A New Perspective: Rehabilitation Modeling for the 21st Century

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Gordon J. Horn, Ph.D. / Frank D. Lewis, Ph.D.
Florida State University / Medical College of Georgia
NeuroRestorative Research Institute
Learning Objectives

At the conclusion of this activity, the participant will be able to:

1. Develop an individualized plan of care using a layered approach.
2. Differentiate models of rehabilitation (traditional vs. hierarchical modeling) that is evidence-based.
3. Understand rehabilitation programming regardless of time since injury.
4. Use remediation and compensatory strategies to reduce plateau of the individual being served.
Part I

Measurable Individualized Rehabilitation

Change from Admission to Discharge

Traditional Approach to Care
Traditional Methods of Rehabilitation

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

**Traditional methods – linear modeling:**
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 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.*
- Use of strengths to remediate weaknesses.
- Time Sensitive.

*(Johns Hopkins Medicine, 2016)*
Traditional Rehabilitation

Assess multiple areas of function, then determine what is “normal”, then consider the weaknesses that require rehabilitation efforts using traditional therapeutic intervention.

Example:
Mobility is impaired – Physical Therapy works to restore strength, coordination, and ultimately balance and movement.

Activities of Daily Living – Occupational Therapy works to restore, improve, coordinate upper and lower extremity skills, and ultimately helping an individual to perform daily tasks in living.

Communication – Speech Therapy works to restore understanding and expressing toward others with the goal of managing in the community.
FIM vs. Mayo Portland – measuring progress

Understanding the differences between the use of the Functional Independence Measure (FIM - Hospital) and the MPAI-4 (Post)

– When to use the **Functional Independence Measure (FIM)** – Acute Care measurement (evaluates assistance needs)
  - Acute Hospital Floor – NICU, Neuro step down
  - Acute Rehabilitation Center

– When to use the **Mayo Portland Adaptability Inventory-4 (MPAI)** Post-Acute Care Measurement (evaluates disability impact)
  - Post Acute Rehabilitation
  - Day Treatment
  - Outpatient
  - Home and Community
<table>
<thead>
<tr>
<th>Functional Independence Measure</th>
<th>Mayo Portland Adaptability Inventory - 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 - Complete independence with no helper; No supervision required.</td>
<td>0 = no problems; no adaptive devices are used; no assistance</td>
</tr>
<tr>
<td>6 - Modified independence with no helper; No supervision required.</td>
<td>1 = Mild problem, but does not interfere with activities; may use assistive device or medication to manage; no assistance</td>
</tr>
<tr>
<td>5 - Supervision or setup with helper; &lt;25% supervision to assist is required.</td>
<td></td>
</tr>
<tr>
<td>4 - Minimal assistance with helper; 25% supervision/assistance required.</td>
<td>2 = Mild problem; interferes with activities 5-24% of the time; 75% of the time the persons adapts</td>
</tr>
<tr>
<td>3 - Moderate assistance with helper; 50% supervision/assistance required.</td>
<td>3 = Moderate problem; interferes with activities 25-75% of the time; 24% or less the person adapt</td>
</tr>
<tr>
<td>2 - Maximal assistance with helper; 75% supervision/assistance required.</td>
<td>4 = Severe problem; interferes with activities 76-100% of the time; rarely can the person adapt</td>
</tr>
<tr>
<td>1 - Total assistance with helper; 100% supervision/assistance required.</td>
<td></td>
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</table>
**FIM Objectives (Example)**

- **Lower Scores = Less Disability**

**MPAI-4 Objectives (Example)**

- **Higher Scores = Less Assistance**
MPAI-4 Subscales

Post Hospital Care Measurement

• The Mayo Portland is now in the 4th revision; the ratings have been tested in multiple ways to refine what is measured and how this relates to rehabilitation planning and outcome (e.g., clinical interventions).

• Measure: 29 items that are evaluated with ratings that range from 0-4, and 6 additional items that record pre-injury and post-injury information about the person.

• Three subscales:
  – Ability Index (sensory, motor, and cognitive abilities)
  – Adjustment Index (mood, interpersonal interactions, family interactions)
  – Participation Index (social contacts, initiation, money management, residence)
Clinical Application - Abilities

MPAI-4 Neurorehabilitation Ability Indices

<table>
<thead>
<tr>
<th>Ability</th>
<th>Admission</th>
<th>Discharge</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility</td>
<td>2.22</td>
<td>1.45</td>
<td>3.00</td>
</tr>
<tr>
<td>Use of Hands</td>
<td>1.81</td>
<td>1.26</td>
<td>3.00</td>
</tr>
<tr>
<td>Vision</td>
<td>1.74</td>
<td>1.24</td>
<td>4.00</td>
</tr>
<tr>
<td>Audition</td>
<td>0.57</td>
<td>0.42</td>
<td>0.00</td>
</tr>
<tr>
<td>Dizziness</td>
<td>0.97</td>
<td>0.51</td>
<td>0.00</td>
</tr>
<tr>
<td>Motor Speech</td>
<td>1.25</td>
<td>0.98</td>
<td>1.00</td>
</tr>
<tr>
<td>Verb Comm</td>
<td>1.90</td>
<td>1.36</td>
<td>3.00</td>
</tr>
<tr>
<td>Non-Verb Comm</td>
<td>1.92</td>
<td>1.40</td>
<td>3.00</td>
</tr>
<tr>
<td>Attention</td>
<td>2.59</td>
<td>2.04</td>
<td>4.00</td>
</tr>
<tr>
<td>Memory</td>
<td>2.80</td>
<td>2.13</td>
<td>4.00</td>
</tr>
<tr>
<td>Fund of Infor</td>
<td>1.65</td>
<td>1.27</td>
<td>4.00</td>
</tr>
<tr>
<td>Prob Solve</td>
<td>2.76</td>
<td>2.20</td>
<td>4.00</td>
</tr>
<tr>
<td>Visual-Spatial</td>
<td>2.01</td>
<td>1.38</td>
<td>4.00</td>
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</table>
Clinical Application - Adjustment

MPAI-4 Neurorehabilitation Adjustment Indices

<table>
<thead>
<tr>
<th></th>
<th>Anxiety</th>
<th>Depression</th>
<th>Irritability</th>
<th>Pain Headache</th>
<th>Fatigue</th>
<th>Sx Sensitivity</th>
<th>Inapp Social</th>
<th>Self-awareness</th>
<th>Family Relation</th>
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</thead>
<tbody>
<tr>
<td><strong>Admission</strong></td>
<td>2.06</td>
<td>1.78</td>
<td>1.77</td>
<td>1.64</td>
<td>2.13</td>
<td>1.57</td>
<td>1.6</td>
<td>2.69</td>
<td>2.51</td>
</tr>
<tr>
<td><strong>Discharge</strong></td>
<td>1.51</td>
<td>1.31</td>
<td>1.32</td>
<td>1.12</td>
<td>1.42</td>
<td>1.17</td>
<td>1.28</td>
<td>2.08</td>
<td>2.25</td>
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<tr>
<td><strong>Current</strong></td>
<td>3.00</td>
<td>1.00</td>
<td>2.00</td>
<td>3.00</td>
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<td>2.00</td>
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<td>3.00</td>
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MPAI-4 Neurorehabilitation Participation Indices

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<thead>
<tr>
<th></th>
<th>Initiation</th>
<th>Social Contact</th>
<th>Leisure/Rec</th>
<th>Self-care</th>
<th>Residence</th>
<th>Transport</th>
<th>Paid Emply</th>
<th>Other Emply</th>
<th>Money Manage</th>
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</thead>
<tbody>
<tr>
<td>Admission</td>
<td>2.52</td>
<td>2.85</td>
<td>2.96</td>
<td>2.22</td>
<td>3.36</td>
<td>3.65</td>
<td>3.52</td>
<td>3.51</td>
<td>3.26</td>
</tr>
<tr>
<td>Discharge</td>
<td>1.9</td>
<td>2.21</td>
<td>2.18</td>
<td>1.4</td>
<td>2.15</td>
<td>3.12</td>
<td>3.17</td>
<td>3.08</td>
<td>2.66</td>
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<td>Current</td>
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Part II

Traditional Rehabilitation vs. Hierarchical Model
Disruption... Times are changing

“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 see things in a way that leads to discovery.

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!
Disruption

Question...
How do we disrupt a process that has been around for decades??

Answer...
Change the view ... (look at it different)
Change the approach ... (use statistics)
Change the outcome ... (model of care that is timeless)
Disruption

Change the view ... (look at it different)

Level 1
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Level 9

Enter any level based on need / deficit
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 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?
More specifically, this analysis has been used to demonstrate two important concepts with measures such as the MPAI-4: item and person fit.

How items contributing to a measure represent the underlying construct (disability),

... and ...

How well the items provide a range of indicators that reliably differentiate among people rated with the measure.”

(Malec & Lezak, 2008)
RELAX...

We’re getting to the good stuff!
Theory to Application

Rehabilitation Modeling:
Using *Evidence* to enhance *Quality*

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

**Results:** The use of the MPAI-4 with the current sample *provided high person reliability (0.90) and excellent item reliability (1.00).* This sample provided similar statistical findings to the original work by Malec & Lezak (2008), but in a post-hospital residential sample providing additional evidence of core construct of outcome after acquired brain injury.

**Translation:** A *clinical model of care* was developed from this analysis to *prioritize* therapeutic interventions. The model produced provides a new approach to rehabilitation for those with acquired neurological impairments.
# Rasch Model of Care

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<td>######</td>
<td>MOTOR SPEECH</td>
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<td>######</td>
<td>PAIN/HEADACHE, VISION</td>
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<tr>
<td>#######</td>
<td>USE OF HANDS, INAPPROPRIATE SOCIAL, IRRITABILITY, SYMPTOM SENSITIVITY</td>
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<tr>
<td>#######</td>
<td>DEPRESSION, FUND OF INFORMATION, VISUAL PERCEPTION,</td>
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<tr>
<td>#######</td>
<td>ANXIETY, FATIGUE, MOBILITY, NON-VERBAL COMM, VERBAL COMM</td>
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<td>0</td>
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<td>#######</td>
<td>SELF-CARE</td>
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<td>#######</td>
<td>FAMILY FUNCTION</td>
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<td>####### S</td>
<td>INITIATION, PRODUCTIVITY</td>
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<td>####### S</td>
<td>ATTENTION, IMPAIRED AWARENESS, MEMORY</td>
</tr>
<tr>
<td>####</td>
<td>NOVEL PROBLEM SOLVE, SOCIAL CONTACT</td>
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<td>####</td>
<td>LEISURE</td>
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<td>HOME SKILLS</td>
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<td>TRANSPORTATION USE</td>
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Sample Size = 1,710 persons
Part IV
Quality Care

Providing an Individualized Approach...

*Person Specific and not Time Dependent*
New Evidenced Based Model

High Impact/Low Probability Barriers

Medium Impact / Medium Probability Barriers

Integrated Treatment – Remediation & Compensation

Skills Application Phase – I-ADLs
New Evidenced Based Model – Phase A

High Impact/Low Probability Barriers

Audition
Dizziness
Motor Speech
Pain/Headache
Vision, and Hands

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

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.
New Evidenced Based Model – Phase A

High Impact/Low Probability Barriers

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

Sensitivity to Symptoms

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

In this second level, the focus is based on neurobehaviorial concerns. 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.
New Evidenced Based Model – Phase B

Medium Impact / Medium Probability Barriers

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

**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, 2016).
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

Leisure
Money Management
Home Skills
Transportation Use

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

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).
Discussion

Conclusions

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 impairment.
Model Summary

**High Impact/Low Probability Barriers**
Audition, Dizziness, Motor Speech, Pain/Headache, Vision, Hands

**Medium Impact / Medium Probability Barriers**
Inappropriate Social Awareness, Irritability, Sensitivity to Symptoms

**Integrated Treatment – Remediation & Compensation**
Depression, Fund of Information, Visual Perception, Anxiety, Fatigue, Mobility, Non-Verbal Communication, Verbal Communication, Self-care, Family Function, Initiation, Productivity, Attention, Impaired Awareness, Memory, Novel Problem Solving, Social Contact

**Skills Application Phase – I-ADLs**
Leisure, Money Management, Home Skills, Transportation Use
References