



TBI Neurological Rehabilitation: An Evidence-based Clinical Model of Care

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| Overview

This presentation will provide participants an alternative rehabilitation model that is evidence-based providing a recovery pathway to reduced disability with neurological impairment.

Plateau no longer means “not able to benefit from treatment”.
Plateau is a step in the recovery process.

| Overview

The model addresses person centered recovery and offers a way to consider remediation and compensatory rehabilitation to improve an individual throughout their life following injury.

More specifically, this statistically derived model (evidence-based) demonstrates an approach that is independent of time since injury and independent of injury type.

Further, this model provides a new understanding and focus for treating those injured from the professional to family member levels.

| Learning Objectives

1. Participants will be able to describe person-centered care principles.
2. Participants will be able to describe about evidenced-based modeling and compare this model with the more traditional methods of rehabilitation.
3. Participants will be able to describe the pathway to care model, including Remediation vs. Compensation
4. Participants will be able to identify and address plateaus in recovery and apply the model across rehabilitation settings (e.g., residential, non-residential care).

Person-Centered Care Concepts

Be yourself!



| Person Centered Care

According to the *Health Innovation Network South London*...

“Person-centered care is a way of thinking and doing things that sees the people using health and social services as equal partners in...

- Planning
- Developing
- Monitoring care

.... to make sure it meets their needs.

Essentially, the care places participants and their families at the center of decisions, working alongside professionals to get the best outcome.

| Person Centered Care

Person centered care also involves...

- Considering people's desires
- Values
- Family situations
- Social circumstances
- Lifestyles

It is seeing the person as an individual, and working together to develop appropriate solutions.

Professionals' attitudes and relationships are critical to care.

| Person Centered Care

Prior methods attempted to “fit” participants into a program and then have measured outcomes that were determined by the team or professional(s).



| Person Centered Care

The former models included the concept of providing treatment “to” them.

Person centered is accomplishing goals “with” the person needing services.

The newest model incorporates the concept of treatment with the individual and with an evidence-based process that is *flexible and adaptable*.

Evidenced-based Model of Rehabilitation

Use of outcome statistics to determine what and when.



Traditional Rehabilitation

A key element is the perspective of the “evidence”.

Traditional methods show the following treatment method:

Patient -> Assess -> Plan -> Implement -> Examine, e.g., measure and analyze outcomes (better, worse, same). This method provides the potential for translational programming – IF, follow up research is performed.

- “Neurological rehabilitation is a doctor-supervised program designed for people with diseases, trauma, or disorders of the nervous system. Neurological rehabilitation can often improve function, reduce symptoms, and improve the well-being of the patient.”
- The goal is a disease model of thinking, with outcome expectations showing a difference from the start of treatment to the end of treatment.

(Johns Hopkins Medicine, 2016)

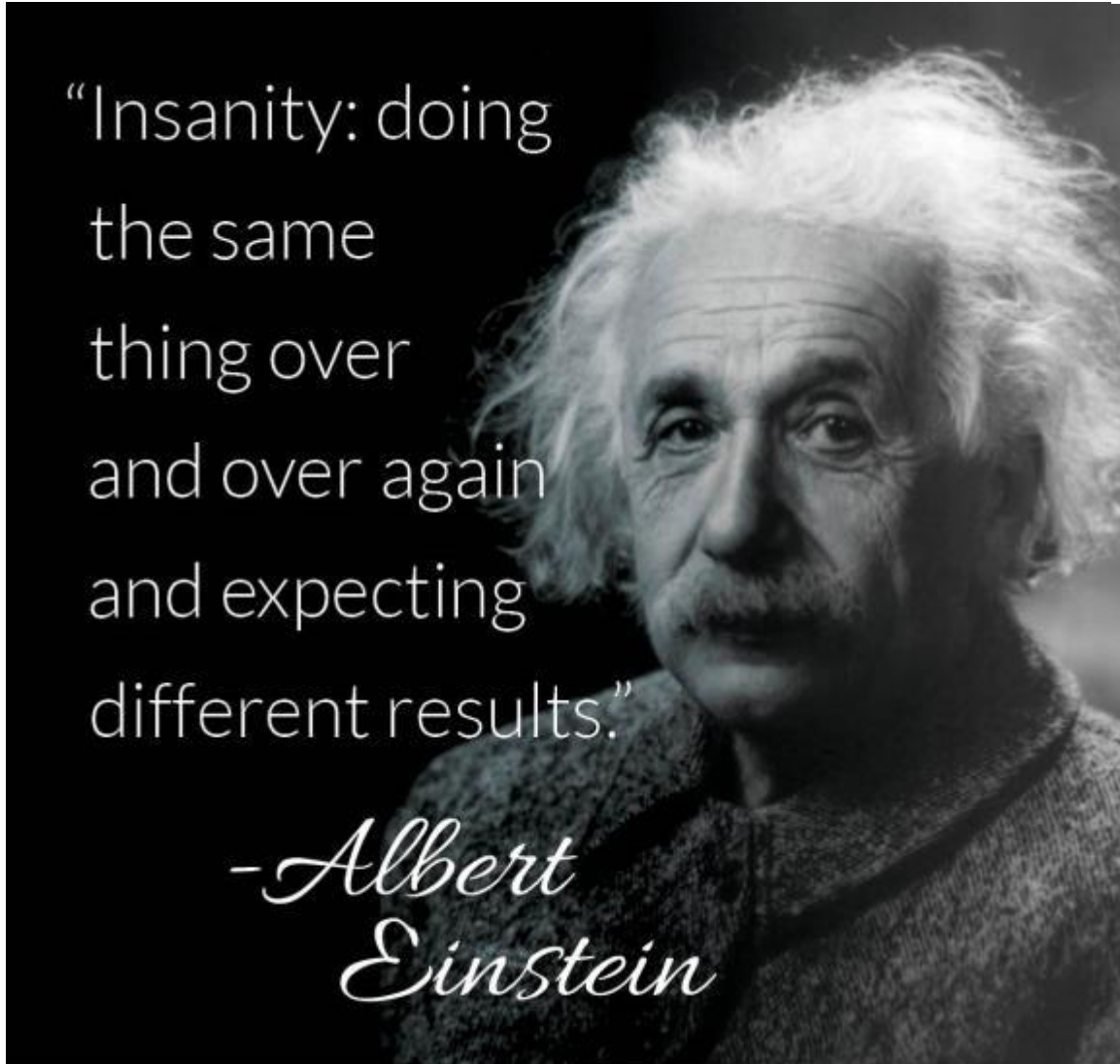
Rehabilitation Modeling:

**Rasch Analysis for evidenced-based care in
post-hospital neurological rehabilitation**

Disruption...

“Insanity: doing
the same
thing over
and over again
and expecting
different results.”

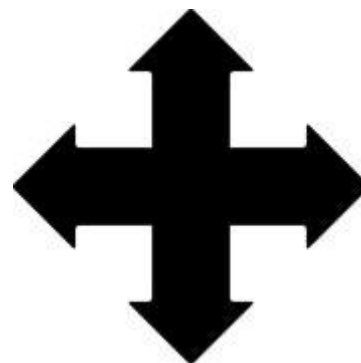
*-Albert
Einstein*



Disruption...

The world-wide healthcare needs have changed.

If we consider the problem
from a different angle, then
maybe we will discover a new
way that leads to better outcomes.



Our changing healthcare industry requires “evidence” to
measure and validate...

But most importantly... discovering things that work for
reasons that may not always be apparent at first!

The statistics... boring stuff



Rasch Review

Rasch analysis was conducted for purposes of determining reliability and construct validity of the MPAI-4 as a measure of disability following brain injury. The model was tested twice with the same findings.

2016 (1,710 persons with mixed neurological disorders)

2023 (1,993 persons with traumatic brain injury only)

The model compares expected from the actual values of an item.

In other words...

Do the actual results conform to what would be expected from a reliable measure of the construct?

Evidenced-based Rehabilitation



Additional Separation:

Person Separation – the extent to which items distinguish among people (distinguishing between high and low performers on items).

Item Separation – the extent to which items are distinct from each other (clear item hierarchy on difficulty)

A separation of at least 2 is desired.

(Malec, Kragness, Evans, Finlay, et al., 2003, p. 483).

Results of current study:

Person Reliability Coefficient: 0.90 (Separation = 2.94) - Acceptable

Item Reliability Coefficient: 1.00 (Separation = 25.44) - Acceptable

Developing the model (2016)

Demographics

Age: Mean = 43.46 years (Range = 17 -89, SD = 14.5)

Biological Sex: 77% male/23% female

Chronicity Average = 37.8 months

(Range = 1 month – 772 months; SD = 82.85 months)

Average Length of Stay: Mean = 7.0 months

(Range = 1-103 months, SD = 10.65 months)

Diagnosis:

TBI = 71%

CVA = 12%

Anoxia = 6%

Tumor = 2%

Other neurological disease = 9%

Research Design

Design: Prospective analysis of admission scores when entering a post-hospital rehabilitation program.

Setting: 44 post-hospital inpatient rehabilitation facilities across 21 states in the US.

Interventions: Multidisciplinary treatment by physicians, nursing, PTs, OTs, SLPs, and Psychology with admission Mayo Portland Adaptability Inventory-4 measurement.

Main Outcome Measures: Mayo Portland Adaptability Inventory (MPAI-4). Analyses were conducted with WINSTEPS V.3.81 and other analyses were conducted with SPSS.V.22.

Results of Rasch

Results:

High person reliability (.90)

High item reliability (1.00).

Similar findings to the original research by Malec & Lezak (2008)

Translation:

A ***clinical model of care*** was developed from this analysis.

This model prioritizes therapeutic interventions.

A new approach to neurological rehabilitation is born.

The model is independent of time and type of injury – That is crazy!

Order of Intervention - 2016

2	.	+	
	.		
	.		
	.#		AUDITION
	.#	T	
	##		DIZZINESS
	###		
1	###	+	
	####	S	
	#####		MOTOR SPEECH
	#####		PAIN/HEADACHE, VISION
	#####		USE OF HANDS, <u>INAPPROPRIATE SOCIAL, IRRITABILITY, SYMPTOM SENSITIVITY</u>
	#####		DEPRESSION , FUND OF INFORMATION, VISUAL PERCEPTION,
	#####		ANXIETY , FATIGUE, MOBILITY , NON-VERBAL COMM, VERBAL COMM
0	#####	+M	<u>SELF-CARE</u>
	#####		FAMILY FUNCTION
	#####		<u>INITIATION</u> , PRODUCTIVITY
	#####	S	ATTENTION, IMPAIRED AWARENESS, MEMORY
	###		NOVEL PROBLEM SOLVE, SOCIAL CONTACT
	####		LEISURE
	.#		
-1	#	T+	MONEY MANAGEMENT
	.#		
	.	T	<u>HOME SKILLS</u>
	.		
	.		TRANSPORTATION USE
	.		
-2	.		
	+		

2016 Original Sample Size = 1,710 mixed persons
2023 Revalidation Sample Size = 1,993 TBI persons

Order of Intervention - 2023

2	.	+	
	.		
	.		
	.#		AUDITION
	.# T		
	##		
	###		
1	###	+	
	##### S		DIZZINESS
	#####		IRRITABILITY, MOTOR SPEECH
	#####		INAPPROPRIATE SOCIAL, SYMPTOM SENSITIVITY,
	#####		DEPRESSION, PAIN/HEADACHE, VISION
	#####		ANXIETY, FUND OF INFORMATION, USE OF HANDS
	#####		FAMILY, NON-VERBAL COMM, VERBAL COMM, VISUAL-SPATIAL
0	#####	+M	MOBILITY, <u>SELF-CARE</u>
	#####		FATIGUE
	#####		<u>INITIATION,</u>
	##### S		IMPAIRED AWARENESS
	###		ATTENTION, SOCIAL CONTACT
	####		MEMORY, NOVEL PROBLEM SOLVING
	.#		LEISURE SKILLS
-1	#		MONEY MANAGEMENT
	.# T		
	.		<u>HOME SKILLS</u>
	.		
	.		TRANSPORTATION USE
	.		
-2	.		
	+		

2016 Original Sample Size = 1,710 mixed persons
2023 Revalidation Sample Size = 1,993 TBI persons

“The model validates what common sense tells us!” (F. Lewis)

The New Model of Rehabilitation



The model that was statistically derived (fact not fiction)...

... providing a pathway of care.

New Evidenced Based Model

High Impact/Low Probability Barriers

Medium Impact / Medium Probability Barriers

Integrated Treatment – Remediation & Compensation

Skills Application Phase – I-ADLs

Where the model incorporates person centered care is that each person enters the model at *different* levels. Also, specific participant goals are developed at each level for that individual to progress toward their outcome.

The model provides a course of outcome that is *measurable and flexible* enough to adapt to the individual at all levels.

New Evidenced Based Model – Phase A



High Impact/Low Probability Barriers

Audition, Dizziness – This incorporates vestibular disorders and other causes of dizziness that may include neuroendocrine disorders

In this first level of care, the focus is on symptom management with reduction. These symptoms are considered “high impact - low probability”. This means that they are not likely to occur based on the model findings. However, when they are present, any of these symptoms are likely to create a significant functional impairment (e.g., disruption) causing greater dysfunction, and likely a longer length of stay than the overall impact of the injury alone.

In particular, the symptoms of Audition (hearing impairment) and Dizziness have the highest impact on rehabilitation outcomes.

New Evidenced Based Model – Phase A



High Impact/Low Probability Barriers

Audition, Dizziness

Therefore, the team that assesses the individual for rehabilitation goal setting would conclude that this is the first level of deficit to address.

By addressing these concerns (if they exist), then other concerns are secondary until either the dysfunction is remediated or compensatory strategy use is well underway.

Goal: Focus for ALL Therapies: remediate with compensatory strategy use until this level can reduce to a mild level of functional impact (e.g., <25% of the time the limitation is present).

New Evidenced Based Model – Phase B



Medium Impact / Medium Probability Barriers

Inappropriate Social Awareness, Irritability, and Sensitivity to Symptoms (2016)

Irritability, Motor Speech, Inappropriate Social, Sensitivity to Symptoms (2023)

In this second level, the focus is based on neurobehavioral concerns first. Research by Lewis and Horn (2014) revealed that behavioral impairments have a substantial impact upon recovery. In fact, the impact can cause 2-3xs increased length of stay within a similar sample.

Further, a neurobehavioral profile was developed that significantly separated those with behavioral impairments from those with greater neurorehabilitation needs without significant behavioral disturbances.

New Evidenced Based Model – Phase B



Medium Impact / Medium Probability Barriers

Inappropriate Social Awareness, Irritability, and Sensitivity to Symptoms (2016)

Irritability, Motor Speech, Inappropriate Social, Sensitivity to Symptoms (2023)

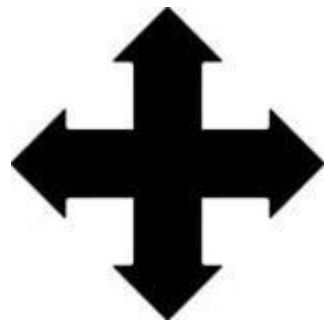
By addressing these concerns as proactively as possible, then the largest level of care can remain on target for successful discharge.

Goal: Focus for ALL Therapies: remediate with compensatory strategy use until this level can reduce to a mild level of functional impact (e.g., <25% of the time the limitation is present).

New Evidenced Based Model – Phase C

Integrated treatment – Multifocal Remediation & Compensation (2016)

(Physical, Cognitive, Communication, Emotion, Family)



DEPRESSION, FUND OF INFORMATION, VISUAL PERCEPTION,

ANXIETY, FATIGUE, MOBILITY, NON-VERBAL COMM, VERBAL COMM

SELF-CARE

FAMILY FUNCTION

INITIATION, PRODUCTIVITY

ATTENTION, IMPAIRED AWARENESS, MEMORY

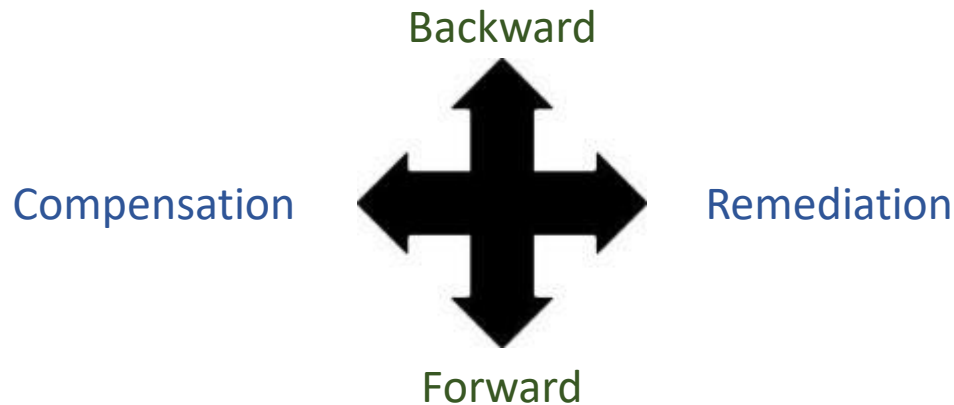
NOVEL PROBLEM SOLVE, SOCIAL CONTACT

These variables are goals that move toward improvement, rather than being seen as barriers to recovery. The only exceptions are *depression and anxiety* – both have been found to reduce the total gains made in treatment (Lewis & Horn, 2017).

New Evidenced Based Model – Phase C

Integrated treatment – Multifocal Remediation & Compensation

By addressing these concerns using the same methodology as noted in Phase A (e.g., treat in order of levels), then successful outcomes can be achieved. The goal is that multiple disciplines integrate the rehabilitation focus.



Goal: Focus for ALL Therapies: remediate with compensatory strategy use until this level can reduce to a mild level of functional impact (e.g., <25% of the time the limitation is present).

New Evidenced Based Model – Phase D



Skills Application Phase – Societal Participation

Leisure, Money Management, Home Skills, and Transportation Use

This phase is based on the construct of Instrumental Activities of Daily Living.

These are the skills that tend to be resistant to change, which is one of the reasons why the prior levels must be either underway or achieved to make a significant change in this phase.

In addition, self-care and initiation, both factor into this phase of community success (Lewis & Horn, 2015).

Pathway to Care - 2023

2 . +
 . |
 . |
 .# | **AUDITION**
 .# T |
 .## |
 .### |
 1 .### +
 ##### S | **DIZZINESS**
 ##### | **IRRITABILITY, MOTOR SPEECH**
 .##### | **INAPPROPRIATE SOCIAL, SYMPTOM SENSITIVITY,**
 .##### | **DEPRESSION, PAIN/HEADACHE, VISION**
 .##### | ANXIETY, FUND OF INFORMATION, USE OF HANDS
 .##### | FAMILY, NON-VERBAL COMM, VERBAL COMM, VISUAL-SPATIAL
 0 .##### +M **MOBILITY, SELF-CARE**
 ##### | FATIGUE
 .##### | **INITIATION,**
 .##### S | IMPAIRED AWARENESS
 .### | ATTENTION, SOCIAL CONTACT
 ##### | MEMORY, NOVEL PROBLEM SOLVING
 .# | LEISURE SKILLS
 -1 # | MONEY MANAGEMENT
 .# T |
 . | T **HOME SKILLS**
 . |
 . | **TRANSPORTATION USE**
 . |
 -2 +

2016 Original Sample Size = 1,710 persons
 2023 Revalidation Sample Size = 1,900 persons

A person can enter..

- at any program level (e.g., residential, non-residential),
- at any time,
- with any injury type.

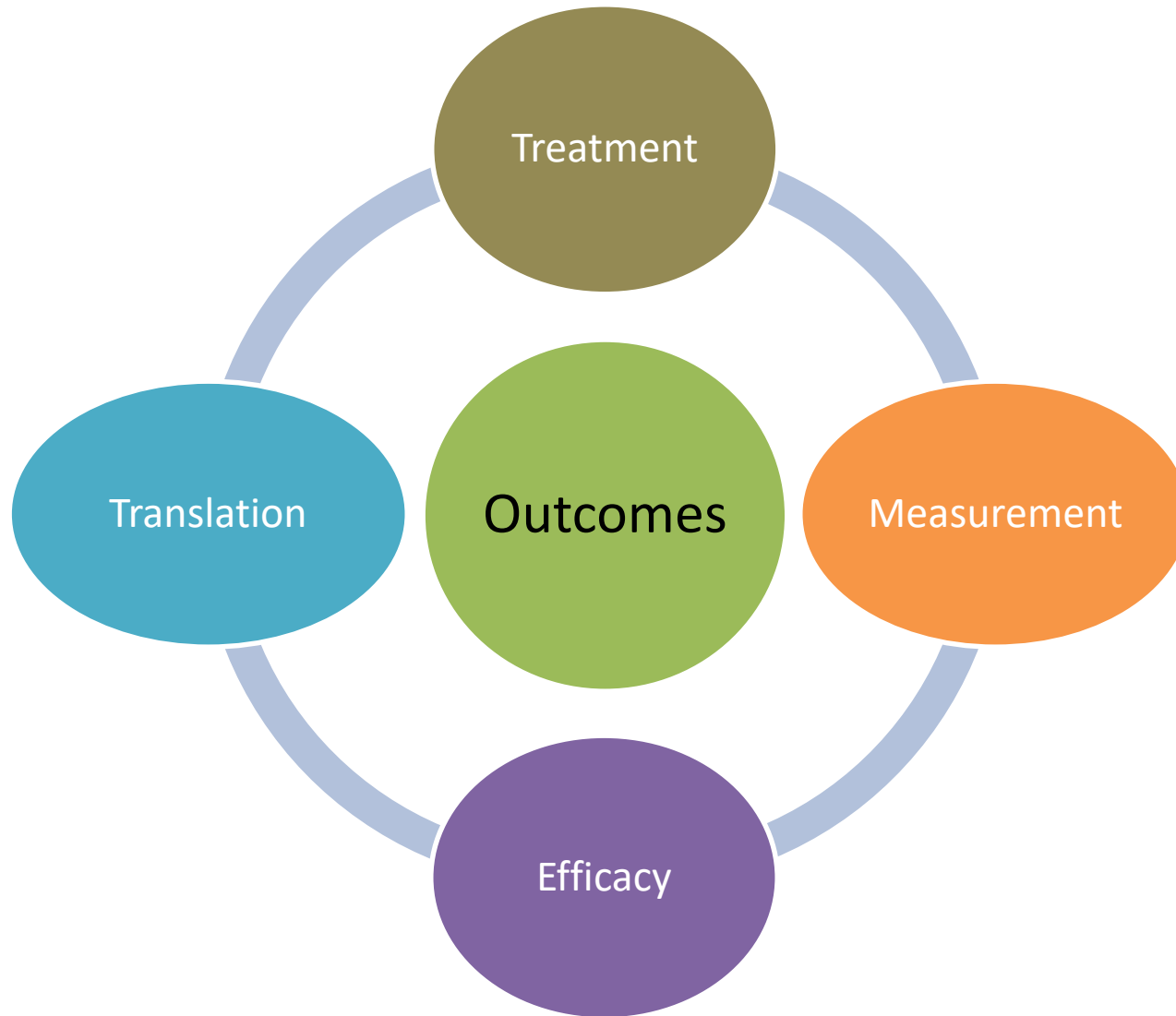
Discussion

The current results conclude that the MPAI-4 provides an excellent method of assessing disability in various neurological samples.

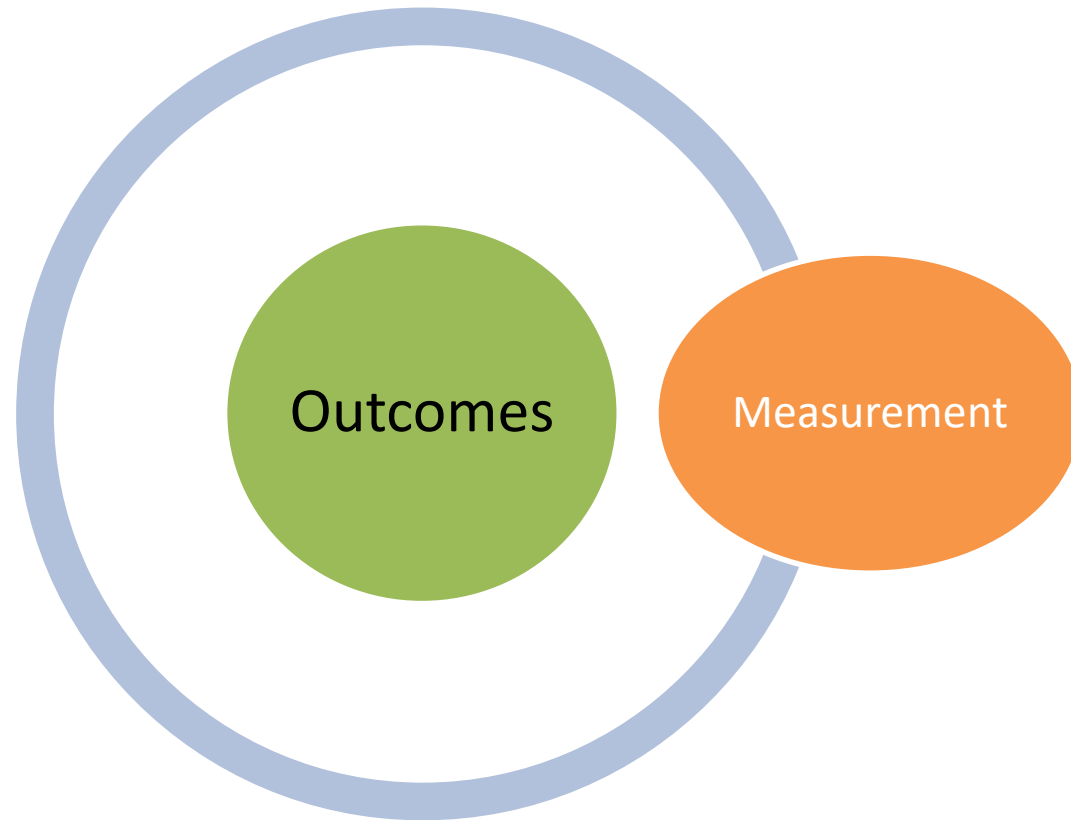
Aside from external validation for the original MPAI-4 Rasch Analysis (2008), this analysis also assisted in developing a pathway to care which focuses rehabilitation interventions.

The refinement of the approach may lead to improved outcomes and reduced length of stay at each level of care. Each level and phase of care can flexibly adapt by using remediation and compensatory strategy development as a person progresses in treatment. The goal is to have deficits continuously addressed until a deficit falls in the mild range of **functional disability** or better.

Ingredients to Outcomes

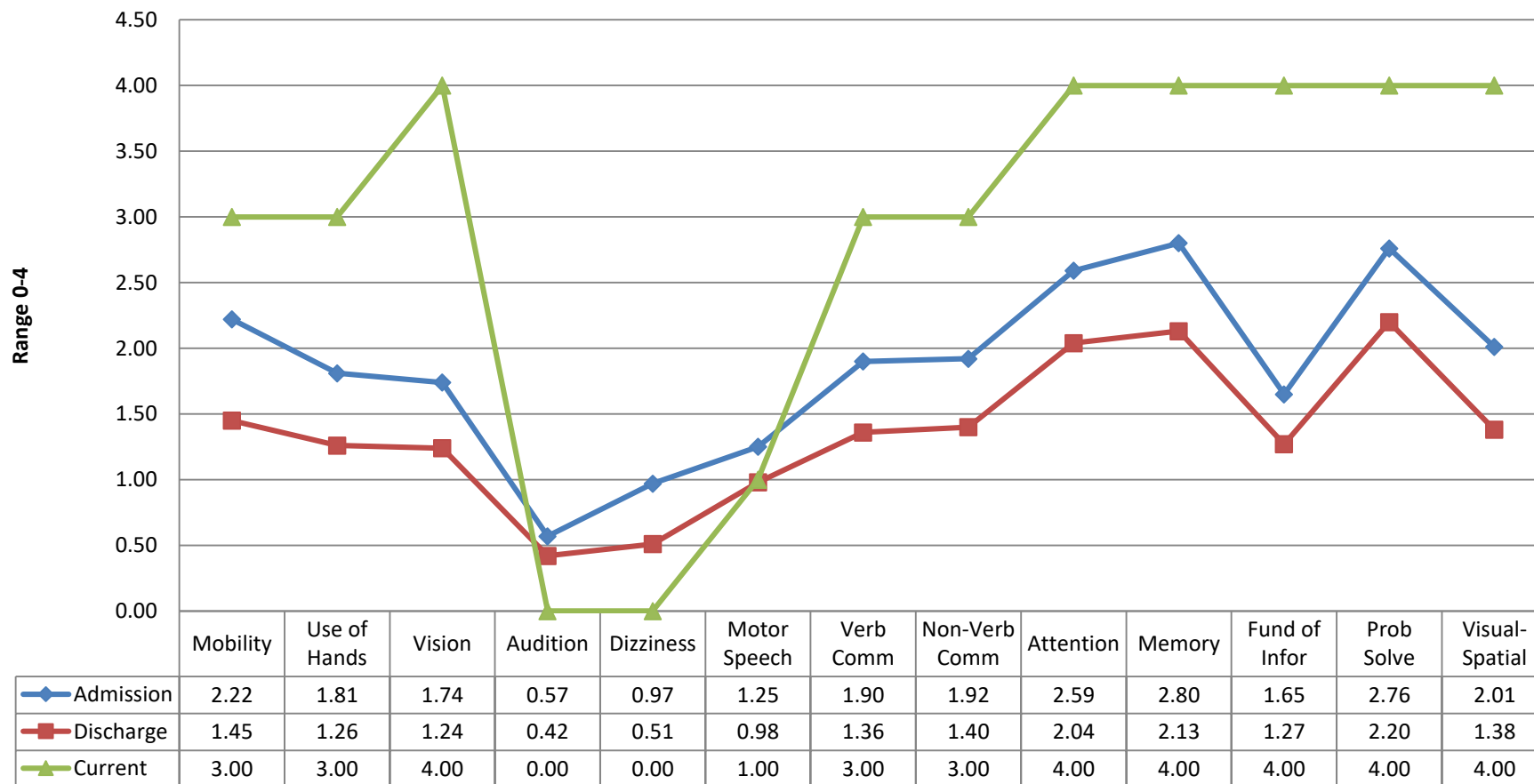


Measurement – Outcomes Analysis

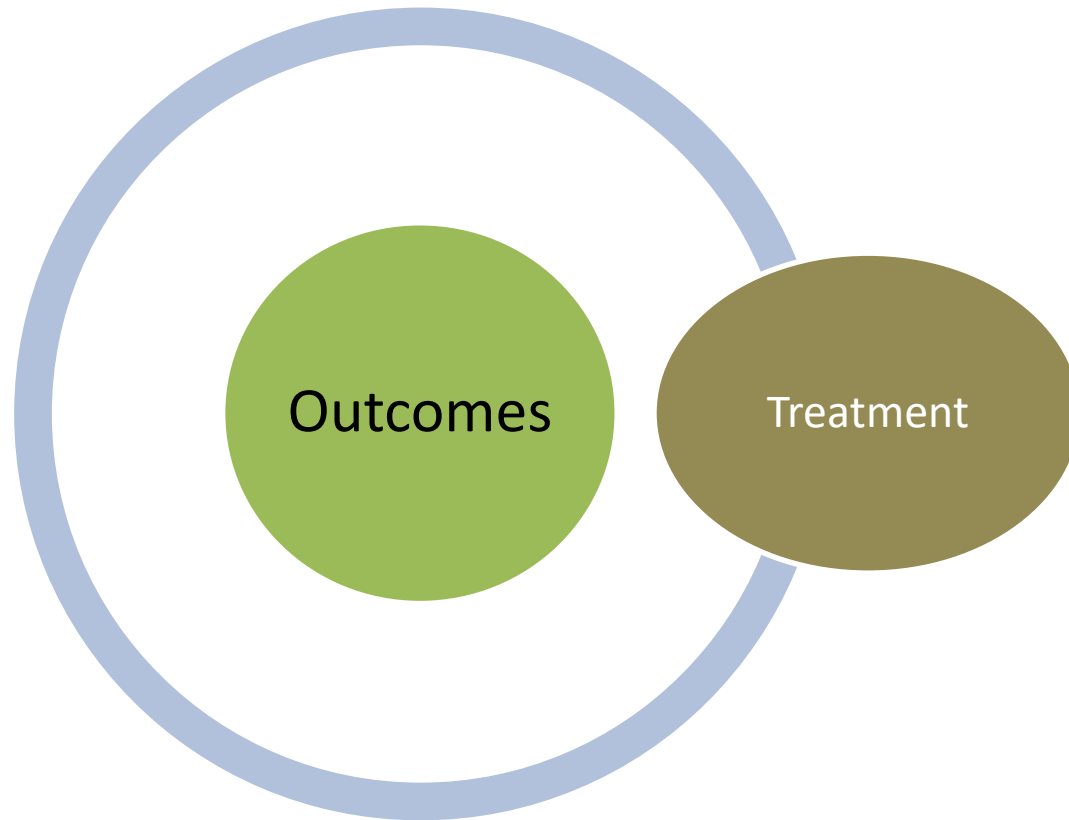


| Clinical Application - Abilities

MPAI-4 Neurorehabilitation Ability Indices



Treatment with Therapy – Outcomes Analysis



Treatment Efficacy

The efficacy of care has to be demonstrated to show that gains can be made for most levels of care; an underlying assumption is to prevent decline.

Considerations of Efficacy...

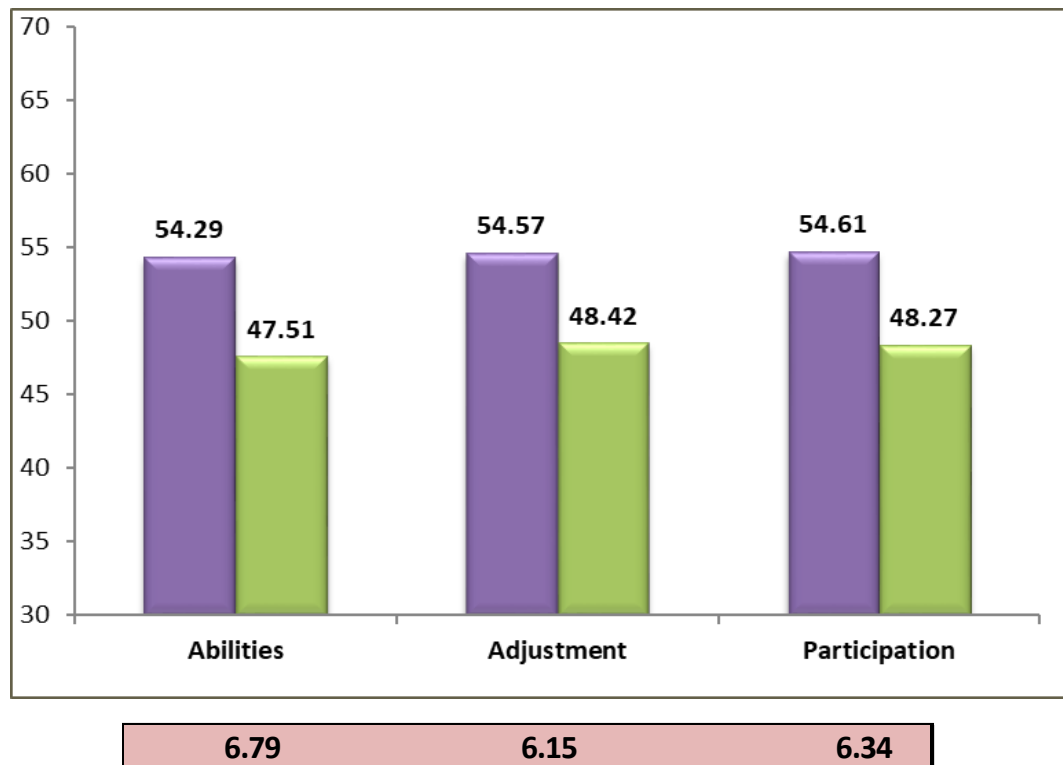
- Reduce disability over time.
- Application of skills to real-world context.
- Improved functional outcomes for community living.
- For those with long-term care needs, provide a healthy and safe environment with focus on producing medical, physical, cognitive, and emotional stability.
- Prevention of decline through the aging process.

Question: Does it work?

Answer: YES. Findings are clinically and statistically significant.

Treatment Efficacy – post hospital

Reduce disability over time. This graph shows that lower scores are achieved across all types of treatment at the post-hospital level of care (N = 6,716).



Program Types:

Residential

Neurorehabilitation
Neurobehavioral
Supported Living
Adolescent Intensive

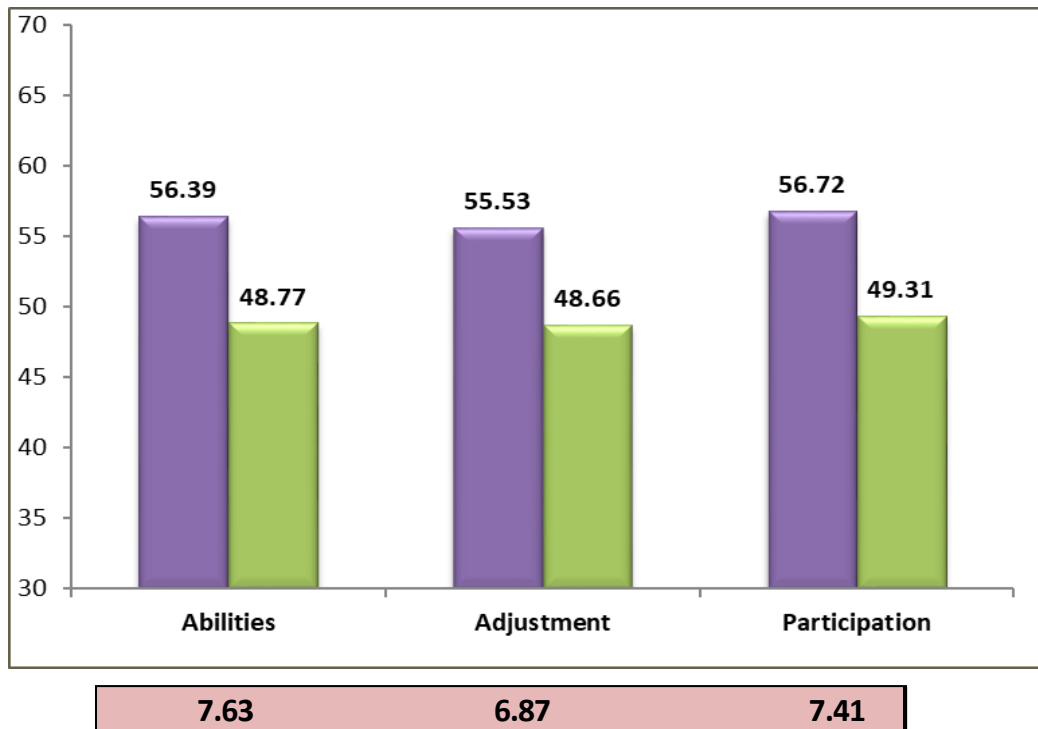
Non-Residential

Day Treatment
Outpatient
Home & Community

Average Age: 44 years

Treatment Efficacy

Reduce disability over time. This graph shows that lower scores are achieved with neurorehabilitation.



Program Types:
Neurorehabilitation
(N = 3,511)

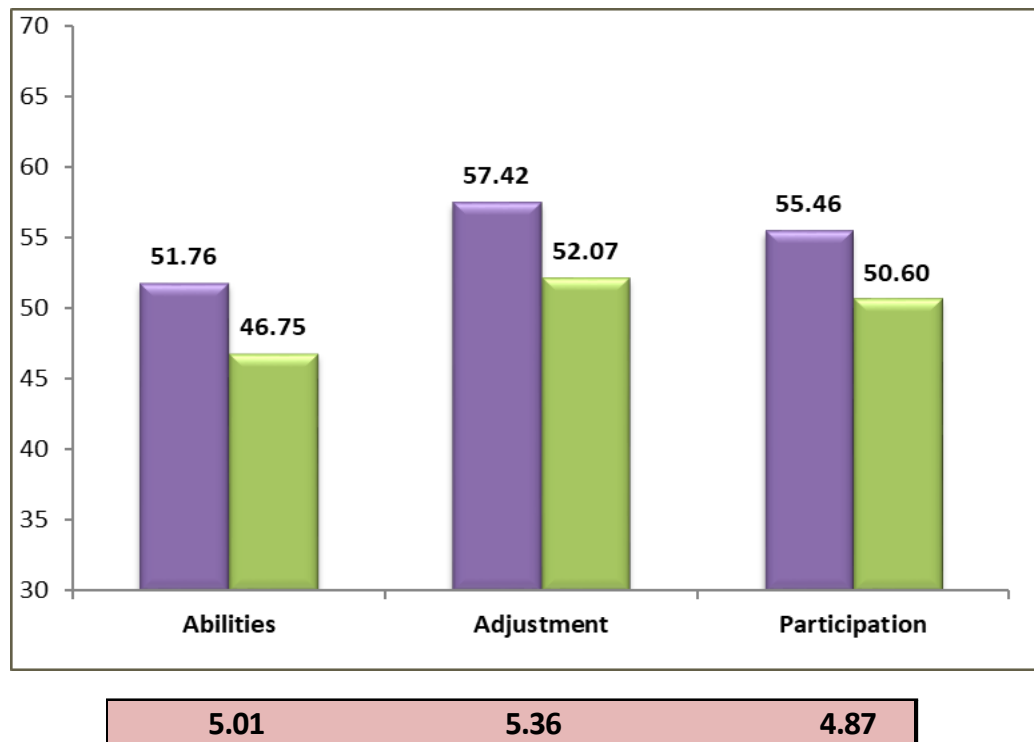
Average Age: 46 years

Greatest changes:
72% have services within
a year of injury.

Improved: Mobility,
Upper extremities,
Communication,
Attention, Memory,
Problem solving, Visual
spatial skills; fatigue,
awareness; Initiation,
Self-care, Home Skills.

Treatment Efficacy

Reduce disability over time. This graph shows that lower scores are achieved with neurobehavioral intense persons.



Program Types:
Neurobehavioral (N = 461)

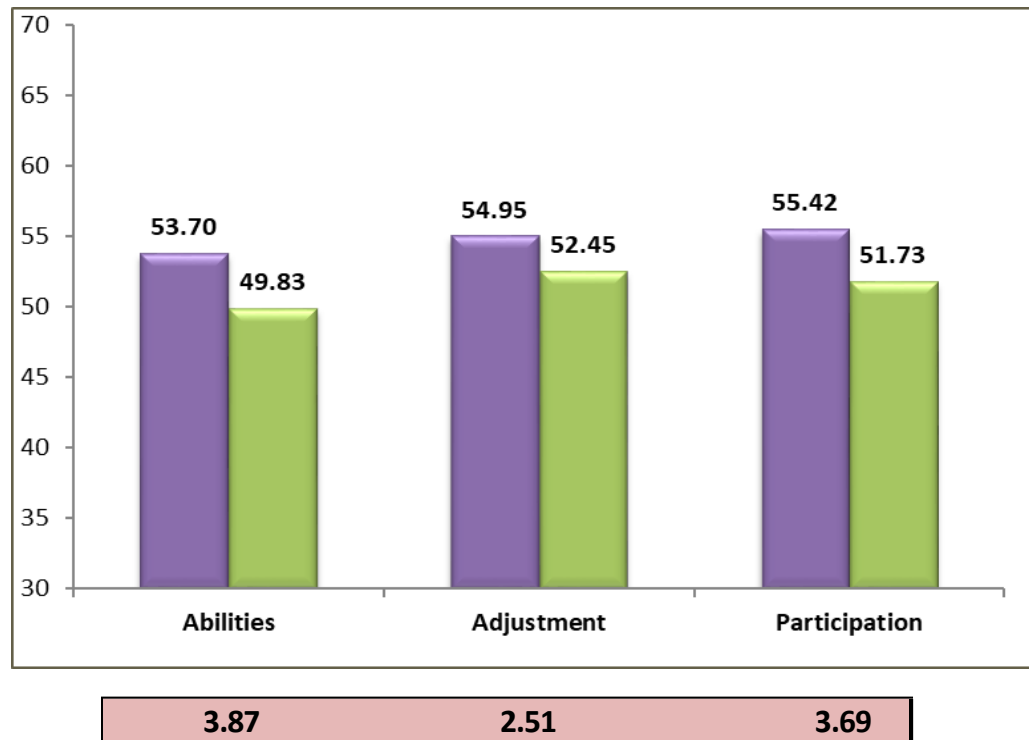
Average Age = 39 years

Greatest changes:
27% receive services
within a year of injury.

Improved: Communication,
Attention, Memory,
Problem solving; Anxiety,
Depression, Irritability,
Social Skills, Awareness;
Initiation, Social contact,
Leisure, Self-care, Home
skills, pre-employment

Treatment Efficacy

Reduce disability over time. This graph shows that lower scores are achieved with supported living environments focusing on health, safety, and quality of life.



Program Types:
Supported Living (N = 770)

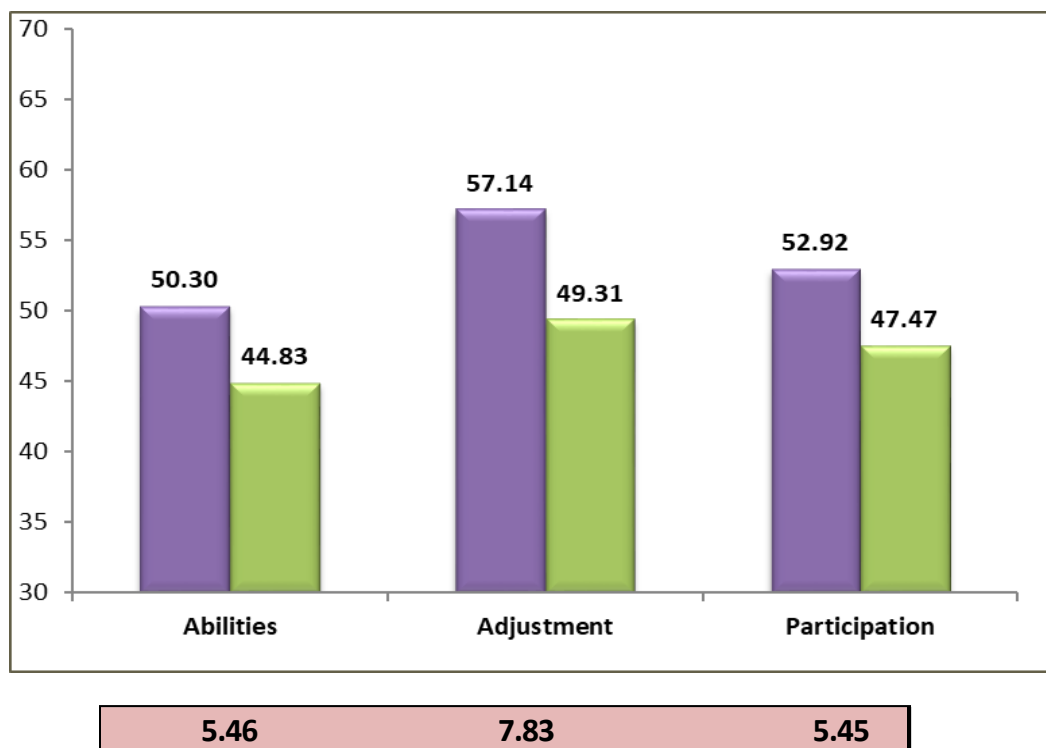
Average Age = 49 years

Greatest Changes:
25% of persons receive supported services within 1 year of injury.

Improved: Mobility, Communication, Memory; emphasis on Instrumental Activities of Daily Living including initiation, self-care, home skills, social and leisure activities, productive activities in the community.

Treatment Efficacy

Reduce disability over time. This graph shows that lower scores are achieved with pediatrics/ adolescents and with behavioral intensity.



Program Types:

**Adolescent Intensive
(N = 331)**

Average Age = 15 years

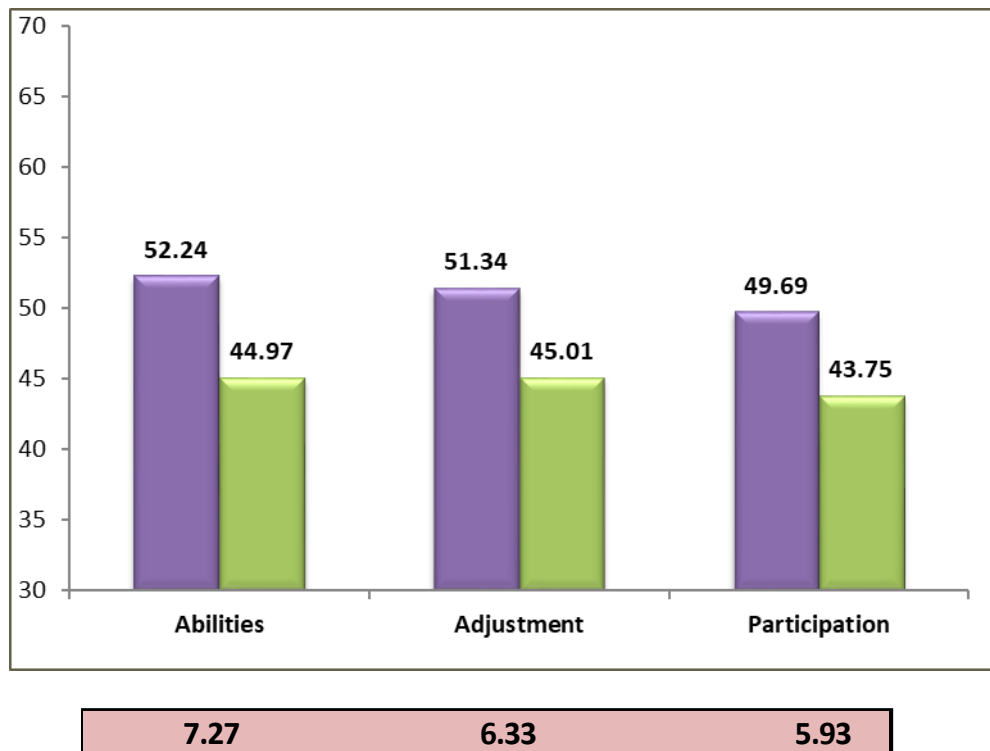
Greatest changes:

28% received services within
1 year of injury onset.

Improved: Mobility, upper
extremities; communication;
Attention, Memory,
Problems solving, Visual
spatial skills;
Neurobehavioral
improvements, Social skills,
Self-awareness, family
relationship; Initiation/
inhibition, leisure develop;
self-care and home skills.

Treatment Efficacy

Reduce disability over time. This graph shows that lower scores are achieved with a day treatment focus.



Program Types:
Day Treatment
(N = 1,147)

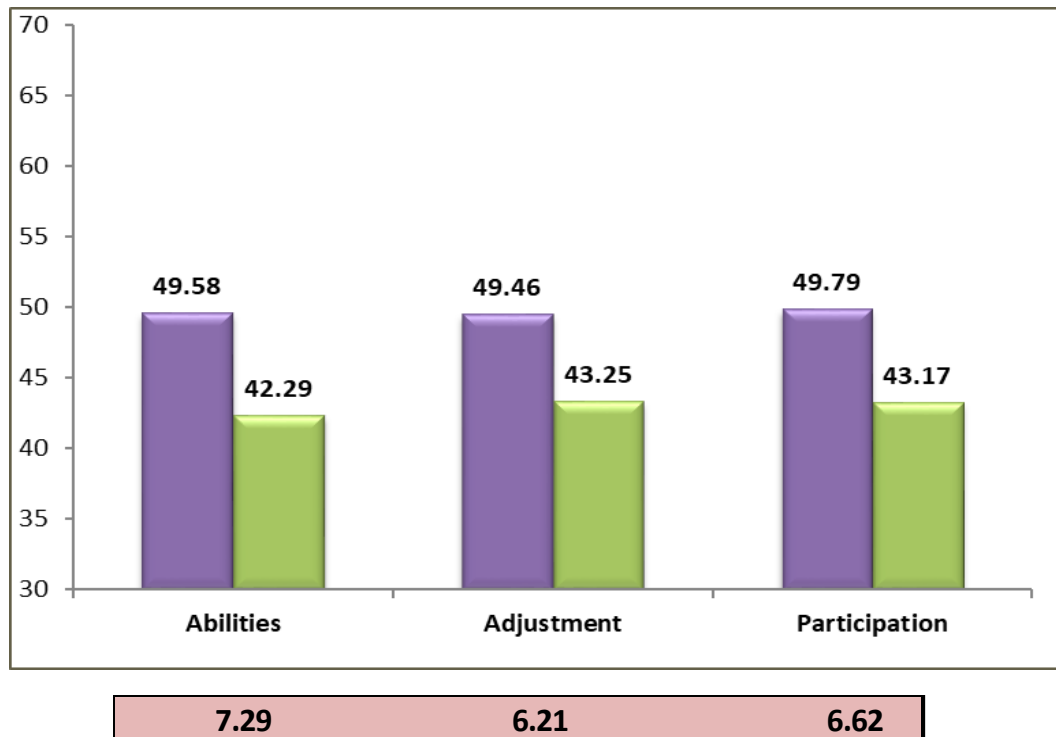
Average Age = 45 years

Greatest changes:
60% received services
within 1 year of their
injury.

Improved: Mobility, Upper
extremities,
Communication,
Attention, Memory,
Problem solving, Visual
spatial skills; fatigue,
awareness; Initiation, Self-
care, Home Skills.

Treatment Efficacy

Reduce disability over time. This graph shows that lower scores are achieved at the outpatient level.



Program Types:
Outpatient (N = 359)

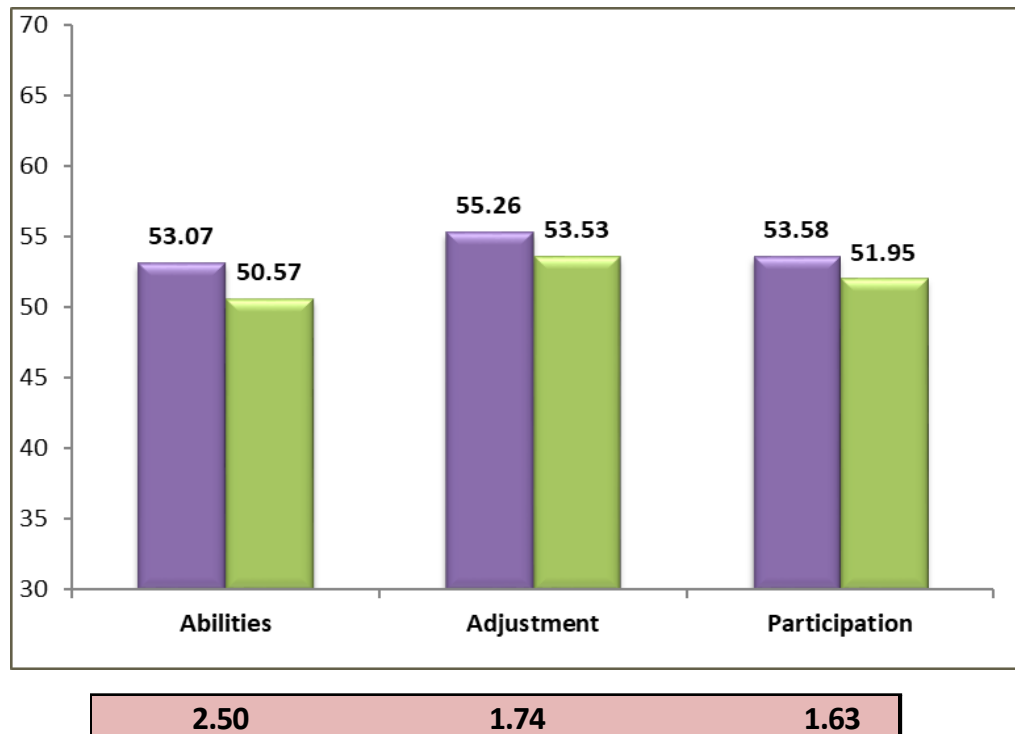
Average Age = 45 years

Greatest Changes:
46% individuals received services within 1 year of injury.

Improved: Mobility, Upper extremities, communication, attention, memory; Fatigue, self-awareness; Initiation, Social and Leisure, self-care, home skills, transportation, and productive activities.

Treatment Efficacy

Reduce disability over time. This graph shows that lower scores are achieved at the home and community integration level.



Program Types:
Home & Community
(N = 76)

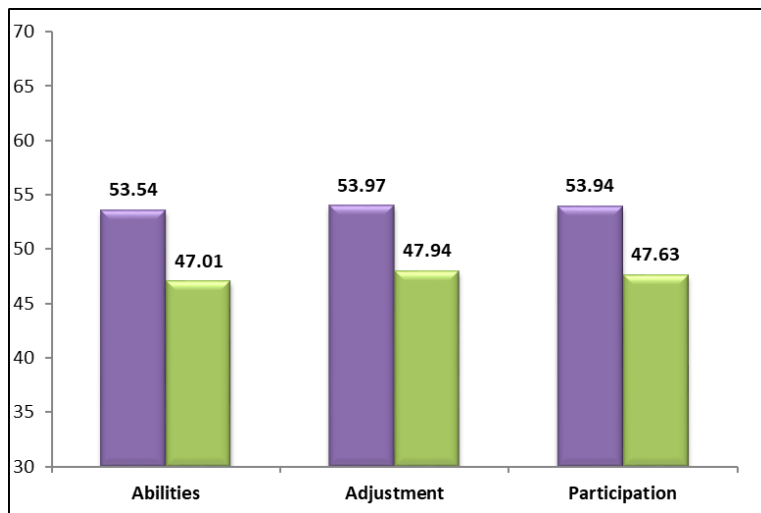
Average Age = 47 years

Greatest Changes:
30% of individuals
received services within
a year of injury.

Improved: Attention,
Memory, non-verbal
communication;
Irritability; Social Skills;
Home skills; Productive
activity; Managing
money.

Treatment Efficacy

Reduce disability over time. This graph shows that lower scores are achieved for men and women in program.



6.54

6.03

6.31

No differences in gains
between men vs. women in all
program types.

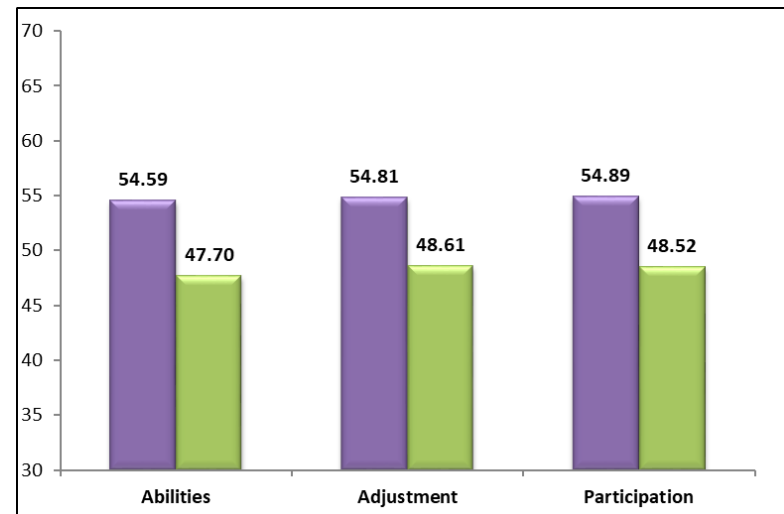
Program Types: ALL

Women = 1,935

Ave Age = 45 years

Men = 4,763

Ave Age = 44 years



6.89

6.20

6.37

Long-term Outcomes – 1 year post discharge



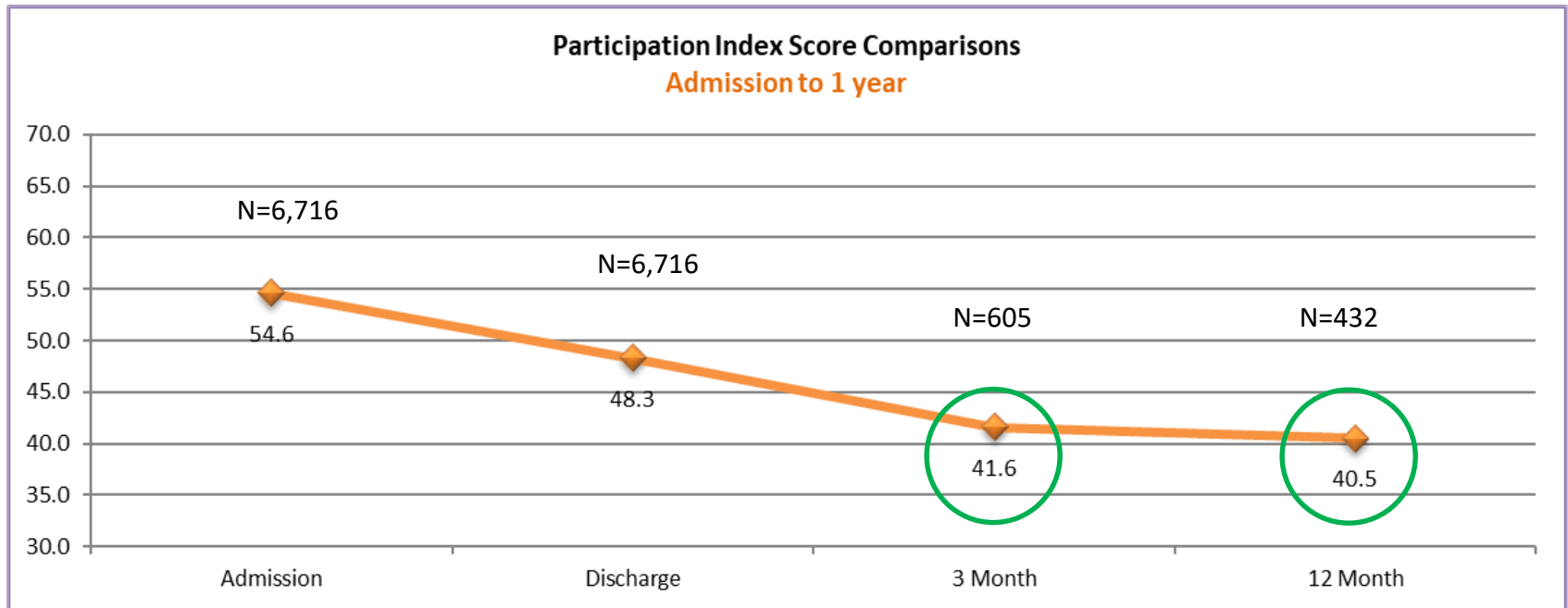
The efficacy of care has to be demonstrated to show that gains can be made, then maintained beyond treatment.

Considerations of Efficacy...

- Prevention of decline through the aging process.
- Treatment reduces disability at any level of care.
- Greater gains are made early in recovery.
- Durability of treatment has been demonstrated.

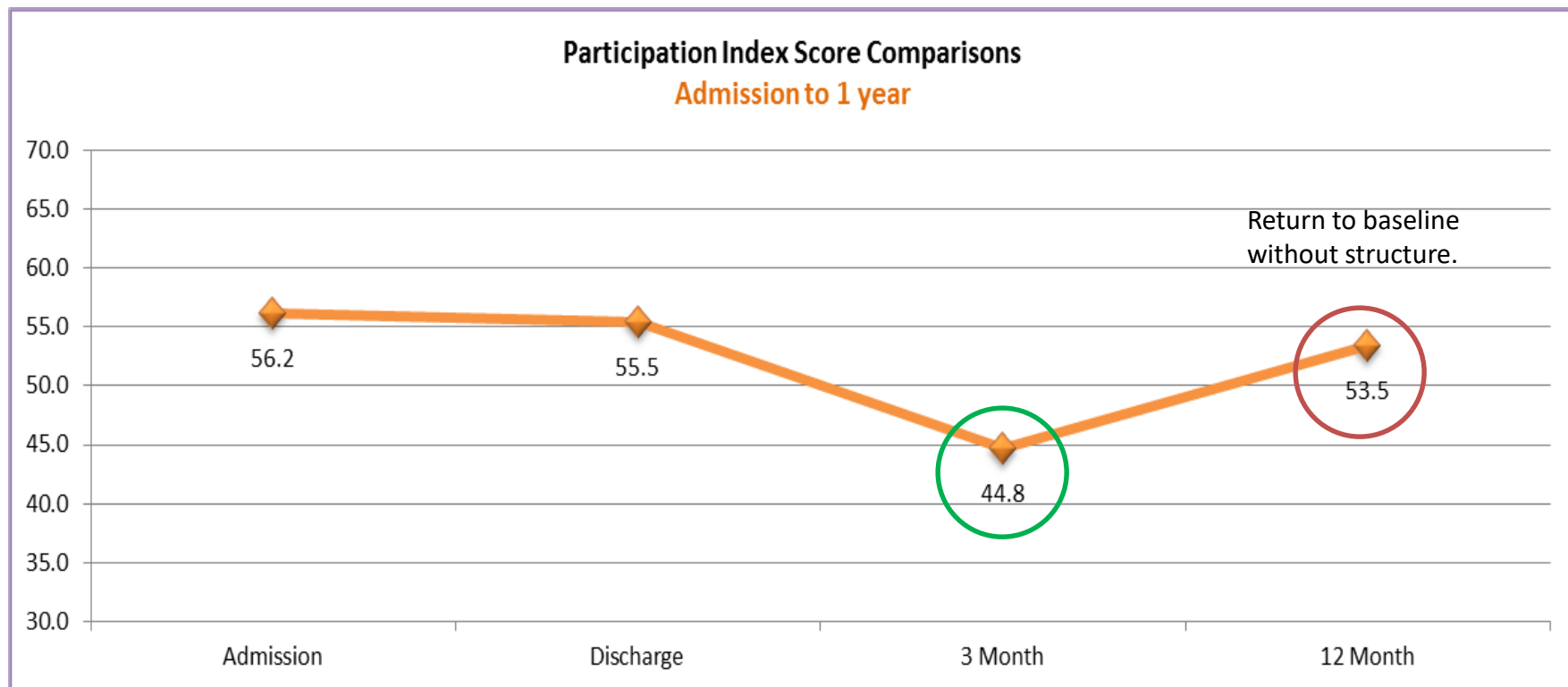
Lewis & Horn, 2022

Outcomes – 1 year post discharge



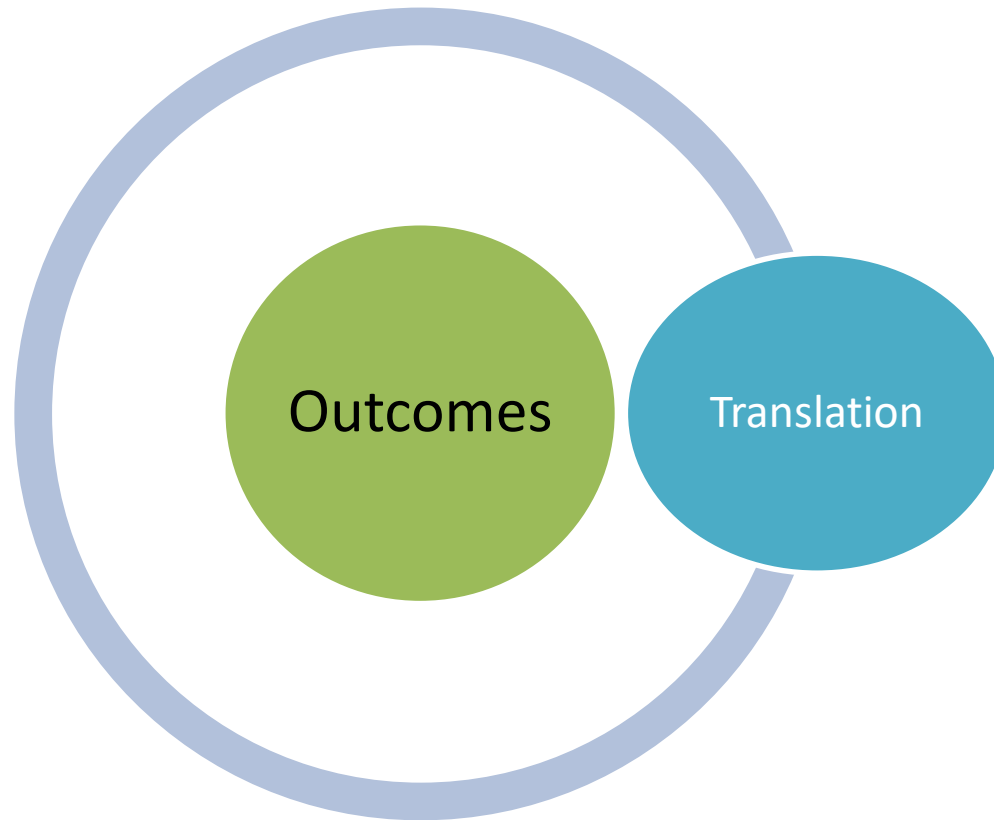
Goal: an individual will continue to maintain their gains; the graph demonstrates that phenomenon with appropriate care for the appropriate length of time.

Treatment Efficacy – Prevention with Supported Living

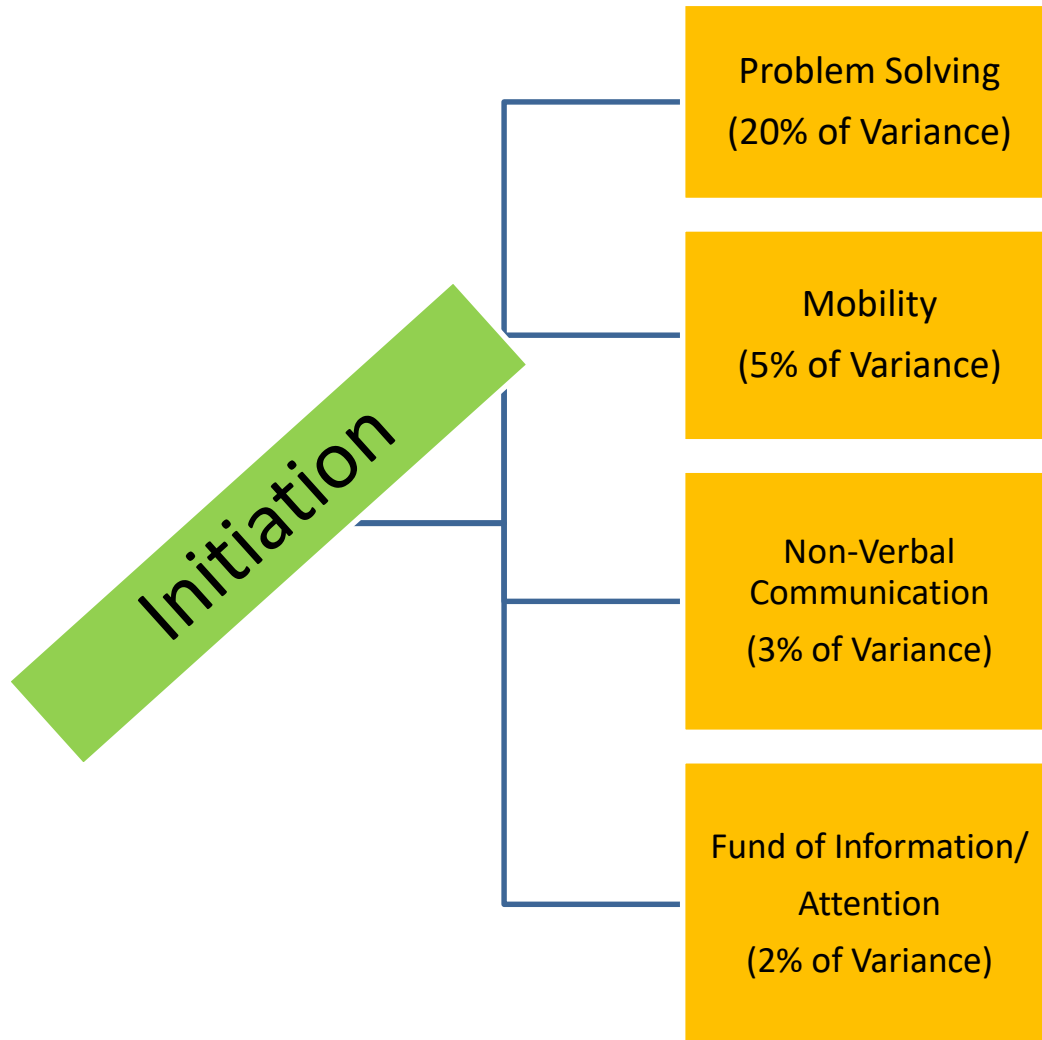


Goal: Individuals that are greater than 4 years post injury typically require ongoing supports and services, and tend to do better with continued structure. Without the structure and support, the individuals are at risk for decline in function (in this graph, higher score indicates greater disability)

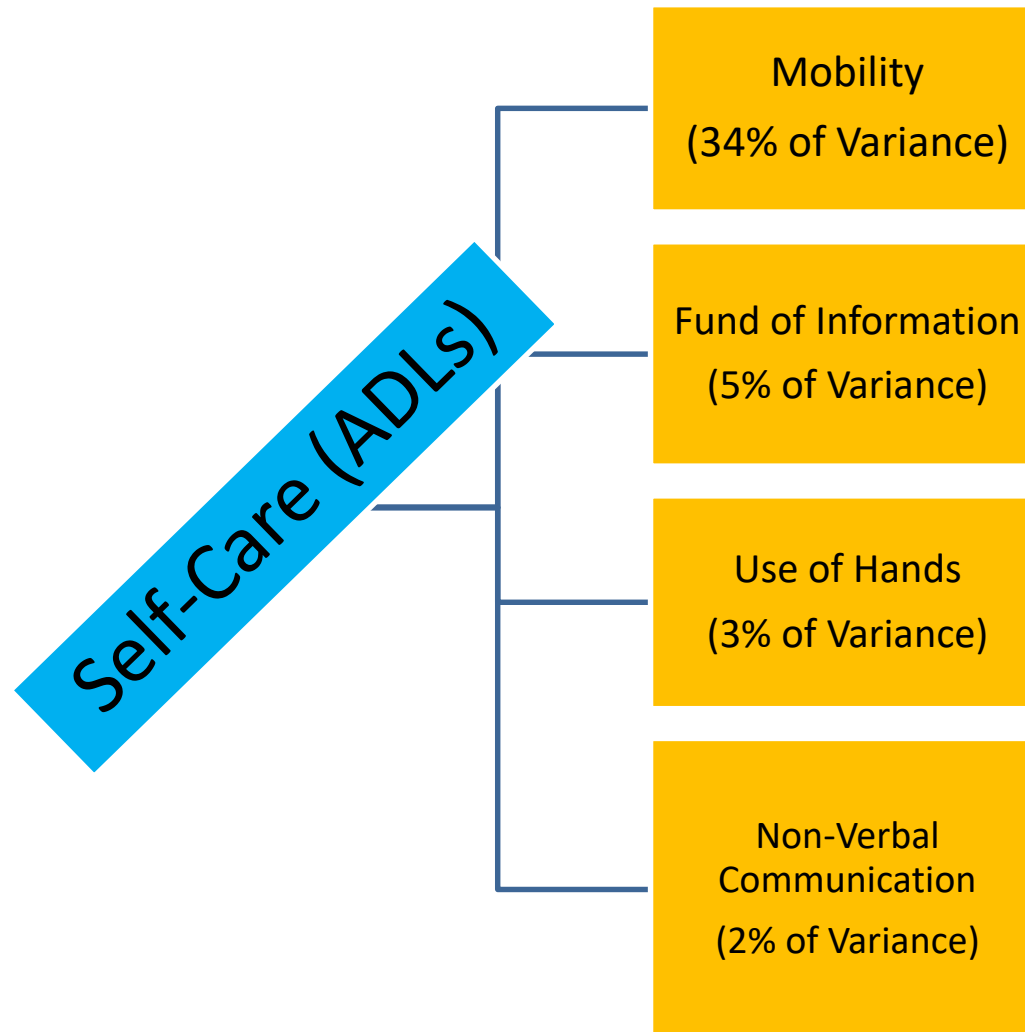
Translation – Outcomes Analysis



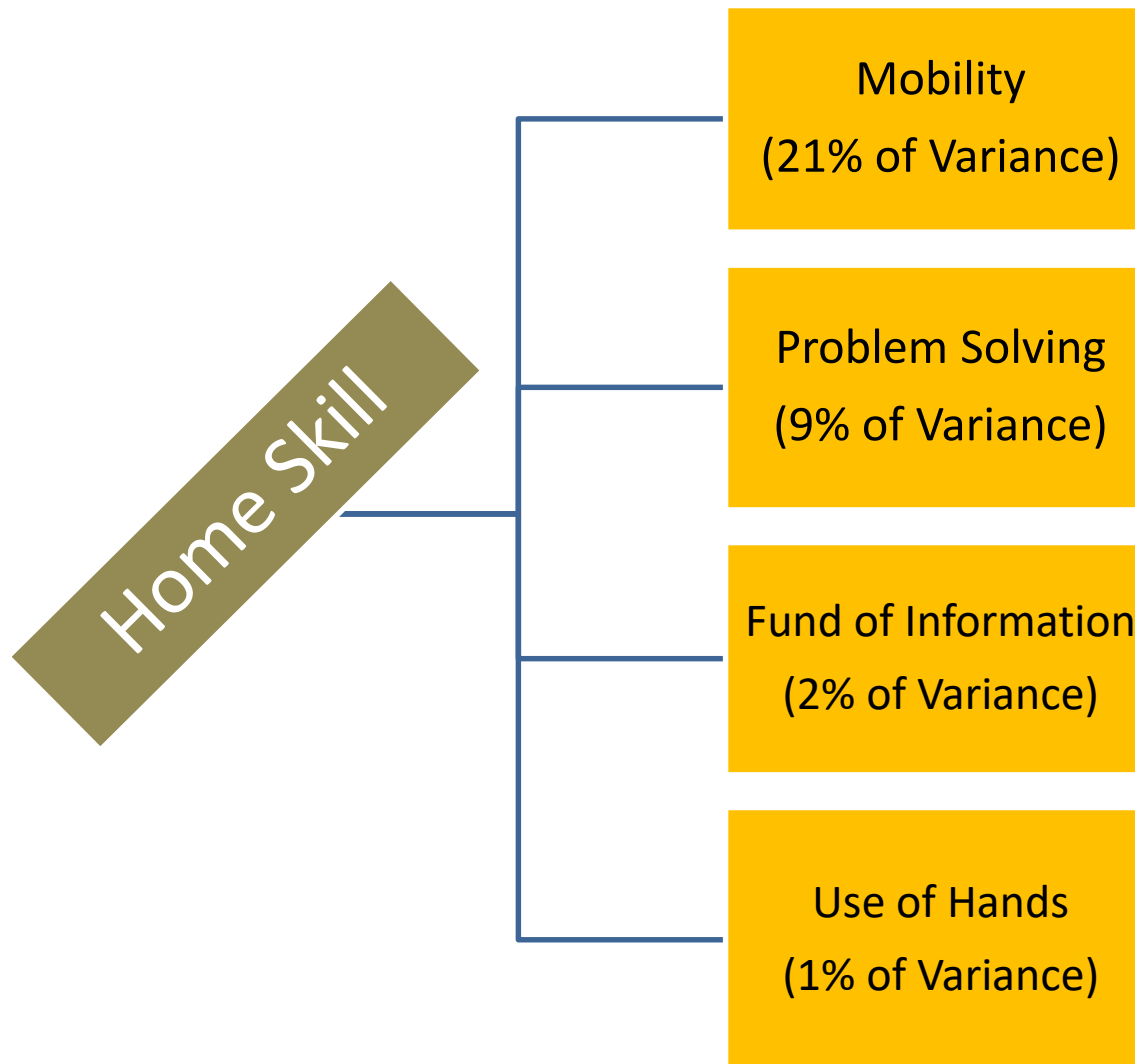
Treatment Efficacy – Targeted Interventions



Treatment Efficacy – Targeted Interventions



Treatment Efficacy – Targeted Interventions



| Take Away Points

Effective rehabilitation is not a random process. Optimal outcomes are achieved by following a prescriptive, evidenced-based order of treatment.

An effective rehabilitation program understands when to use restorative vs. compensatory strategies to achieve outcomes.

The model presented provides a treatment map for therapy services to achieve positive outcomes effectively and efficiently. The map allows for flexibility. The map also allows for entry at any point with a projected end goal.

| Questions



Frank Gordon

Research 2013

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Lewis, F.D. & Horn, G.J. (2013). Traumatic Brain Injury: Analysis of functional deficits and post-hospital rehabilitation outcomes. *Journal of Special Operations Medicine*, 13 (3), 56-61.

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Horn, G.J. & Lewis, F.D. (2014). A Model of Care for Neurological Rehabilitation. *AANLCP – Journal of Nurse Life Care Planning*, 14 (3), 681-691.

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