Characterizing Speech and Language Pathology Outcomes in Stroke Rehabilitation

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Brendan Conroy, MD
Randall J. Smout, MS
The focus of our time together

- Describe Practice-Based Evidence Clinical Practice Improvement (PBE-CPI) design
- Describe the Post Stroke Rehabilitation Outcomes Project (PSROP)
- Examine who receives SLP services in post-stroke rehabilitation
- Examine how SLPs spend their time with patients in post-stroke rehabilitation
The focus of our time together

- Review the results of early data analyses regarding outcomes
- Consider clinical implications of the findings
- Consider limitations and future data queries
- Try not to think about the mojitos we’re missing out on by being here
Practice-Based Evidence for Clinical Practice Improvement

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PBE-CPI Study Design

- Content and timing of individual steps of a health care process, to determine how to achieve:
  - Superior medical outcomes
  - Least necessary cost
  - Across the continuum of care
Goals of PBE-CPI

- Improve/standardize process factors
  - Practitioner activities/interventions
  - Other interventions
  - Medications
  - “what we did”
Goals of PBE-CPI

- Control for *patient factors*
  - Psychosocial/demographic Factors
  - Disease(s)
  - Severity of Disease(s)
  - Physiologic signs and symptoms
  - Multiple points in time
  - “for whom we did it”
Goals of PBE-CPI

- Measure outcomes
  - Clinical
  - Health status
  - Length of stay
  - Discharge location
  - “how far we got” and “how much it cost to get there”
Characteristics of a PBE study

- Non-experimental – follows outcomes of treatments actually prescribed
- Inclusive – uses pt. populations undergoing routine clinical care
- Pragmatic – uses actual clinical outcomes
- Lower cost
Advantages of PBE study

- Can simultaneously study outcomes of a large variety of treatments
- Can ask complex questions regarding treatment sequence effects, conditional effectiveness
- Can look at treatment effectiveness in whole clinical populations
  - More heterogeneous – reflecting clinical reality
  - Less pt. selection bias – no requirement to consent
# PBE-CPI: an alternative to Randomized Control Trials

## PBE – CPI

<table>
<thead>
<tr>
<th>Patient Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use severity of illness to measure comorbidities and disease severity</td>
</tr>
<tr>
<td>All patient qualify</td>
</tr>
</tbody>
</table>

## RCT

<table>
<thead>
<tr>
<th>Patient Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eliminate patients who could bias results based on comorbidities and more serious disease</td>
</tr>
<tr>
<td>15% of patients qualify</td>
</tr>
<tr>
<td><strong>PBE-CPI</strong></td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td><strong>Process Variables</strong></td>
</tr>
<tr>
<td>Methods for stabilization</td>
</tr>
<tr>
<td><strong>Measure all processes and use analysis findings to develop protocol associated with better outcomes</strong></td>
</tr>
</tbody>
</table>
### PBE-CPI: an alternative to Randomized Control Trials

<table>
<thead>
<tr>
<th>PBE-CPI</th>
<th>RCT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Variables</strong></td>
<td><strong>Outcome Variables</strong></td>
</tr>
<tr>
<td>Dynamic improvement based on combinations of interventions</td>
<td>Change based on one protocol</td>
</tr>
<tr>
<td><strong>Result</strong></td>
<td><strong>Result</strong></td>
</tr>
<tr>
<td>Effectiveness research (usual conditions)</td>
<td>Efficacy research (ideal conditions)</td>
</tr>
</tbody>
</table>
PBE-CPI: an alternative to Randomized Control Trials

**PBE-CPI**
- Hypotheses many and vague
- Alternatives *not* discrete
- Local knowledge contributes

**RCT**
- Hypothesis clear
- Alternatives discrete
- Not depend on local knowledge
PBE-CPI: an alternative to Randomized Control Trials

PBE-CPI
- Confounders affect outcomes and are interesting
- Effects are large

RCT
- Confounders not interesting
- Effects are small
Alternatives to RCTs in the Literature

- Results from 2 NEJM studies
  
  “Average results of the observational studies were remarkably similar to those of the randomized, controlled trials”

New England Journal of Medicine 2000
(June 22, 2000) 342: 1878-92
Alternatives to RCTs in the Literature

- Conclusions from JAMA study
  “Significant between-study variability was seen as frequently among RCTs as between RCTs and non-randomized studies.”

  “…may reflect differences in true treatment effects under different study settings and in different populations.”

  JAMA (Aug 2001) 286, 7:821-830
So what is a PBE-CPI study?

- Three-dimensional measurement framework
  - Patient variables, process variables, and outcomes
- Adjusts for severity of illness
- Led by a transdisciplinary team that
  - Develops and frames questions
  - Defines variables for study
  - Gathers data
  - Interprets findings
  - Implements findings
Measuring and Adjusting for Severity of Illness

Comprehensive Severity Index (CSI®)

- 2,200 + individual criteria
  - 5,500 disease specific groups
- Disease-specific and overall severity levels on a scale of 0 – 4, continuous
- Fixed times for inpatient reviews
  - Admission
  - Maximum
  - Discharge review
Components of a PBE-CPI Study

- Development of data collection tool to record practices for each point of contact
- Patients enrolled, normal practices recorded via point-of-care forms
- Retrospective chart review to record data regarding patient, processes, and outcomes
- Retrospective chart review using CSI®
- Data analyzed and findings interpreted
A Previous PBE-CPI Study

Nursing Home Study (NPLUS) 1996-1997
- 6 LTC provider organizations
- 109 facilities
- 2,490 residents studied

Outcomes
- Developed pressure ulcer
- Healed pressure ulcer
- Hospitalization
- Systemic Infections
A Previous PBE-CPI Study

Outcome: Develop Pressure Ulcer

- More likely to develop a pressure ulcer if:
  - The patient was male
  - The patient was >85 years old
  - Static pressure relieving devices were used
  - Dependency in greater or equal to 7 ADLs
  - Signs of dehydration
  - Weight loss of more than 5% in last 30 days
  - Mechanical devices such as catheters were used
A Previous PBE-CPI Study

Outcome: Develop Pressure Ulcer

- Less likely to develop a pressure ulcer if:
  - Disposable briefs were used
  - Toileting program was used
  - Combination of newer SSRI and antipsychotic were used
  - RN spent more than 15 minutes with the patient
  - Fluid orders and nutritional supplements were used
Pressure Ulcer Clinical Outcomes
Post Implementation

- Development of pressure ulcers for high-risk residents
  - decreased from
    - 14% pre-implementation to 8.7% post-implementation
    - is still decreasing
Post-Stroke Rehabilitation Outcomes Project (PSROP)

- Using PBE-CPI to investigate the “black box” of post-stroke rehabilitation
  - 6 US sites, 1 New Zealand
  - A study team at each site:
    - Physician
    - Nursing
    - Social Work
    - Psychology
    - PT/OT/SLP
    - Therapeutic Recreation
# Post-Stroke Rehabilitation Outcomes Project (PSROP)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Site Director(s)</th>
<th>Type</th>
<th>Beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Rehabilitation Hospital</td>
<td>Washington, DC</td>
<td>B Conroy, MD</td>
<td>Freestanding</td>
<td>128</td>
</tr>
<tr>
<td>Univ. of Pennsylvania Med Center</td>
<td>Philadelphia, PA</td>
<td>R Zorowitz, MD</td>
<td>Rehab Unit</td>
<td>24</td>
</tr>
<tr>
<td>LDS Hospital Rehabilitation Ctr</td>
<td>Salt Lake City, UT</td>
<td>D Ryser, MD</td>
<td>Rehab Unit</td>
<td>26</td>
</tr>
<tr>
<td>Legacy Health System</td>
<td>Portland, OR</td>
<td>F Wong, MD</td>
<td>Rehab Unit</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LA Sims, RN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stanford University Hospital</td>
<td>Palo Alto, CA</td>
<td>J Teraoka, MD</td>
<td>Rehab Unit</td>
<td>17</td>
</tr>
<tr>
<td>Loma Linda Univ. Medical Center</td>
<td>Loma Linda, CA</td>
<td>M Brandstater, MD</td>
<td>Rehab Unit</td>
<td>40</td>
</tr>
<tr>
<td>Wellington/Kenepuru Hospitals</td>
<td>Wellington, NZ</td>
<td>H McNaughton, MD</td>
<td>Rehab Unit</td>
<td>25, 20</td>
</tr>
</tbody>
</table>
PSROP Study Questions

- Which *patient characteristics* are associated with improved post-stroke outcomes?
- Which *treatment interventions* or combinations are associated with improved outcomes (when controlling for patient characteristics)?
- What is the *optimal intensity and duration* of various post-stroke treatment interventions?
PSROP Patient Variables

- Age, gender, race
- Payer source
- Type and side of stroke
- Stroke location
- Admission FIM
- Case-mix group

- Admission severity of illness
- Acute care hospital LOS
- Date/time of stroke symptom onset
PSROP Process Variables

- Rehabilitation LOS
- Medications
- Nutritional process
- Pain management
- Time to first rehab
- Oxygen use

- Specific therapy interventions
- Intensity, frequency, and duration of therapy interventions
PSROP Inclusion Criteria

- Rehab diagnosis: ICD-9 code of 430-438.99, 997.02, or 852-853
- 18 years or older
- 1st inpatient rehab admission after current stroke
- If interrupted stay – remained in study if less than 30 day interruption
- No exclusion criteria or need for consent
PSROP Data Collection

- Supplemental documentation from all rehab disciplines at point of contact
- Retrospective chart review for Auxiliary Data Module (records data re: all variables) and CSI®
- March 2001 – March 2003
- 200 patients/site for consecutive stroke admissions
PSROP Limitations

- Reliance on chart review
- Limited acute care information
- No standard of initial stroke severity (e.g. NIH Stroke Scale) in all facilities
- CSI dependent on ICD-9 codes
- Point of care documentation
  - Train-the-trainer approach
  - Burdensome to team members
  - Paper – some may have been misplaced
The Depth of the Data Set

- 141,511 point of care forms
- 235 variables captured once for each patient
- 71 complication/process variables that depended on each patient’s length of stay
- 15 variables captured daily over length of stay
- Up to 8 variables per medication administered
Point-of-Care Documentation
All Clinical Services

Development of a taxonomy of rehab activities to capture *in detail* what clinicians do – it had to:

- be quick (less than 1 minute) to complete
- record duration of activity and date of session
- break down into *activities* and *interventions*
  - Activities: general target area of the task – broad
  - Interventions: strategies, cues, protocols, equipment, education, diagnostic tests
Point-of-Care Documentation
SLP Activities

- Pre-functional
- Swallowing
- Face/Neck mobility
- Speech/Intelligibility
- Voice
- Verbal Expression
- Alternative/Non-verbal Expression
- Written Expression

- Auditory comprehension
- Reading comprehension
- Problem solving/reasoning
- Orientation
- Attention
- Memory
- Pragmatics
- Executive functional skills
Point-of-Care Documentation
SLP Interventions

- Adaptive and Compensatory Strategies
- Neuromuscular Interventions
- Modalities
- Devices
- Perception
- Soft Tissue Work
- Education/Counseling
- Diagnostic Tests
  - Did not include standardized tests
Point-of-Care Documentation
Additional Data Points

- Date
- Time spent in:
  - Co-treatment
  - Formal assessment
  - Supervisory/team input
  - Preparation of activities
  - Group treatment
- Professional level of treating clinician
  - SLP
  - SLP-A
  - SLP aide/tech
  - SLP student
### Speech & Language Therapy Rehabilitation Activities

<table>
<thead>
<tr>
<th>Intervention Codes</th>
<th>Duration of Activity</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive &amp; Compensatory Strategies:</td>
<td>Enter in 5 minute increments.</td>
<td>Enter one intervention code per group of boxes.</td>
</tr>
<tr>
<td>01. Memory strategies</td>
<td>Pre-Functional Activity</td>
<td></td>
</tr>
<tr>
<td>02. Motor speech strategies</td>
<td>Swallowing</td>
<td></td>
</tr>
<tr>
<td>03. Swallowing strategies</td>
<td>Face/Neck Mobility</td>
<td></td>
</tr>
<tr>
<td>04. Diet modification/evaluation</td>
<td>Speech/Intelligibility</td>
<td></td>
</tr>
<tr>
<td>05. Arousal strategies</td>
<td>Voice</td>
<td></td>
</tr>
<tr>
<td>06. Point/gesture strategies</td>
<td>Verbal expression</td>
<td></td>
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<tr>
<td>07. Visual strategies/cueing</td>
<td>Written expression</td>
<td></td>
</tr>
<tr>
<td>08. Verbal strategies/cueing</td>
<td></td>
<td></td>
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<tr>
<td>09. Auditory strategies/cueing</td>
<td></td>
<td></td>
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<tr>
<td>10. Tactile strategies/cueing</td>
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<td></td>
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<tr>
<td>11. Analysis &amp; summary strategies/cueing</td>
<td></td>
<td></td>
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<tr>
<td>Neuromuscular Interventions:</td>
<td></td>
<td></td>
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<tr>
<td>12. Oral motor treatment/ROM</td>
<td></td>
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<tr>
<td>13. Respiratory treatments</td>
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<td>14. Vocal treatments</td>
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<td>15. Resonance treatments</td>
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<tr>
<td>16. NDT</td>
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<tr>
<td>17. DPNS</td>
<td></td>
<td></td>
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<tr>
<td>18. Thermal tactile stimulation</td>
<td></td>
<td></td>
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<tr>
<td>19. Postural awareness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modalities:</td>
<td></td>
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<tr>
<td>20. EMG</td>
<td></td>
<td></td>
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<tr>
<td>21. Biofeedback</td>
<td></td>
<td></td>
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<tr>
<td>22. Electrical stimulation</td>
<td></td>
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<tr>
<td>Devices:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Incentive spirometry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Memory book/aids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Speaking valves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. Augmentative communication devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. Computer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Visi pitch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. Nasal manometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. Right or left side awareness strategies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft Tissue Work:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. Strengthening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. Stretching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. Myofascial release</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34. Beckman protocol</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sample**

- **Patient ID:**
- **Therapist:**
- **Date of Therapy Session:**
- **Time session begins:**

**Duration of Activity**

- **Pre-Functional Activity**
- **Swallowing**
- **Face/Neck Mobility**
- **Speech/Intelligibility**
- **Voice**
- **Verbal expression**
- **Written expression**

**Interventions**

- **Alternative/non-verbal expression**: 15 06
Um, we’re going to need a few more boxes

- Fast forward to when
  - All of the charts are reviewed for CSI and ADM information
  - All of the point-of-care forms are scanned
  - Data was “cleaned”

There was a huge pile of information and data waiting to be organized!
Data Analysis

- Manageable bites
  - For analysis, “blocks” of therapy time were identified
  - 1 block of SLP treatment = 3 hours
  - 1 block of OT treatment = 4 hours
  - 1 block of PT treatment = 6 hours
  - Allows for comparison of groups while eliminating natural recovery time
Grab your coffee, it’s time for statistics

- **Descriptive statistics**
  - Study variables

- **Chi-tests**
  - Used to compare patient, process, and outcome variables

- **ANOVA**
  - Continuous data

- **Logistic regression**
  - Variables entered step-wise into model
  - Importance determined via Wald chi-square
General Outcomes of the PSROP
US subjects: N = 1,161

- Patient demographics
  - Male 51.8% Female 49.2%
  - White 61% Black 23%

- Average age 66.0 (18.6 – 95.5)

- Common comorbidities
  - HTN 78.6%
  - DM 30.8%
  - CAD 22.5%
General Outcomes of the PSROP

- Process demographics
  - Average time from onset to admission to rehab: 13.8 days
  - Mean rehab LOS: 18.6

- The stroke itself
  - Right 44.2%  Left 42.5%  Bilateral 10.5%
  - Hemorrhagic 23.2%
  - Ischemic 76.7%
General Outcomes of the PSROP

- **Severity**
  - **CMG**
    - Mild (101-103): 11.5%
    - Moderate (104-107): 39.6%
    - Severe (108-114): **42.5%**
  - **Admission FIM (mean)**
    - Total: 61.0
    - Motor: 40.1
    - Cognitive: 21.0
  - **Severity of illness per CSI (mean):** 20.7
  - **Discharge to home:** 81%
Factors Associated with Outcomes

- Interpreting outcomes
  - Associations vs. causations
  - For patients who had ___?___ on admission, they were more/less likely to achieve the outcome.
  - For patients who spent more time in ___?___, they were more/less likely to achieve the outcome.

- Will need predictive validity studies to follow-up
## Outcome: Discharge Motor FIM

**Moderate stroke**

<table>
<thead>
<tr>
<th>General Assessment</th>
<th>PT Interventions</th>
<th>OT Interventions</th>
<th>SLP Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Formal assessment</td>
<td>Toileting</td>
<td>Speech intelligibility</td>
</tr>
<tr>
<td>Female</td>
<td>Bed mobility</td>
<td>Transfers</td>
<td>Auditory comprehension</td>
</tr>
<tr>
<td>Brainstem/ Cereb</td>
<td>Transfer</td>
<td>Home management</td>
<td>Voice</td>
</tr>
<tr>
<td>Mod motor imp.</td>
<td></td>
<td>Upper extremity control</td>
<td></td>
</tr>
<tr>
<td>Admission motor FIM</td>
<td></td>
<td></td>
<td>Problem solving</td>
</tr>
<tr>
<td>General Interventions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medications</td>
<td></td>
</tr>
<tr>
<td>Days onset to rehab</td>
<td></td>
<td>Anti-Parkinson</td>
<td></td>
</tr>
<tr>
<td>LOS</td>
<td></td>
<td>Opioid analgesics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advanced gait</td>
<td>Atypical</td>
<td>antipsychotics</td>
</tr>
</tbody>
</table>
### Outcome: Discharge Motor FIM
**Moderate stroke – 1st tx block only**

<table>
<thead>
<tr>
<th>General Assessment</th>
<th>PT Interventions</th>
<th>OT Interventions</th>
<th>SLP Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Sitting</td>
<td>Bathing</td>
<td>Auditory comprehension</td>
</tr>
<tr>
<td>Female</td>
<td>Transfer</td>
<td>Feeding/Eating</td>
<td>Voice</td>
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<tr>
<td>Brainstem/ Cereb</td>
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<td>Mod motor imp.</td>
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**Admission motor FIM**

<table>
<thead>
<tr>
<th>General Interventions</th>
<th>Medications</th>
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</thead>
<tbody>
<tr>
<td>Days onset to rehab</td>
<td>Muscle relaxant</td>
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<tr>
<td>LOS</td>
<td>Opioid analgesics</td>
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<td></td>
<td>Old anticonvulsants</td>
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</table>
**Outcome: Discharge Cognitive FIM**

**Moderate stroke**

<table>
<thead>
<tr>
<th>General Assessment</th>
<th>PT Interventions</th>
<th>OT Interventions</th>
<th>SLP Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphasia</td>
<td>Feeding/Eating</td>
<td>Auditory comprehension</td>
<td></td>
</tr>
<tr>
<td>Admission cognitive FIM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Medications**

- Anti-Parkinsons
- Opioid analgesics
- New SSRIs
Outcome: Discharge Cognitive FIM
Moderate stroke– 1st tx block only

<table>
<thead>
<tr>
<th>General Assessment</th>
<th>PT Interventions</th>
<th>OT Interventions</th>
<th>SLP Interventions</th>
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</thead>
<tbody>
<tr>
<td>Aphasia</td>
<td>Toileting</td>
<td>Auditory comprehension</td>
<td></td>
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<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admission cognitive FIM</td>
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<table>
<thead>
<tr>
<th>General Interventions</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anti-Parkinsons</td>
</tr>
<tr>
<td></td>
<td>Old Anti-nausea</td>
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</tbody>
</table>
### Outcome: Discharge Motor FIM

**Severe stroke**

<table>
<thead>
<tr>
<th>General Assessment</th>
<th>PT Interventions</th>
<th>OT Interventions</th>
<th>SLP Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Formal assessment</td>
<td>Home management</td>
<td>Swallowing</td>
</tr>
<tr>
<td>Black race</td>
<td>Bed mobility</td>
<td></td>
<td>Orientation</td>
</tr>
<tr>
<td>Mild motor impairment</td>
<td>Gait</td>
<td></td>
<td>Reading comprehension</td>
</tr>
<tr>
<td>Admission motor FIM</td>
<td>Advanced gait</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admission cognitive FIM</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

#### Medications

- **Anti-Parkinsons**
- **Modafinil**
- **Old SSRIs**

- **Days onset to rehab**
- **Enteral feeding**
## Outcome: Discharge Motor FIM

Severe stroke—1st tx block only

<table>
<thead>
<tr>
<th>General Assessment</th>
<th>PT Interventions</th>
<th>OT Interventions</th>
<th>SLP Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Bed mobility</td>
<td>Home management</td>
<td></td>
</tr>
<tr>
<td>Severe motor impairment</td>
<td>Gait</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No dysphagia</td>
<td>Advanced gait</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admission motor FIM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No dysphagia</td>
<td></td>
<td></td>
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<tr>
<td>Neurotropic meds</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>General Interventions</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days onset to rehab</td>
<td>Other antidepressant</td>
</tr>
<tr>
<td>Enteral feeding</td>
<td>Old SSRIs</td>
</tr>
<tr>
<td>LOS</td>
<td></td>
</tr>
</tbody>
</table>
Outcome: Discharge Cognitive FIM
Severe stroke

<table>
<thead>
<tr>
<th>General Assessment</th>
<th>PT Interventions</th>
<th>OT Interventions</th>
<th>SLP Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphasia</td>
<td>Advanced gait</td>
<td>Grooming</td>
<td>Auditory comprehension</td>
</tr>
<tr>
<td>Mood and cognitive disturbance</td>
<td>Bed mobility</td>
<td>Orientation</td>
<td></td>
</tr>
<tr>
<td>Admission cognitive FIM</td>
<td>Functional mobility</td>
<td>Verbal expression</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Community integration</td>
<td>Problem solving</td>
<td></td>
</tr>
</tbody>
</table>

General Interventions

Medications

LOS
### Outcome: Discharge Cognitive FIM

**Severe stroke – 1\textsuperscript{st} tx block only**

<table>
<thead>
<tr>
<th>General Assessment</th>
<th>PT Interventions</th>
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<tbody>
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<td>Aphasia</td>
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<td>Bed mobility</td>
<td>Orientation</td>
</tr>
<tr>
<td>Mood and cognitive disturbance</td>
<td></td>
<td></td>
<td>Problem solving</td>
</tr>
</tbody>
</table>

- Race: other
- Max severity of illness
- Severe motor impairment
- Right brain stroke

**Admission cognitive FIM**

**Days onset to rehab**

**LOS**
Trends Across Disciplines

- Patients involved in **higher level activities** in the **first block of therapy** despite their initial level of impairment were **more** likely to be “successful”

  - PT: early gait training
  - OT: home management
  - SLP: problem solving

- What made the treating clinician decide **to do** these activities with severe patients?
  - They had “nothing to lose”.

- Why **didn’t** they decide to do these activities?
  - Staffing issues, size of the patient, time resources
Is there something to this?

The question:

Does introduction of high-level SLP activities *early* in post-stroke rehabilitation correlate with improved outcomes for low to mid-level functioning communicators following stroke?
What we (thought we) knew about SLP practice in inpatient rehab

- Assessment leads to identified deficit areas

- Treatment plans target deficit areas directly
  - lead to improvement in the deficit area
    - deficit in verbal expression +
    - therapy targets verbal expression =
    - measurable improvement in verbal expression
Interventions and activities are introduced in a hierarchy of complexity

- from simple to complex
- more impaired patients start low in the hierarchy with simple tasks
- more advanced patients start with more complex tasks because they can do them
PSROP data indicate there may be a more effective way…

- How to address the question?
  - ID a homogenous group
  - Set an outcome
  - Use logistic regression to ID the variables positively associated with achieving the outcome
Identifying a Homogenous Group

- The patient subset  n=397
  - At least 1 documented SLP session
    - Over 90% of patients at 5 US sites
  - 1 - 8 blocks (3 hour chunks) of SLP services

- Removed labeled aphasia
  - Concern over inaccurate recording
  - More variability in treatment approaches for patients without aphasia

- Removed patients at A FIM 6, 7 for Aud Comp and Verbal Expression
Identifying a Homogenous Group

- Low-level communicators
  - Admission FIM 1 – 3 for Comprehension alone
  - Admission FIM 1 – 3 Comprehension paired with FIM 1 – 3 Verbal Expression

- Mid-level communicators
  - Admission FIM 4 -5 Comprehension alone
  - Admission FIM 4-5 Comprehension combined with Admission FIM Verbal Expression 4 -5
Identifying a Measurable Outcome

- **Success**
  - Change in FIM at discharge (D FIM): Verbal Expression and Auditory Comprehension

- **Low-level communicators**
  - Expression: increase to > Level 4
  - Comprehension: increase by 2 levels

- **Mid-level communicators**
  - Expression: increase to Level 6 or higher
  - Comprehension: increase to Level 6 or higher
Classifying SLP Activities

- Simple
  - Swallowing, speech intelligibility, voice, orientation, attention, pre-functional

- Mid-level
  - Verbal expression, alternative/non-verbal expression, written expression, auditory comprehension, reading comprehension, memory, pragmatics

- Cognitively-linguistically complex
  - Problem solving/reasoning, executive functioning skills
Amount and Timing of Treatment Provided

- 397 patients averaged:
  - 16.4 SLP sessions
  - 11.4 days
  - 602 minutes
Patients per Block of SLP Treatment

Number of Patients

Blocks of Treatment

1 2 3 4 5 6 7 8
**Who were these patients?**

<table>
<thead>
<tr>
<th></th>
<th>Short (1 block)</th>
<th>Medium (5 blocks)</th>
<th>Long (8 blocks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>66.1</td>
<td>56.7</td>
<td>67.3</td>
</tr>
<tr>
<td>Side of lesion (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>right</td>
<td>50.6</td>
<td>43.3</td>
<td>58.8</td>
</tr>
<tr>
<td>left</td>
<td>34.5</td>
<td>33.3</td>
<td>35.3</td>
</tr>
<tr>
<td>bilateral</td>
<td>12.6</td>
<td>20.0</td>
<td>5.9</td>
</tr>
<tr>
<td>Site of lesion (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>brainstem</td>
<td>18.4</td>
<td>36.7</td>
<td>17.7</td>
</tr>
<tr>
<td>subcortical</td>
<td>31.0</td>
<td>23.3</td>
<td>11.8</td>
</tr>
<tr>
<td>cortical</td>
<td>37.9</td>
<td>33.3</td>
<td>58.8</td>
</tr>
</tbody>
</table>
### Who were these patients?

<table>
<thead>
<tr>
<th></th>
<th>Short (1 block)</th>
<th>Medium (5 blocks)</th>
<th>Long (5 blocks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor FIM</td>
<td>44.5</td>
<td>34.5</td>
<td>28.9</td>
</tr>
<tr>
<td>Cognitive FIM</td>
<td>19.9</td>
<td>15.6</td>
<td>17.4</td>
</tr>
<tr>
<td>CSI</td>
<td>18.5</td>
<td><strong>24.0</strong></td>
<td>20.9</td>
</tr>
</tbody>
</table>
## Intensity of SLP services

<table>
<thead>
<tr>
<th></th>
<th>Short (1 block)</th>
<th>Medium (5 blocks)</th>
<th>Long (8 blocks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean LOS (days)</td>
<td>12.2</td>
<td>23.6</td>
<td>34.7</td>
</tr>
<tr>
<td>Days of SLP sessions</td>
<td>5.0</td>
<td>16.3</td>
<td>24.8</td>
</tr>
<tr>
<td>SLP sessions during rehab</td>
<td><strong>6.2</strong></td>
<td>24.8</td>
<td>39.7</td>
</tr>
<tr>
<td>SLP minutes during rehab</td>
<td>214</td>
<td>914</td>
<td>1439</td>
</tr>
</tbody>
</table>
% Time Across Short Stay (1 Block Total)

- Problem solving: 16%
- Swallowing: 19%
- Executive functions: 5%
- Speech: 7%
- Voice: 2%
- Written expression: 3%
- Auditory comprehension: 9%
- Memory: 9%
- Pragmatics: 0%
- Orientation: 5%
- Verbal expression: 12%
- Attention: 5%
- Reading comprehension: 6%
- Alt/Nonverbal: 0%
- PF/Not related: 2%

Problem solving: 16%
Swallowing: 19%
Executive functions: 5%
Speech: 7%
Voice: 2%
Written expression: 3%
Auditory comprehension: 9%
Memory: 9%
Pragmatics: 0%
Orientation: 5%
Verbal expression: 12%
Attention: 5%
Reading comprehension: 6%
Alt/Nonverbal: 0%
PF/Not related: 2%
% Time in 1st block only; Short Stay

Low level communicators (Comp 1 -3)
% Time in 1st block only; Short Stay
Mid level communicators (Comp 4-5)

- Executive functions: 6%
- Swallowing: 16%
- Speech: 11%
- Attention: 6%
- Memory: 8%
- Verbal expression: 14%
- Problem solving: 18%
- Auditory comprehension: 8%
- Written expression: 3%
- Reading comprehension: 6%
- Alt/Non-verbal: 0%
- Pragmatics: 0%
- Voice: 2%
- Orientation: 1%
- PF/Not related: 1%
Complexity of activities (% time) for Short Stay (1 block)
Trends for a Short Stay

- Averaged 6.2 SLP sessions over 12.2 day LOS
- Patients had more:
  - R CVAs
  - Cortical lesions
- Discharge: home
- Least amount of:
  - Cognitive and Motor FIM change
  - Time in simple SLP activities; 1st block
% Time Across Medium Stay (5 blocks)

- **Problem solving:** 19%
- **Swallowing:** 25%
- **Verbal expression:** 10%
- **Attention:** 7%
- **Orientation:** 4%
- **Speech:** 6%
- **Voice:** 2%
- **Written expression:** 3%
- **Memory:** 5%
- **Auditory comprehension:** 9%
- **Alt/Non-verbal:** 1%
- **Pragmatics:** 1%
- **Executive functions:** 1%
- **PF/Not related:** 0%
% Time in 1st block only; Medium Stay

Low level communicators (Comp 1-3)

- Swallowing: 39%
- Problem solving: 13%
- Auditory comprehension: 11%
- Written expression: 4%
- Verbal expression: 8%
- Memory: 2%
- Pragmatics: 1%
- Alt/Non-verbal: 1%
- Reading comprehension: 7%
- Written expression: 4%
- Executive functions: 2%
- Voice: 0%
- PF/Not related: 0%
- Attention: 3%
- Speech: 4%
- Orientation: 5%
% Time in 1st block only; Medium Stay
*Mid level* communicators (Comp 4-5)

- Swallowing: 39%
- Problem solving: 14%
- Executive functions: 2%
- Speech: 7%
- Attention: 6%
- Orientation: 4%
- Written expression: 4%
- Verbal expression: 7%
- Auditory comprehension: 6%
- Reading comprehension: 4%
- Memory: 3%
- Pragmatics: 1%
- Alt/Non-verbal: 0%
- PF/Not related: 0%
- Voice: 3%
Complexity of Activities for Short and Medium Stays

- Simple
  - 1 block: 40
  - 5 blocks: 45
- Mid
  - 1 block: 35
  - 5 blocks: 40
- Complex
  - 1 block: 20
  - 5 blocks: 25
Trends for a Medium Stay

- Averaged **24.8** SLP sessions over **23.6** day LOS
- Younger (56 years)
- Patients had more:
  - R CVAs
  - **Brainstem** lesions
  - Time in *simple* activities in 1st block
    - Swallowing
  - Time in auditory comp (in low level group)
- Discharge: **institution**
% Time in 1st block only; Long Stay
*Low level communicators (Comp 1-3)*

- **Swallowing**: 47%
- **Auditory comprehension**: 7%
- **Written expression**: 1%
- **Pragmatics**: 0%
- **Problem solving**: 5%
- **Alt/Non-verbal**: 1%
- **Executive functions**: 0%
- **Written expression**: 1%
- **Memory**: 5%
- **Reading comprehension**: 3%
- **Verbal expression**: 11%
- **PF/Not related**: 0%
- **Voice**: 0%
- **Orientation**: 7%
- **Speech**: 6%
- **Attention**: 7%
% Time in 1st block only; Long Stay
*Mid level communicators (Comp 4-5)*

- **Pragmatics** 0%
- **Executive functions** 0%
- **Swallowing** 35%
- **Attention** 19%
- **Problem solving** 18%
- **Executive functions** 0%
- **Memory** 10%
- **Alt/Non-verbal** 0%
- **Reading comp** 10%
- **Written expression** 3%
- **Auditory comp** 4%
- **PF/Not related** 0%
- **Verbal expression** 0%
- **Voice** 4%
- **Orientation** 2%
- **Speech** 4%

---

**% Time in 1st block only; Long Stay**

*Mid level communicators (Comp 4-5)*

- **Pragmatics** 0%
- **Executive functions** 0%
- **Swallowing** 35%
- **Attention** 19%
- **Problem solving** 18%
- **Executive functions** 0%
- **Memory** 10%
- **Alt/Non-verbal** 0%
- **Reading comp** 10%
- **Written expression** 3%
- **Auditory comp** 4%
- **PF/Not related** 0%
- **Verbal expression** 0%
- **Voice** 4%
- **Orientation** 2%
- **Speech** 4%
Complexity of Activities for Short, Medium, and Long Stays

- **Simple**
- **Mid**
- **Complex**

- **1 block**
- **5 blocks**
- **8 blocks**
Trends for a Long Stay

- Averaged 34.7 SLP sessions over 39.7 day LOS

- Patients had more:
  - R CVAs
  - *Cortical* lesions
  - Time in *swallowing*: 47% of 1\textsuperscript{st} block
  - Time in *attention* (mid level group)

- Almost no time in executive function across LOS

- Discharge: home
Activities in the 1st block of therapy
### How did these patients do?

<table>
<thead>
<tr>
<th></th>
<th>Short (1 block)</th>
<th>Medium (5 blocks)</th>
<th>Long (8 blocks)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean increase</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>motor FIM</td>
<td>19.6</td>
<td>23.1</td>
<td>30.1</td>
</tr>
<tr>
<td>cognitive FIM</td>
<td>4.6</td>
<td>5.3</td>
<td>8.1</td>
</tr>
<tr>
<td><strong>Discharge destination (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>home/community</td>
<td>81.6</td>
<td>60.0</td>
<td>88.2</td>
</tr>
<tr>
<td>institution</td>
<td>18.4</td>
<td>40.0</td>
<td>11.8</td>
</tr>
</tbody>
</table>
Factors Associated with Success

A reminder of “success”:

- Low-level communicators
  - Expression: increase in D FIM to $\geq$ Level 4
  - Comprehension: increase in D FIM by 2 levels

- Mid-level communicators
  - Comprehension: increase D FIM to $\geq$ Level 6
  - Expression: increase D FIM to $\geq$ Level 6
If the patient’s *comprehension* was 1 – 3 on admission

they were **more** likely to be successful if

- in the *first 3 hours* of SLP they spent time in:
  - Problem solving
  - Executive function

- and/or they:
  - stayed **longer**
If the patient’s *comprehension* was 1 – 3 on admission

they were *less* likely to be successful if

- in the *first 3 hours* of SLP they spent time in:
  - Verbal expression
  - Written expression

- and/or they:
  - were *female*
  - had a *brainstem* stroke
  - had a *D FIM* for *bladder* of 1 - 3
Success Rate

- Admission comprehension 1–3

- 88 patients / 50% were successful
If the patient’s *comprehension* was 1 – 3 and *expression* was 1 -3 they were more likely to be successful if

- in the *first 3 hours* of SLP they spent time in:
  - **Problem solving**
  - **Executive function**

- and/or they:
  - stayed longer
  - had a **hemorrhagic** stroke
  - had **higher** A FIM Cognition and **Verbal Expression***
If the patient’s *comprehension* was 1–3 and *expression* was 1–3, they were less likely to be successful if
- in the *first 3 hours* of SLP they spent time in:
  - **Reading comprehension**
- and/or they:
  - were *female*
  - had a *D FIM for bladder* of 1–3*
  - had a *D FIM for bladder* of 4–5
Success Rate

- Admission comprehension 1 – 3 and expression 1 – 3

- 77 patients / 54.6% were successful
If the patient’s *comprehension* was 4 – 5 on admission they were *more* likely to be successful if

- in the *first 3 hours* of SLP they spent time in:
  - Problem solving

- and/or they:
  - stayed longer
  - had *higher* A FIM Cognition, Memory*, or Comprehension*
If the patient’s *comprehension* was 4 – 5 on admission they were **less** likely to be successful if

- in the *first 3 hours* of SLP they spent time in:
  - **Auditory comprehension**

- and/or they:
  - had **higher A CSI**
  - had a **D FIM for bladder of 1 – 3**
Success Rate

- Admission comprehension 4 – 5

  - 114 patients / 52% were successful
If the patient’s *comprehension* was 4 – 5 and *expression* was 4 – 5

they were more likely to be successful if

- in the *first 3 hours* of SLP they spent time in:
  - Problem solving

- and/or they:
  - were *white*
  - stayed *longer*
  - had a *D FIM* for *bladder* of 6-7
  - had *higher* A FIM Cognition or *Expression*
If the patient’s *comprehension* was 4 – 5 and *expression* was 4 -5 they were **less** likely to be successful if

- in the *first 3 hours* of SLP they spent time in:
  - Verbal expression

- and/or they:
  - had a *hemorrhagic* stroke
  - stayed **longer**
  - had a **higher** A CSI
  - had **higher** A FIM Motor or Toilet Transfer*
  - were of **race: other**
Success Rate

- Admission comprehension 4–5 and expression 4 - 5

- 75 patients / 52% were successful
# In Summary, during 1st therapy block

<table>
<thead>
<tr>
<th>Greater likelihood of success</th>
<th>Less likelihood of success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex activities</td>
<td>Mid-level activities</td>
</tr>
<tr>
<td>Problem solving, executive functioning</td>
<td>Verbal expression, reading comprehension and written expression</td>
</tr>
</tbody>
</table>
What this means for clinical practice

- For patients with low linguistic ability on admission
  - Appear to benefit from high level tasks early in treatment
  - Tasks may not directly correspond to impairment area
  - May need more cueing/assistance to complete tasks initially
Why might this be?

- High level tasks involve
  - critical thinking
  - mental flexibility
  - mental manipulation
  - integration of multiple components of information
  - creativity
Common Threads

- Corresponds to results in other therapy disciplines
  - OT – home management tasks
  - PT – gait and advanced gait
Common Threads

- Introducing complex tasks earlier in a length of stay *despite the patient’s level of impairment* is associated with better outcomes
  - integration of individual components vs. each component in isolation
  - May require recruitment of more cognitive and linguistic skills that drive functional activity
    - Error detection, revision/repair, self-regulation
Limitations in data analysis

- Limitations of FIM as measurement tool
- Subjective and objective choices in creating homogenous groups
- Potential inconsistencies/inaccuracies in recording of treatment interventions
- Context in which the intervention was implemented was not captured
Future research

-Validity studies
-Interventions
-Correlation of findings with standardized test scores
-Initial evaluation time
-Impact of such a large % of time on swallowing
-Variation in site practice
-International comparisons of practice
  -New Zealand
  -CERICE
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Koen Putnam, PhD