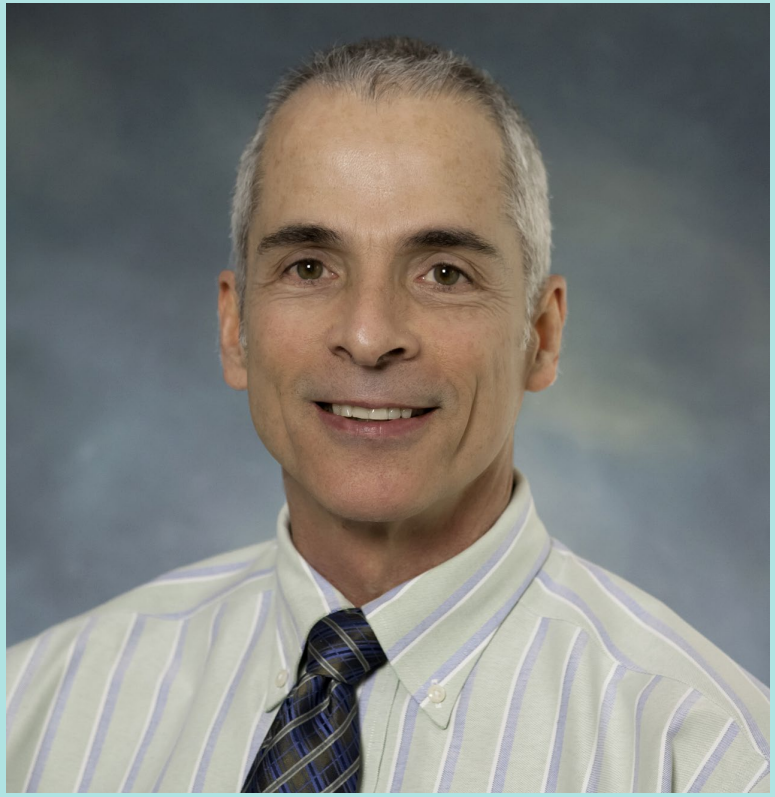
What do IRFs seek to achieve? How well do they achieve it?

John Whyte, MD, PhD

Institute Scientist Emeritus, Moss Rehabilitation Research Institute



The Context of IRF Care for Brain Injury

- Most admissions occur soon after the injury or event; smaller numbers are admitted or re-admitted later
- Patients must be:
  - Sufficiently medically stable to be cared for in a less intensive medical environment, but still in need of frequent medical supervision
  - Significantly functionally impaired with a prognosis for improvement
  - Able to actively participate in the rehabilitation process (hence the “3-hour rule”)
- The facility must provide:
  - 24-hour nursing and medical care
  - intensive multidisciplinary rehabilitation
  - Caregiver education/training

Additional constraints

- There must be goals that are achievable within the length of stay which the anticipated payment will cover.
- There must be a discharge option that is feasible given whatever level of functional improvement the patient experiences in that length of time.
- Patients with severe injuries may spend much or all of their IRF stay with a disorder of consciousness and/or post-traumatic amnesia

WHAT DO IRFs SEEK TO ACHIEVE?

- Medically stabilize patients and manage medical comorbidities
- Remove barriers to functional recovery (hydrocephalus, seizures, sedating medications…)
- Enhance the functional impact of emerging neurologic recovery, through ongoing multidisciplinary assessment and iteratively updated treatment targeting:
  - Mobility skills
  - ADL skills
  - Communication skills

Aims of IRFs (cont.)

- Management of emotional/behavioral dysregulation
- Discharge planning, including
  - Caregiver training (or facility transfer priorities)
  - Assistive device & equipment provision
  - Referral to needed follow up services

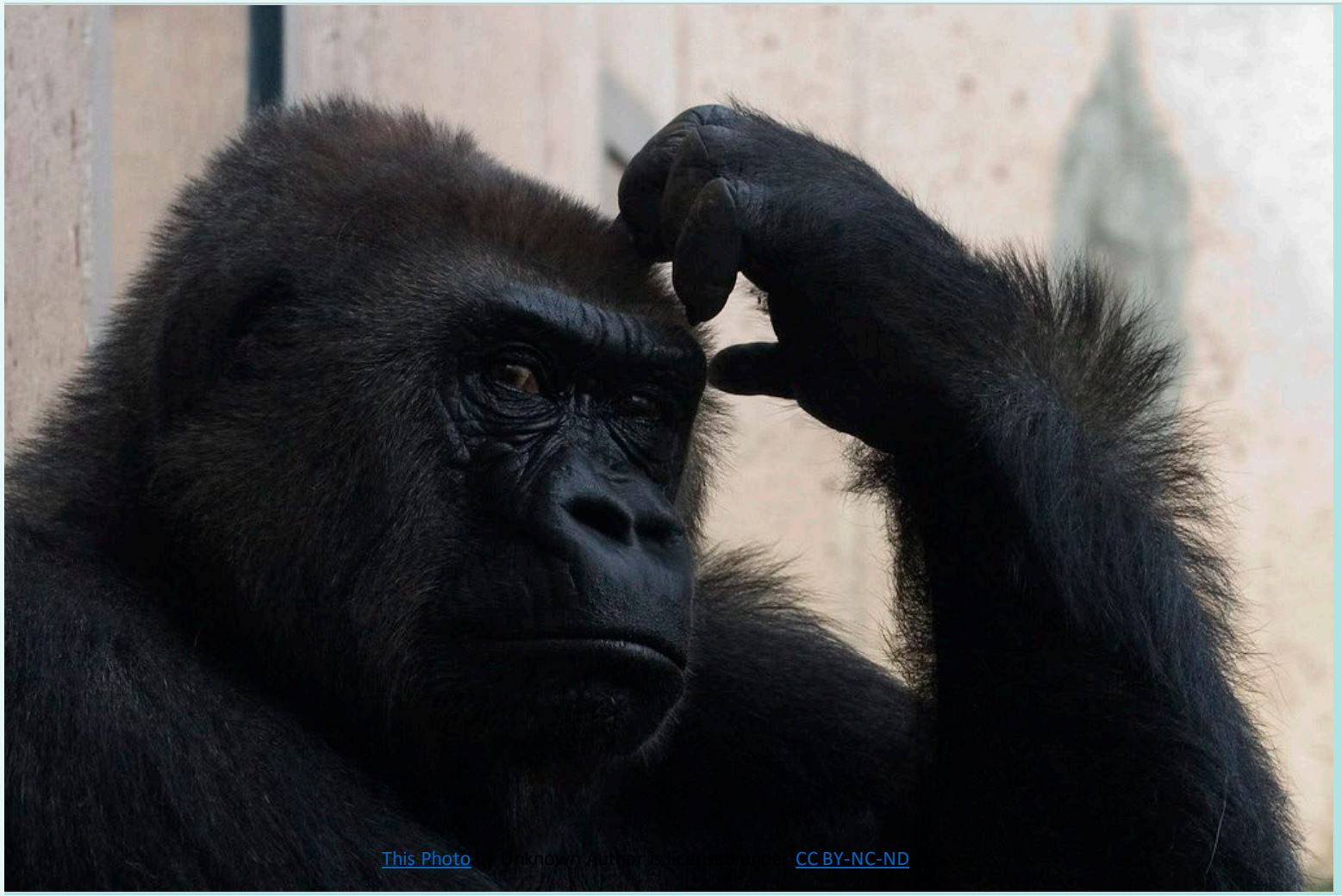
With the ultimate purpose of optimizing:
Community discharges
Functional independence
(costs)

Plausible impacts of IRF care

- Severe TBI is increasingly recognized as a chronic condition with a long window:
  - of improvement;
  - of increased health risks;
  - of service need
- IRF care for patients with severe TBI is short (3 – 4 weeks) and can only launch patients on a trajectory
- Silos of care, including IRF care, complicate:
  - a smooth service trajectory
  - research on the impact of any given component of care

HOW WELL DO IRFs ACHIEVE THE INTENDED AIMS?

That’s complicated…



Methodologic obstacles

- The IRF is a "black box":
  - Varied kinds and amounts of services depending on need
  - Intended outcomes range from improved family caregiving to independence and return to community functioning.
- Should the question be:
  - Are IRFs effective?
  - Are IRFs more effective than ____?
  - Are IRFs more effective in achieving X outcome (e.g., functional independence) than ____?
  - Are IRFs more effective in achieving X outcome in Y population (e.g., patients admitted to rehab with a DoC) than ____?
  - Are specific elements/dimensions (e.g., # of hours of therapy; nursing ratios…) of IRFs effective in achieving X outcome in Y population?

Obstacles (cont.)

- RCTs are challenging to conduct on research budgets; securing support from multiple clinical payors is also challenging. (US)
- Since only a fraction of those eligible for an IRF stay receive one, what about an observational design? (US)
  - Each acute care center transfers a modest number of individuals with brain injuries to a wide set of post-acute providers
  - Many of those providers lack significant research infrastructure
  - Patients often move among post-acute providers during a given follow-up interval
- Clinical and administrative data systems and data collection time points differ among post-acute services, further complicating comparisons. (US)

Obstacles (cont.)

- Ultimately it is the ***nature and intensity*** of ***specific treatments*** provided, after controlling for ***case mix factors***, that should drive ***outcome***, BUT
  - Many unmeasured social and clinical determinants operate on the case mix side;
  - We have no agreed upon measures of treatments and their intensities; (the 3-hour rule constrains “dose” variation and we don’t know how to measure content variation)

Despite those obstacles…we have some relevant evidence

Most patients have considerable potential for functional improvement in the short and long term

- Multiple studies conducted during inpatient rehabilitation demonstrate meaningful improvement for most patients regardless of age or injury severity (e.g., Hayden et al, 2013)
- Multiple longitudinal studies demonstrate continued slow functional improvement over many years, suggesting a similar need for updating later clinical services over time (e.g. Hammond, 2021)
- Studies of service needs over the long haul demonstrate continued and evolving service needs (Finn, et al, 2022)

Intensive rehabilitation for severe brain injury is cost-efficient

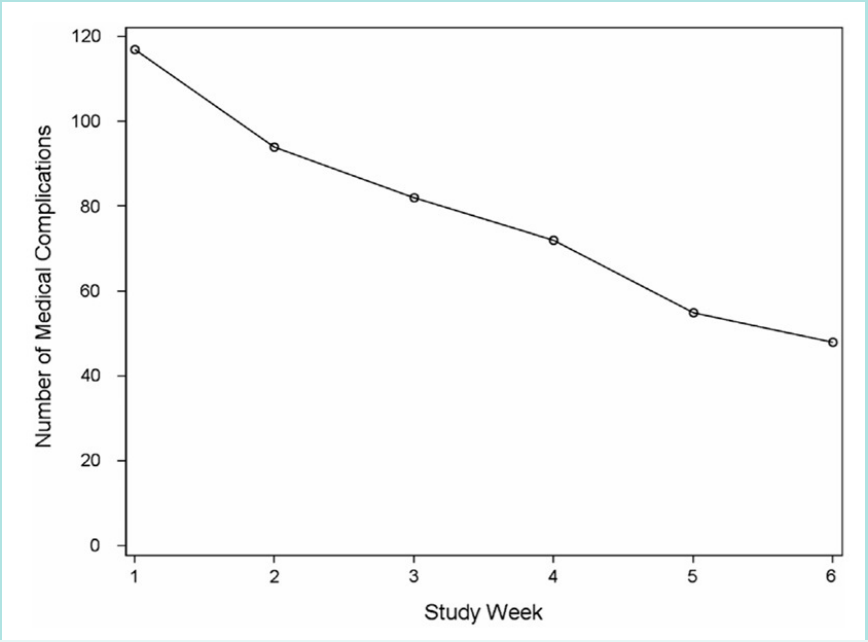
- Studies in the UK (Turner-Stokes, 2019) and Norway (Andelic, 2014) of individuals with complex neurologic disability and/or severe TBI treated in specialty rehabilitation hospital systems
- Functional change from admission to discharge is mapped to a reduction in predicted future care needs and balanced against cost of hospitalization
- In the UK study, on average, the costs of intensive rehabilitation were recouped in ~18 months from reductions in later care costs
- But…proportion of the functional improvement that was *caused* by the rehab process is difficult to evaluate

Early and uninterrupted rehabilitation provides better outcomes

- European observational studies suggest that rapid and continuous involvement in intensive rehabilitation results in greater functional independence (e.g. Andelic, 2014)

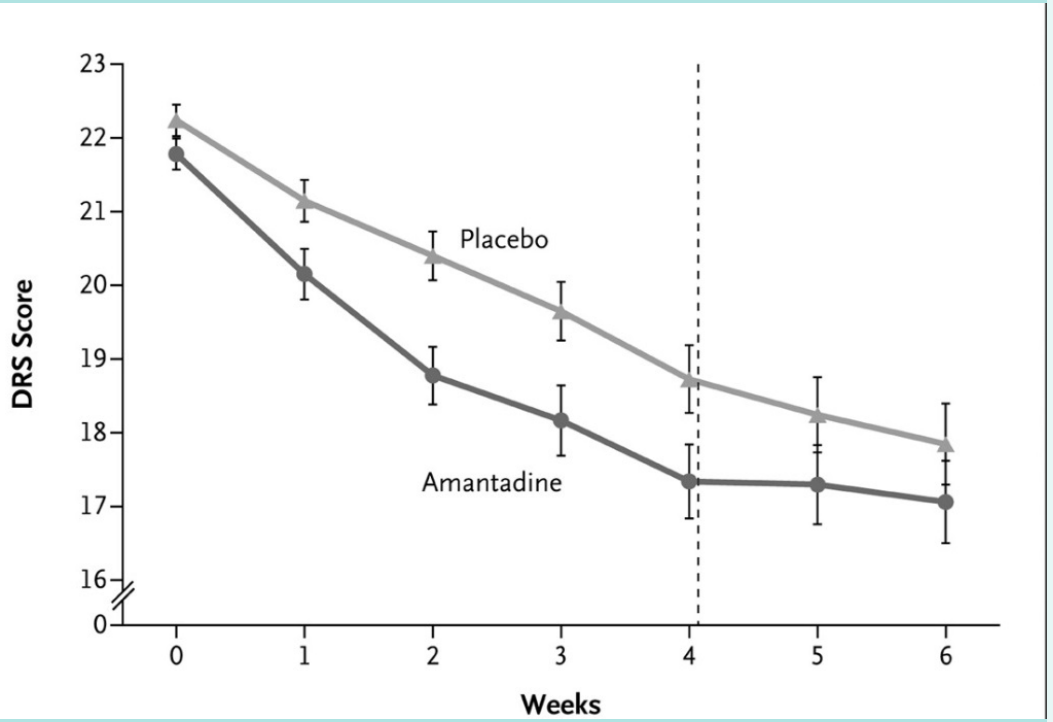
IRF Care Contributes to Medical Stability

- Patients experience a high rate of new medical complications (many requiring brain injury expertise and specialty consultation) during an IRF stay. In a 6-week clinical trial of amantadine (n=184; Whyte et al, 2013)
  - 80% of patients had at least 1 medical complication
  - The average patient had .4 new medical complications/week (about 10% "SAEs")
  - Medical complications declined over time in relation to time in rehabilitation ($p<.001$), NOT time since injury ($p=.83$).
- Patients in VA Polytrauma system have high rate of use of medical specialty consultations (Nakase-Richardson, et al, 2013)

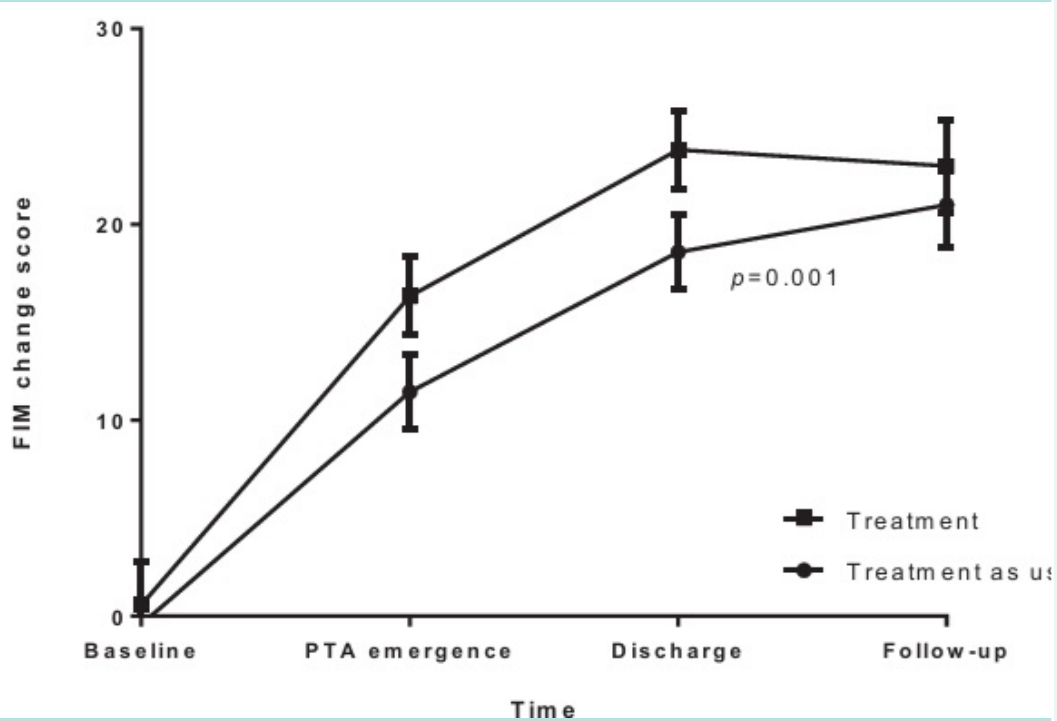


Some of what we do in rehabilitation is to keep the patient safe while their brain recovers; Do we have evidence that the rehabilitation process can actually *accelerate* recovery?

Pharmacologic rehab: Giacino & Whyte (2012)



Procedural training: Travena-Peters J, et al (2018)



Certain treatment elements appear to have potency

- Practice-based evidence studies (e.g., Bogner at al, 2019; Beaulieu et al, 2021) categorized inpatient rehabilitation services into specific "grass-roots" categories
- After controlling for multiple patient and facility characteristics, certain *types* of therapy (rather than gross quantities) were associated with improved outcomes at 1 year:
  - *Advanced* therapy activities (i.e., ones that appeared to be at the edge of the patient's ability level)
  - *Contextualized* activities (i.e., practice with real-world or realistically-simulated real-world activities)

Summary

- A big global question like, “Is IRF care effective?” isn’t a good question
- We have strong evidence that:
  - Most patients have the capacity to improve early after injury and for long periods thereafter
  - Many patients are medically complex in the early post-acute period and need expert medical management
  - There is evidence that a range of pharmacologic and behavioral treatments administered in this period can enhance recovery and reduce comorbidities
  - There is a need for an expert setting that can design and execute a multidisciplinary rehabilitation plan, and update it frequently until the pace of improvement slows to allow a less intensive setting to continue treatment

References

•Andelic N, Ye J, Tornas S, et al. Cost-effectiveness analysis of an early-initiated, continuous chain of rehabilitation after severe traumatic brain injury. *J Neurotrauma.* 2014; 31(14):1313-20, 2014

•Beaulieu CL, Peng J, Hade EM, et al. Quasi-Contextualized Speech Treatment in Traumatic Brain Injury Inpatient Rehabilitation: Effects on Outcomes During the First Year After Discharge. *J Head Trauma Rehabil.* 2021;36(5):E312-E321

•Bogner J, Dijkers M, Hade EM, et al. Contextualized Treatment in Traumatic Brain Injury Inpatient Rehabilitation: Effects on Outcomes During the First Year After Discharge. *Arch Phys Med Rehabil.* 2019;100(10):1810-1817.

•Finn JA, Klocksieben FA, Smith AN, et al. Family Needs After Traumatic Brain Injury: A VA TBI Model Systems Study. J Head Trauma Rehabil. 2022 Nov-Dec 01;37(6):327-337.

•Giacino JT*, Whyte J*, Bagiella E, et al: Placebo-controlled trial of amantadine for severe traumatic brain injury. *NEJM,* 366(9): 819-26, 2012 [* co-first authors]

•Hammond FM, Malec JF, Corrigan JD, et al. Patterns of Functional Change Five to Ten Years after Moderate-Severe Traumatic Brain Injury. *J Neurotrauma.* 2021 Jun 1;38(11):1526-1534.

References (cont.)

•Hayden ME, Plenger P, Bison K, et al. Treatment effect versus pretreatment recovery in persons with traumatic brain injury: a study regarding the effectiveness of postacute rehabilitation. *PM R*. 2013 Apr;5(4):319-27

•Nakase-Richardson R, McNamee S, Howe, LL. Descriptive Characteristics and Rehabilitation Outcomes in Active Duty Military Personnel and Veterans With Disorders of Consciousness With Combat- and Noncombat-Related Brain Injury. *Arch Phys Med Rehabil*. 2013;94:1861-9

•Trevena-Peters J, McKay A, Spitz G, et al. Efficacy of Activities of Daily Living Retraining During Posttraumatic Amnesia: A Randomized Controlled Trial. Arch Phys Med Rehabil. 2018; 99(2):329-337

•Turner-Stokes L, Dzingina M, Shavelle R, Bill A, Williams H, Sephton K. Estimated Life-Time Savings in the Cost of Ongoing Care Following Specialist Rehabilitation for Severe Traumatic Brain Injury in the United Kingdom. J Head Trauma Rehabil. 2019 Jul/Aug;34(4):205-214.

•Whyte J, Nordenbo AM, Kalmar K, et al: Medical complications during inpatient rehabilitation among patients with traumatic disorders of consciousness. *Arch Phys Med Rehabil*, 94(10):1877-1883, 2013