daytime sedating medications as tolerated.

"Wean opioids and benzos first."

Minimize nighttime interruptions.

2. Are there cognitive deficits, and are they interfering with *function*? i.e. therapy participation

Neurostimulants in Brain Injury Rehabilitation

The NEW ENGLAND JOURNAL of MEDICINE

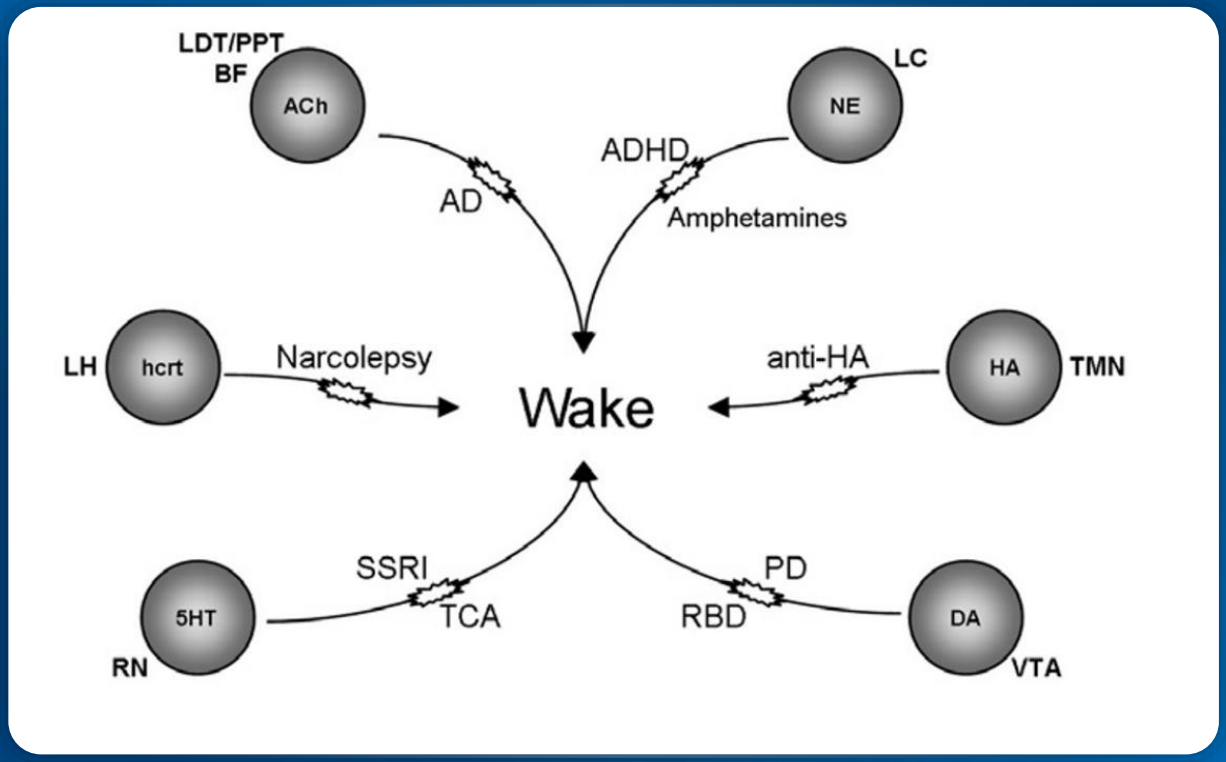
ORIGINAL ARTICLE

Placebo-Controlled Trial of Amantadine for Severe Traumatic Brain Injury

Joseph T. Giacino, Ph.D., John Whyte, M.D., Ph.D., Emilia Bagiella, Ph.D., Kathleen Kalmar, Ph.D., Nancy Childs, M.D., Allen Khademi, M.D., Bernd Eifert, M.D., David Long, M.D., Douglas I. Katz, M.D., Sooja Cho, M.D., Stuart A. Yablon, M.D., Marianne Luther, M.D., Flora M. Hammond, M.D., Annette Nordenbo, M.D., Paul Novak, O.T.R., Walt Mercer, Ph.D., Petra Maurer-Karattup, Dr.Rer.Nat., and Mark Sherer, Ph.D.

2012: N = 184, 11 clinical sites

Neurotransmitters Involved in Wakefulness



- Norepinephrine (NE)
- Histamine (HA)
- Dopamine (DA)
- Serotonin (5HT)
- Hypocretin (hcrt)
- Acetylcholine (Ach)

JM Zeitzer. "Control of Sleep and Wakefulness in Health and Disease" 2013 Progress in Molecular Biology and Translational Science, Vol 119 Ch 6.

Amantadine Did Not Positively Impact Cognition in *Chronic* Traumatic Brain Injury

N = 119

		Raw scores				Linear model[a]		
Outcome measure	*Day*	*Placebo*	*Treatment*	*Difference*	*Change from baseline*	*Model-adjusted change*	*Sig.*	*95% CI*
Rey (T)	0	34.5	37.7	3.16				
	28	41.7	41.1	–0.58	–3.74	–3.62	0.045	(–7.16, –0.08)
	60	43.5	46.9	3.45	0.29	–0.46	0.801	(–4.05, 3.13)
Short Delay Free (Z)	0	–1.43	–1.32	0.11				
	28	–0.94	–1.01	–0.07	–0.18	–0.21	0.231	(–0.55, 0.13)
	60	-0.77	–0.6				.720	(–0.41, 0.29)
Short Delay Cued (Z)		–1.43	–1.3					
			–1.01				0.154	(–0.58, 0.09)
Overall Composite (GCI)					52.7		5.37	
						–1.39	-6.76	–6.24 **0.002** (–10.14, –2.34)
							–1.79	–2.62 0.195 (–6.59, 1.35)
Learning/ Memory Index (LMI)								.001 (–16.32, –4.00)
			60					0.90)
	60	8.95	9.27	0.33				
PSI	0	78.5	83.0	4.53				
	28	83.6	85.9	2.34	–2.19			
	60	84.5	88.8	4.36	–0.17	0.14	0.9	
Trail A (T)	0	36.4	39.8	3.46				
	28	40.3	42.0	1.69	–1.78	–0.85	0.625	(–4.25, 2.56)
	60	41.9	45.0	3.14	–0.32	–0.25	0.888	(–3.71, 3.22)
Trail B (T)	0	37.6	39.5	1.93				
	28	41.4	41.0	–0.35	–2.28	–1.20	0.522	(–4.91, 2.50)
	60	40.1	42.5	2.34	0.41	0.37	0.846	(–3.38, 4.13)
COWAT	0	37.6	36.3	–1.36				
	28	38.8	38.5	–0.26	1.10	1.34	0.251	(–0.95, 3.63)
	60	39.5	39.9	0.42	1.79	2.12	0.074	(–0.21, 4.45)
Overall Composite (GCI)	0	47.3	52.7	5.37				
	28	50.6	49.2	–1.39	-6.76	–6.24	**0.002**	(–10.14, –2.34)
	60	48.3	51.9	3.58	–1.79	–2.62	0.195	(–6.59, 1.35)
Learning/ Memory Index (LMI)	0	46.7	53.4	6.69				
	28	51.5	48.3	–3.20	–9.90	–10.16	**0.001**	(–16.32, –4.00)
	60	48.4	51.9	3.49	–3.20	–5.37	0.093	(–11.63, 0.90)
Attention/ Processing Speed Index (APSI)	0	48.0	52.0	4.04				
	28	49.6	50.2	0.57	–3.46	–2.11	0.250	(–5.71, 1.49)
	60	48.2	51.9	3.67	–0.36	0.26	0.889	(–3.41, 3.93)

Placebo

Amantadine

We Still Don't Know

Hammond FL et al. J of Neurotrauma 2018

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Neurostimulants – Side Effects

Do not take after 2pm.

Do not give amantadine if the patient has renal insufficiency.

Methylphenidate (Ritalin) has been shown to only increase HR by 7-10 bpm on average (Alban JP et al. 2004, Willmott C et al. 2009), but can lower seizure threshold.

Giacino J, et al. 2012 NEJM

Table 2. Adverse Events, According to Treatment Group.*

Adverse Event	Amantadine (N=87)	Placebo (N=97)
	number (percent)	
Seizure	2 (2)	4 (4)
Changes on electroencephalography	1 (1)	0
Nausea	1 (1)	1 (1)
Vomiting	10 (11)	8 (8)
Constipation	2 (2)	3 (3)
Diarrhea	5 (6)	5 (5)
Other gastrointestinal event	4 (5)	11 (11)
Elevated liver-function tests†	3 (3)	3 (3)
Restlessness	7 (8)	9 (9)
Agitation	12 (14)	11 (11)
Insomnia	12 (14)	14 (14)
Involuntary muscle contractions	2 (2)	0
Hypertonia or spasticity	18 (21)	14 (14)
Other motor problems	1 (1)	1 (1)
Rash	5 (6)	6 (6)
Congestive heart failure	0	1 (1)

Acute Inpatient Rehabilitation at URMC

UR MEDICINE

Physical Medicine & Rehabilitation

Care With Skill & Compassion

Appropriate Patients for Acute Inpatient Rehabilitation

1. Have medical complexity that requires daily physician oversight.
2. Have functional needs in at least 2 skilled therapy domains (PT, OT, and SLP).
3. Can tolerate, actively participate, and benefit from being in at least 3 hours of 1:1 therapy 6 days per week (can be broken into pieces).

5-1200 and 6-1200 are both part of Acute Inpatient Rehabilitation

Patients must be conscious to qualify.

5-1200: Spinal Cord Injury service line, Medically Complex service line

6-1200: Brain Injury service line

Rationale – Community Need Analysis relative to NYS

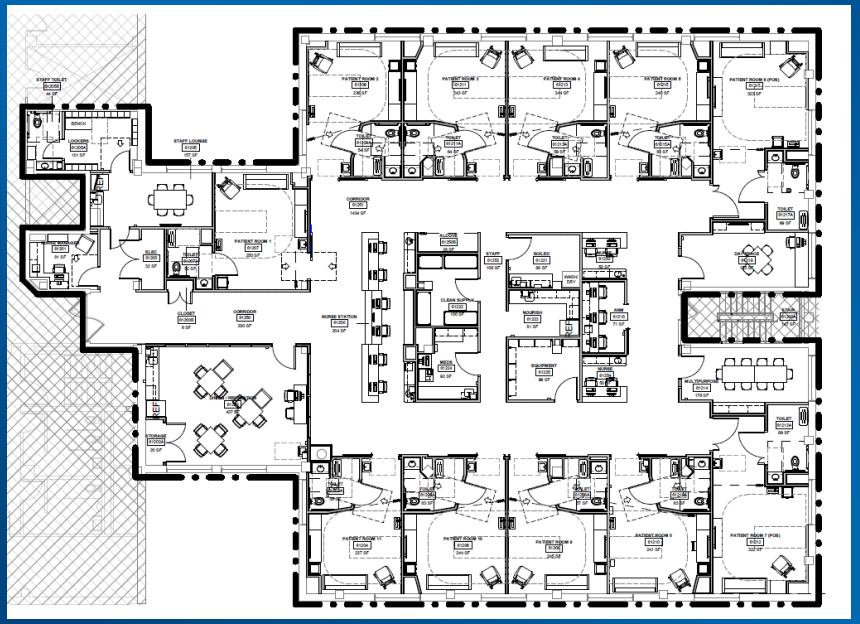
NYS (19.4M population):

- 1,194 rehab beds exist (2020 UDSMR) (1 rehab bed exists per 16.3K pop)
- On avg. 868 rehab beds (71%) are occupied (1 rehab bed is occupied per 22.4K)

Applying this ratio to the Greater Rochester community (1.2M population) suggests **54 rehab beds at 100% occupancy or 60 beds at 90% occupancy are required to meet the community need**

Greater Rochester currently has only **45** rehab beds (20 SMH, 25 Unity)

6-1200 Features and Proposed Floor Plan



Meets *current* NYS Acute Rehab Requirements:

256 SqFt/Pt (209 single; 138 double on 512)

Private Rooms

Individual Bathrooms

Additional Family Meeting Space

Safety Features for Cognitively Impaired Patients Recovering from Acute Brain Injuries

Secure unit

Full visibility - 360 degree line of sight

Wanderguard capabilities

Behavior technicians

UNIVERSITY of ROCHESTER
MEDICAL CENTER

MEDICINE of THE HIGHEST ORDER