By the Numbers: What Research Tells Us About Outcomes in Rehabilitation

3:45 – 5:00 pm

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Big Questions about Access and Quality in PAC

- Does site of care or intensity of treatment or nursing/physician ratios matter for outcomes, especially for certain populations such as joint replacements and stroke?
- Who decides the setting of care at discharge from the hospital? From PAC sites?
- What is the decision based upon?
- What is the appropriate length-of-stay in post-acute care settings?
- Are patient and family preferences taken into account in decisions about post-acute care?
- How can we research outcomes across a long care trajectory that are meaningful for our patients and families?

The Really Big PAC Questions

- What is the future of post-acute care?
- If we were to redesign the post-acute care system, what would it look like?
Comparative Effectiveness Research

- Directly informs clinical or health policy decision-making
- Compares at least two interventions, each with the potential to be "best practice"
- Describes results at the population and subgroup levels
- Measures outcomes that are important to patients
- Is conducted in settings that are similar to those in which the intervention will be used in practice
- Employs methods and data appropriate for the decision of interest
  - Institute of Medicine, Initial National Priorities for CER, 2009

CER and the ARRA

The American Recovery and Reinvestment Act (ARRA), 2009

"...the development and dissemination of research assessing the comparative effectiveness of health care treatments and strategies, including through efforts that conduct, support, or synthesize research that compares the clinical outcomes, effectiveness, and appropriateness of items, services, and procedures that are used to prevent, diagnose, or treat diseases, disorders, and other health conditions."
Evidence Translation: 3 Tiers (AHRQ)

- **T1: Clinical Efficacy**: Translating basic science into clinical efficacy (can it work?): randomized controlled trials

- **T2: Clinical Effectiveness**: Using patient-oriented outcomes and health services research to develop knowledge about clinical effectiveness of a treatment or device (does it work?): comparative effectiveness research

- **T3: Implementation Research**: Using implementation research for continuous measurement and refinement of treatment implementation

Research in a Large Integrated Health System

- What is the potential of an electronic medical record to compare rehabilitation populations within an integrated health system?
- Does variation in care within a health system provide evidence to study rehabilitation outcomes?
- What are the most available and useful variables for rehabilitation research that might be studied using this approach?
- What are the various types of care, care settings, and care delivery of rehabilitation that might be compared using this approach

Quality or Performance Measures
What are the Questions? What Measures?

Quality of Care
  Process, Structure, or Outcome

Access to Care
  Barriers: Structural, Financial, Attitudinal, etc.

Service Delivery
  Patient and Family Satisfaction
  Guideline Adherence

Disparities
  Quality, Access or Service

Examples: Process Measures

- Acute Management
  - tPA administration

- Prevention
  - Another stroke: antithrombotic therapy; statins; anticoagulation in atrial fibrillation
  - Venous thromboembolism: heparin, etc.
  - Aspiration pneumonia

  These are all process measures not outcome measures…

Examples: Outcome Measures

- Function
- Caregiver burden
- Quality of life
- Patient satisfaction - with the process of care and informed decision-making not just individual encounters
Examples: More Complex Measures

- Readmissions
- Mortality
- Length of stay
- Discharge to community
- Prevention of another stroke or secondary condition

2010 AHRQ Expert Panel Recommendations: People with Disabilities

- Utilize measures for people with disabilities that are specific, not those utilized for general populations
- Take a longitudinal approach: over the lifespan and the care continuum
- Consider health, wellness and prevention
- Promote use of self-reports of functional status
- Capture the patient-care experience and measure it
- Utilize the concepts of the International Classification of Function in the development of specific measures of the quality and outcomes of care

Function: WHO Terminology

Diagnosis: (ICD)
Impairment: organ system
Disability: whole person in a social/environmental context

International Classification of Function (ICF)
- Activity: task
- Participation: life or role
Decisions about Post-Acute Care?

Multi-factorial…
- Patient characteristics; preferences
- Provider characteristics
- Role of physician, discharge planner
- Cultural factors and other social determinants of health
- Geographic factors
- Access; bed availability
- Guidelines adherence

KP Health System: Integration

- Northern California: 3.2 million members
- US: 8.6 million members
- Prepayment
- Not-for-profit health plan & hospitals (36) + other ambulatory centers
- Permanente physicians - salaried
- National Federation of Permanente Medical Groups
- Call centers, pharmacies, labs, radiology, etc
- IT and data systems: EMR throughout the national system – inpatient and outpatient
- Quality Operations and Support
- Divisions of research in most Regions

Kaiser Permanente National Program

[Map of the United States with states highlighted]

[Image 66x676 to 287x699]
[Image 66x457 to 287x479]
[Image 90x123 to 263x230]
Approximate annual incidence in Northern CA
- SCI: 130
- TBI: 6000
- Stroke: 4000

TBI Registry = 70,000+ over 8 years

Prevalence is high for most diagnoses

Disenrollment rates are very low

Our Research Methods

- Retrospective studies
- Prospective studies
- Variation in care explorations
- Qualitative research: interviews and focus groups
- Implementation research: not yet
The KFRC Courtyard: Patients Practice Mobility on a Variety of Outdoor Surfaces

Post-Acute Care Stroke Studies

- **Retrospective Studies**
  1. Disparities in Stroke Rehabilitation (CDC)
  2. Stroke Onset-Days (KP Community Benefits)
  3. Stroke Mortality in Post-Acute Care (KP Community Benefits)
  4. Intensity of Treatment (KP)

- **Prospective Studies**
  1. Outcomes Monitoring Study (NIH Clinical Center)
  2. OMS Sub-study (NIH-CC)
  3. KP-Functional Outcomes System (NINDS)
  4. Monitoring Health and Function (NIH-CC)

Disparities in Stroke Rehabilitation

Kabat-Knott Center for Rehabilitation Research
Kaiser Foundation Rehabilitation Center, Vallejo, CA

A Center of Excellence for Members with Disabilities
Kaiser Permanente
Institute for Culturally Competent Care

Funded by the CDC
Early Work: Multiple Sites of Care in KP System

Sites of Care

Research Questions: Disparities Study

- What are the referral and enrollment rates for rehabilitation (post-acute care) following discharge from the hospital after a stroke?
- Are there disparities in care for patients in various settings based on variables such as:
  - Race/ethnicity
  - Gender
  - Age
  - Socioeconomic status: education and income level
  - Hospital referral patterns
  - Rural/urban setting
  - Type of stroke

Research: Disparities Study

- Retrospective Cohort Study within the Northern California Kaiser Permanente Health System
- Methods: Tracked rehabilitation services for 365 days following acute hospitalization for a first stroke
- Participants: 11,119 stroke patients hospitalized for acute stroke from 1996-2003
- Outcome measures (service delivery): Inpatient rehabilitation hospital, skilled nursing facility, home health services, outpatient rehabilitation services
- Variables: Age, gender, race/ethnicity, socioeconomic status (income, education), rural/urban residence, medical center referrals, type of stroke
Results: Disparities Study

- Mean age: 69.7, 51% female
- Race-ethnicity: 70.2% white, 10.8% black, 8.8% Asian, 7.4% Hispanic
- Median household income: $56,750
- Median percentage with at least a high school education: 87%; 28% had 4 years or more of college education
- Type of stroke: 85% ischemic, 15% hemorrhagic
- LOS: Median = 3; mean = 5.2

Results: Disparities Study

- **Age**: Younger patients more likely go to IRH; older patients to SNF
- **Gender**: Female patients more likely to receive IRH and SNF care
- **Race/ethnicity**: Asian and black patients more likely to receive IRH care than whites and Hispanics
- **Geography**: Central Valley and Capital Service areas less likely to receive IRH and SNF care; rural patients less likely to receive IRH, HH, and more likely to have only OP care or no care at all
- **Socioeconomic status**: Patients with higher income and more education more likely to go to IRH; patients with lower income more likely to go to SNF

The KFRC Outpatient Gym Opens on the Courtyard
Time to Inpatient Rehabilitation Hospital Admission and Functional Outcomes of Stroke Patients

Kabat-Knott Center for Rehabilitation Research
Kaiser Foundation Rehabilitation Center, Vallejo, CA

Funded by KP Community Benefits

Research Questions: Onset Days Study

- Does time to IRH admission affect functional outcomes of stroke patients?
- Is there a cut-off time to IRH admission for optimal functional gain?
- Are there other influential factors on functional improvement?

Methods: Onset Days Study

- Stroke patients admitted to KFRC 2002 - 2006 (n=1,981, first admission for patients with multiple admissions)
- Subgroups based on CMG
  - Mildly impaired group (CMG=0101-0103, n=73, not included in further analysis)
  - Moderately impaired group (CMG=0104-0107, n=614)
  - Severely impaired group (CMG=0108-0114, n=1,294)
Methods: Onset Days Study

- **Study outcomes**
  - Functional gain during KFRC stay measured by FIM
  - Motor, cognition, and total scores

- **Major exposure**
  - Onset days: time from stroke onset to KFRC admission
  - Six categories: 0-7, 8-14, 15-21, 22-30, 31-60, 61-365 days

- **Covariates**
  - Patient socio-demographics: age, gender, marital status, race/ethnicity, urban or rural residential area, median household income, pre-stroke employment and living status (alone or not alone)
  - Stroke type and side, previous stroke, co-morbidities
  - PAC setting before KFRC admission, KFRC LOS, medication

Methods: Onset Days

**Data analysis**

- Univariate analysis for data distribution
- Bivariate analysis for unadjusted relationships among variables
- General Linear Models to examine the associations of influential factors and functional gain

Findings: Onset Days

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Moderately Impaired</th>
<th>Severely Impaired</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Score (Mean±SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRH Admission</td>
<td>42.9±7.0</td>
<td>25.6±7.4</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>IRH Discharge</td>
<td>61.4±9.8</td>
<td>45.4±14.3</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>FIM Gain</td>
<td>19.4±8.5</td>
<td>19.8±10.6</td>
<td>0.4775</td>
</tr>
<tr>
<td>Cognition Score (Mean±SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRH Admission</td>
<td>22.2±7.1</td>
<td>17.3±7.6</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>IRH Discharge</td>
<td>26.2±6.3</td>
<td>21.6±7.4</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>FIM Gain</td>
<td>4.0±4.0</td>
<td>4.3±4.4</td>
<td>0.1662</td>
</tr>
<tr>
<td>Total FIM™ Score (Mean±SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRH Admission</td>
<td>67.3±12.0</td>
<td>45.0±13.6</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>IRH Discharge</td>
<td>91.9±14.0</td>
<td>70.4±20.4</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>FIM Gain</td>
<td>24.7±10.7</td>
<td>25.4±13.3</td>
<td>0.2142</td>
</tr>
<tr>
<td>LOS Efficiency</td>
<td>1.7±1.0</td>
<td>1.2±0.8</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>
### Findings: Onset Days

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Moderately Impaired</th>
<th>Severely Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to IRH Admission (Days, Reference= 61-365)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-7</td>
<td>6.44</td>
<td>9.69</td>
</tr>
<tr>
<td>8-14</td>
<td>4.58</td>
<td>7.89</td>
</tr>
<tr>
<td>15-21</td>
<td>5.82</td>
<td>7.71</td>
</tr>
<tr>
<td>22-30</td>
<td>1.35</td>
<td>6.61</td>
</tr>
<tr>
<td>31-60</td>
<td>2.10</td>
<td>3.35</td>
</tr>
<tr>
<td>Age at IRH admission (Years)</td>
<td>-0.17</td>
<td>-0.22</td>
</tr>
<tr>
<td>Previous stroke (Reference=No)</td>
<td>-2.36</td>
<td>-2.13</td>
</tr>
<tr>
<td>IRH LOS (Days)</td>
<td></td>
<td>0.45</td>
</tr>
<tr>
<td>Total FIM™ at IRH admission</td>
<td>-0.26</td>
<td>0.09</td>
</tr>
</tbody>
</table>

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### Findings: Total FIM Gain

**Total FIM Gain between IRH Admission and Discharge: Moderately Impaired Group**

<table>
<thead>
<tr>
<th>Stroke Onset to IRH Admission (Days)</th>
<th>Adjusted FIM Gain (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7</td>
<td></td>
</tr>
<tr>
<td>8-14</td>
<td></td>
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<tr>
<td>15-21</td>
<td></td>
</tr>
<tr>
<td>22-30</td>
<td></td>
</tr>
<tr>
<td>31-60</td>
<td></td>
</tr>
</tbody>
</table>

**Total FIM Gain between IRH Admission and Discharge: Severely Impaired Group**

<table>
<thead>
<tr>
<th>Stroke Onset to IRH Admission (Days)</th>
<th>Adjusted FIM Gain (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7</td>
<td></td>
</tr>
<tr>
<td>8-14</td>
<td></td>
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<tr>
<td>15-21</td>
<td></td>
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<tr>
<td>22-30</td>
<td></td>
</tr>
<tr>
<td>31-60</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion: Onset Days

- Functional recovery of stroke patients with moderate to severe impairments depends in part on the time frame from stroke onset to IRH admission.
- Age, race/ethnicity, side of stroke, history of a previous stroke, initial FIM scores at IRH admission, and IRH LOS also contribute to the functional improvement.

The Vallejo Hospital Atrium

Post-Acute Care and Ischemic Stroke Mortality: Findings from an Integrated Health Care System in Northern California
Research Questions

- Does post-acute care (PAC) contribute to survival of ischemic stroke patients after acute care hospital stay?
- Does mortality rate vary with PAC settings?
- Are there disparities or variations in stroke mortality based on age, gender, race/ethnicity, socioeconomic status, rural/urban residence, service area, or other influential factors?

Methods

- KPNC yearly incidence: ischemic stroke cases between 1996 and 2004
- Initial sample: N=22,433
- Initial exclusion
  - Under 18 years of age
  - Brain tumor, abscess, or trauma
  - Deaths at acute care hospital
- Further exclusion
  - Early deaths during follow-up
  - Hospice admission
  - With no PAC treatment

- Study outcome
  - 1-year mortality after acute care hospital stay
- Major exposure
  - Highest level of PAC services: IRH, SNF, HH, OP
- Covariates
  - Patient socio-demographics: age, gender, marital status, race/ethnicity, urban or rural residential area, median household income
  - Previous stroke and comorbid conditions
  - Length of stay at acute care hospital and region of acute care facilities
Methods

• Two study Samples
  - PAC 14-Day Sample: PAC services received 14 days after acute care hospital discharge (N=16,538)
  - PAC 61-Day Sample: PAC services received 61-days after acute care hospital discharge (N=16,468, 90% of patients in the study cohort ever admitted to IRH were admitted within 61-days)

• Data analysis
  - Univariate analysis for data distribution
  - Bivariate analysis for unadjusted relationships among variables
  - Survival analysis to explore the associations of influential factors and mortality outcomes

Findings

• PAC 14-Day Sample
  - N=16,538
  - Mean age 72 years, Female 52.7%, Married 56.4%
  - Asian 7.9%, Af Am 12.6%, Hispanic 7.3%, White 69.3%
  - Rural area residence: 3.7%
  - Median household income: 24.1% ≤ $40,000, 59.1% $40,001-$80,000, and 16.8% ≥ $80,000
  - History of previous stroke: 55%
  - Deyo-Charlson comorbidity score: 32.3% (0), 43.2% (1-2), 24.5% (3+).
  - Remote acute care facility: 30%
  - Median acute care hospital stay: 3 days (IQR, 2-5 days)
Findings

- PAC 61-Day Sample
  - N=16,468
  - Data distribution of explanatory measures: similar to PAC 14-Day group

<table>
<thead>
<tr>
<th>PAC Services</th>
<th>PAC 14-Day Sample</th>
<th>PAC 61-Day Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%) 1-year Mortality</td>
<td>N (%) 1-year Mortality</td>
</tr>
<tr>
<td></td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>IRH</td>
<td>918 (5.6) 4.4</td>
<td>1,802 (10.3) 4.3</td>
</tr>
<tr>
<td>SNF</td>
<td>7,981 (48.3) 22.4</td>
<td>6,647 (40.4) 16.2</td>
</tr>
<tr>
<td>HH</td>
<td>3,130 (18.9) 9.3</td>
<td>3,140 (19.1) 6.6</td>
</tr>
<tr>
<td>OP</td>
<td>4,509 (27.3) 7.3</td>
<td>4,879 (29.6) 4.5</td>
</tr>
</tbody>
</table>

Findings

Parameter Study Samples

<table>
<thead>
<tr>
<th>Parameter</th>
<th>PAC 14-Day RR (95% CL)</th>
<th>PAC 61-Day RR (95% CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (10 years)</td>
<td>0.92 (0.62, 1.37)</td>
<td>0.93 (0.58, 1.51)</td>
</tr>
<tr>
<td>Age² (10 years)</td>
<td>1.04 (1.01, 1.07)</td>
<td>1.04 (1.01, 1.07)</td>
</tr>
<tr>
<td>Female (Reference=Male)</td>
<td>0.87 (0.80, 0.94)</td>
<td>0.89 (0.81, 0.99)</td>
</tr>
<tr>
<td>Race (Reference=African American)</td>
<td>Asian 0.81 (0.66, 0.99)</td>
<td>0.69 (0.54, 0.90)</td>
</tr>
<tr>
<td></td>
<td>Hispanic 0.84 (0.68, 1.04)</td>
<td>0.76 (0.59, 0.98)</td>
</tr>
<tr>
<td></td>
<td>White 0.91 (0.80, 1.04)</td>
<td>0.82 (0.70, 0.95)</td>
</tr>
</tbody>
</table>
### Findings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Study Samples</th>
<th>PAC 14-Day RR (95% CL)</th>
<th>PAC 61-Day RR (95% CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous Stroke</td>
<td></td>
<td>1.21 (1.11,1.32)</td>
<td>1.39 (1.25,1.55)</td>
</tr>
<tr>
<td>Deyo-Charlson Index (Reference=0)</td>
<td></td>
<td>1.45 (1.30,1.62)</td>
<td>1.41 (1.24,1.61)</td>
</tr>
<tr>
<td>1-2</td>
<td></td>
<td>2.44 (2.18,2.72)</td>
<td>2.25 (1.96,2.57)</td>
</tr>
<tr>
<td>Service Area (Reference=D)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td>0.70 (0.61,0.80)</td>
<td>0.72 (0.61,0.85)</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>0.82 (0.70,0.95)</td>
<td>0.77 (0.63,0.93)</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.75 (0.67,0.89)</td>
<td>0.75 (0.64,0.87)</td>
</tr>
<tr>
<td>E</td>
<td></td>
<td>0.78 (0.68,0.89)</td>
<td>0.76 (0.64,0.90)</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td>0.71 (0.63,0.81)</td>
<td>0.67 (0.57,0.79)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Study Samples</th>
<th>PAC 14-Day RR (95% CL)</th>
<th>PAC 61-Day RR (95% CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Care LOS (Day)</td>
<td></td>
<td>1.019 (1.015,1.023)</td>
<td>1.021 (1.016,1.026)</td>
</tr>
<tr>
<td>PAC (Reference=SNF)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRH</td>
<td></td>
<td>0.33 (0.24,0.45)</td>
<td>0.42 (0.33,0.53)</td>
</tr>
<tr>
<td>HH</td>
<td></td>
<td>0.47 (0.42,0.54)</td>
<td>0.49 (0.42,0.57)</td>
</tr>
<tr>
<td>OP</td>
<td></td>
<td>0.44 (0.39,0.49)</td>
<td>0.42 (0.36,0.49)</td>
</tr>
</tbody>
</table>

![Graph showing survival curves by PAC 14-day group](image)
Findings

- Ischemic stroke patients treated at IRH, HH, and OP as the “highest level of care” had significantly lower 1-year mortality after acute care hospital discharge than patients treated at a SNF as the “highest level of care”

- Age, gender, race/ethnicity, previous stroke, comorbidities, and service area were also significantly associated with mortality outcomes

AM-PAC and CAT Logic

- AM-PAC was originally developed as a standard assessment instrument using a structured interview to locate a patient’s function in a domain

- AM-PAC developers used Computer Assisted Testing (CAT) logic to establish a computer-presented assessment selecting questions based on the patient’s response

- CAT logic reduces test time because it only presents questions that are close to the patient’s current function

- CAT methodology eliminates ceiling and floor effects and is therefore ideal for studying patients across a care continuum
Implementing the Activity Measure for Post-Acute Care

Kabat-Knott Center for Rehabilitation Research
Kaiser Foundation Rehabilitation Center, Vallejo, CA

Funded by the NIH Clinical Center

- The AM-PAC CAT application runs on a secure web server at the Kaiser Permanente Division of Research in Oakland
- A clinician uses the application in a web browser on their local computer
- The AM-PAC CAT web address is accessible from any computer on the Regional Kaiser Permanente network
- AM-PAC data can be combined with both clinical and administrative data in the electronic health record (Health Connect) to permit comparisons of functional improvement based on patient characteristics and service utilization
The application delivers questions about a stroke patient’s function in five domains:

- Mobility
- Activities of daily living
- Applied cognition
- Social participation
- Role participation

On average, the measurement takes about 5-15 minutes for administration and scoring.

Traditional Instruments for Functional Measurement

- FIM
- SF-36

Example of an AM-PAC Question Sequence

Q1: Can I take off my sweatshirt by pulling it over my head? Response: Easy

Score = 62 ± 15
Q2: Can take a book out of my book bag?
Response: A Little Difficulty
Score = 64 +/- 10

Q3: Can I zip up my jacket?
Response: A Lot of Difficulty
Score = 63 +/- 7

Q4: Can I hang my coat on a hook?
Response: Easy
Score = 62 +/- 5
AM-PAC Functional Outcome Report

Patient | Facility | Episode Visits
---|---|---
Admission | Discharge
Bending over: A Lot Difficulty | Bending over: A Lot Difficulty
Walking outdoors: A Little Difficulty | Walking indoors: No Difficulty
Stand from chair: A Lot of Difficulty | Low Couch: A Little Difficulty
Walking indoors: A Little Difficulty | Run short: No Difficulty
Run 10 min: No Difficulty | Run short: No Difficulty
Vigorous activities: Limited a Little | Total score: 54.7 (2.3)
Sharp turns: A Little Difficulty | Total score: 70.8 (2.7)

Total score: 54.7 (2.3)  Total score: 70.8 (2.7)

A Functional Outcome System for Stroke
Kabat-Knott Center for Rehabilitation Research
Kaiser Foundation Rehabilitation Center, Vallejo, CA
Funded by the National Institute for Neurological Diseases and Stroke (NINDS) and the NIH Clinical Center

KP Functional Outcomes System: Specific Aims

- Integrate the AM-PAC CAT instrument with the Kaiser Permanente clinical databases (which include demographic elements, pre-morbid and co-morbid conditions, resource utilization, and interventional data) to form the Kaiser Permanente Functional Outcome System (KP-FOS) for use in comparative effectiveness studies of post acute care after stroke
- Utilize KP-FOS to analyze data across different post-acute settings, particularly IRF and SNF settings, to identify the most effective post-acute care approaches to promote functional recovery after stroke
- 248 more patients to create a cohort of 470
  - NINDS-Sponsored Challenge Grant, 2009
Our Research Questions

- What is the feasibility of using a computer-based assessment of functional outcomes of stroke patients across the continuum of post-acute care?
- What is the variation, if any, in functional outcomes of patients across multiple sites of care in a 6-month period after an acute stroke?
- What is the variation, if any, in functional outcomes, relative to patient characteristics or clinical pathways, service delivery?

Network Infrastructure: FOS

- The AM-PAC CAT application runs on a secure web server at the Kaiser Permanente Division of Research
- A clinician runs the AM-PAC CAT in a web browser on their local computer
- The AM-PAC CAT web address is accessible from any computer on the Regional network
- AM-PAC data can be combined with both clinical and administrative data in Health Connect to permit comparisons of functional improvement based on patient characteristics and service utilization

Study Procedure: Functional Outcomes Study

- Recruited acute stroke patients from 4 hospitals
- Used surrogate decision-makers, if needed, as approved by the IRB
- Assessed stroke severity using the mNIH Stroke Scale
- Assessed functional outcomes with the AM-PAC CAT assessment instrument
- Study staff performed assessments on site or by phone, with proxies if patient was unable due to competency
- Study staff followed participants for six months, doing an assessment at discharge from each level of care and at 6 months
What Key Data Elements are Missing from the EMR Data Bases for Stroke?

- Severity of illness, injury, or condition (NIHSS*)
- Functional status (AM-PAC*)
  - Activity
  - Participation in social roles
- Social and Family Data (added to the AM-PAC*)
  - Socioeconomic data
  - Education
  - Living situation

* these data elements were added into our prospective study…

Study Procedure: Outcomes Monitoring System

- 562 patients enrolled — on target for about 450 completions
- Surrogate decision-makers or proxies, if needed
- Assess stroke severity using the NIH Stroke Scale
- Assess functional outcomes with the AM-PAC CAT assessment instrument
- Study staff perform assessments on site or by phone, with professional staff or family proxies if patient was unable due to competency
- Study staff follow participants for 6 months; assessments at discharge from each level of care and at 6 months
Stroke Study Participants

Total number of participants: 222

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Percent of Respondents</th>
<th>Average PAC Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any IRH</td>
<td>30</td>
<td>114</td>
</tr>
<tr>
<td>Any SNF no IRH</td>
<td>9</td>
<td>81</td>
</tr>
<tr>
<td>HH or OPR</td>
<td>11</td>
<td>90</td>
</tr>
<tr>
<td>No PAC Treatment</td>
<td>42</td>
<td>0</td>
</tr>
</tbody>
</table>

The SNF group was more likely to be older, female, have fewer social supports, and have had a more severe stroke.

AM-PAC Usage and Results

AM-PAC Usage

- Average Number of Assessments: 3
- Average Number of Items Presented During Each Assessment: 27
- Average Length of AM-PAC Session: 7.9 min

At baseline, 35% required a proxy, while at 6 months, 26% required a proxy.

At the 6 month evaluation those who received no PAC treatment, IRH, or HH/OPR had clinically significant improvements (p < 0.001).

Those receiving SNF care had minimal changes.

AM-PAC Mobility Change

Unadjusted Basic Mobility: AM-PAC Scores

- Any IRH vs IRH
- Any SNF no IRH vs SNF no IRH
- HH or OPR vs HH or OPR
- No PAC Treatment vs No PAC Treatment

The graph shows the mobility scores over time for each group, indicating the progression of mobility improvements or declines.
Therapeutic Intensity and Functional Gains of Stroke Patients during Inpatient Rehabilitation

Hua Wang, PhD *, Michelle Camicia, MSN CRRN *, Joseph Terdiman, MD PhD **, Murali K Mannava, BS **, Steve Sidney, MD, MPH **, M. Elizabeth Sandel, MD *

* Kaiser Foundation Rehabilitation Center, Vallejo, CA; ** Kaiser Permanente Division of Research, Oakland, CA

Preliminary results to follow at time of presentation...

The consensus is that the patient should receive as much therapy as they need or tolerate to achieve the goal of getting maximal independence.

There is no specific recommendation as to how much or how long therapy should be provided, but...

Two meta-analyses: slightly better outcomes with greater intensity.
The Present Realities

“Health systems are better at measuring than improving”
—Carolyn Clancy, AHRQ

- Data analyses pose more questions than we can answer
- Research is not moving quickly enough for translation of findings into changes in practice
- Most health systems are not integrated enough or supported with EHRs to do the kind of research that needs to be done (VA and KP have more capacity)
- Incentives must change for us to do this work on a large-scale
- Crucial data elements: severity measures and functional measures; across care continuum

Challenges and Caveats

- Complexity of patient populations
- Complexity of care delivery and changes over time
- Generalizability to other populations and health systems
- Data bases: weaknesses and constraints
- Research methodology: weaknesses and constraints

What Would an Ideal PAC System Look Like in Terms of Measures of Quality & Access?

- Measures that are meaningful to people, to patients, to families; patient-reported outcomes
- Measures that capture severity of disease, illness, impairment, disability not just diagnosis
- Quantitative and qualitative measures
- Measures of the structure and processes of care
- Measurement of disparities in access and quality of care
- Measures of social determinants of health
- Decision support across the continuum using the electronic medical record for triage to levels of care
Collaborators and Sponsors: 2004-2012

- KP Division of Research
- Kaiser Permanente Community Benefits
- University of Washington
- Boston University
- CDC
- NIH Clinical Center
- National Institute of Neurological Diseases and Stroke

Research Team: Disparities Study

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- Richard Delmonico, PhD, Chief of Neuropsychology

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- Steven Sidney, MD, PhD
- Charles Quesenberry, PhD

Co-Investigators: Bernadette Ford Lattimer, CDC; Jeanne Hoffman, Marcia Ciol, University of Washington, and Leighton Chan, NIH

Funding: Centers for Disease Control and Prevention SIP 3-05

Research Team: Stroke Mortality in PAC

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Funding: Kaiser Permanente Community Benefits

Stroke Onset Days to Rehabilitation

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- Joseph Terdiman, MD, PhD Co-investigator

Funding: Kaiser Permanente Community Benefit

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Funding: National Institutes of Health Clinical Center
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Thank you

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