ACTIVITY BASED THERAPY PROGRAMS: Practical Applications

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Objectives:
- Discuss ways to implement activity based therapy into inpatient and outpatient neurological rehabilitation programs
- Discuss financial considerations regarding activity based therapy programs
- Review a case studies depicting implementation of a community activity based therapy program in individuals with neurologic disability and disease

Activity Based Therapy
- The goal of this approach is to achieve activation of the neurological levels located both above and below the injury level using rehabilitation therapies in order to facilitate recovery after a debilitating neurological incident (Sadowsky 2009).
Consumer Demand

- Philosophy
- Information Highway
- Consumer Awareness
- Higher Expectations
- Therapeutic Approach
- Bracing
- Anti-Spasmodics

Where do we go?

- Marketing
- Competition
- Health Care Economics
- Staff perceptions
- Inpatient Goals
- Out Patient Goals
- Staff Training/Retention
- Patient Dx mix

Does ABT fit into neurologic rehabilitation?

- Inpatient considerations
- Out patient programs
Getting Started
• Funding Sources
• Value Proposition
• Staff Education and Acceptance
• Establishing patient utilization criteria

Technology
Pros
- Outcomes
- Expansion of Services
- Increased Market Share
- Efficiency of Care Delivery
- Staff Retention and Recruiting
- Staff Education

Cons
- Cost
- Staff Training
- Efficiency of Care Delivery
- Managing Expectations
- "Cookie Cutter" mentality
- Space

Inpatient ABT Programs
• Activation to the neuromuscular system below the level of injury
• Focus on Recovery of Function vs. Compensation
• Adjunct to primary therapy
• Can include multiple diagnosis
• Primary Components often include:
  1. Intensive Strengthening
  2. Motor Patterned Activity
  3. Locomotor Training/Task Specificity
Financial Considerations:
- LTACs: Lengthened LOSs
  - Payor Mix
    - Medicare/Medicaid: DRG
      - 40% of inpatients
      - ~50% of charges
    - Contracted Payors: % of charges
      - 60% of inpatients
      - ~70% of charges
- IRFs:
  - PPS
    - Market to neurologic dx
    - Flat fee
    - Incentivized to ↓ LOS

Inpatient ABT Programs
- FES Program
  - FES bike group
  - FES with Elliptical
  - Foot Drop and Thigh Stimulation (OG and Ltting)
  - Upper Limb Stimulation
- Locomotor Training Program
  - Robotic Locomotor Training with BWS
  - Manual Locomotor Training with BWS
  - Over Ground Training with BWS
- Group Classes:
  - 8 SCI Classes
  - 4 BI classes

Inpatient FES Program
- Group FES Bike Class
  - Mon/Wed/Fri
  - 6 hours of classes
  - 4-5 patients/class
  - Staffing: 1 PT and 1 Tech
  - Volunteers
  - Financial considerations vs. Optimal training!
- RT 600 Elliptical Trainer
  - Wed/Fri
  - 6 hours = 6 patients
  - 1:1 Training
  - Staffing: 1 PT and 1 Tech
  - Volunteer
  - Financial considerations vs. Optimal Training

Financial considerations vs. Optimal training!
AIS A-D BI

FES Program

If LE Movement and Tolerates 20 minutes vertical
RT600

If LE Movement, but not tolerating 20 minutes vertical
FES Bike

If NO LE movement
FES Bike

Will Progress to RT600 when primary therapist notifies FES therapists re: vertical tolerance

Inpatient ABT Program: FES

Evaluate:
• Spasticity
• Isolated Movement
• Trunk Control
Transition:
• FES Bike → RT600

FES Training Algorithm

1. Assess unilaterally for all tasks
2. As patient continues to progress, discharge FES unilaterally when standard is met.
Inpatient Locomotor Training

- Robotic LTing
  - 12-15 hours/week
  - 6 patients/day
  - Lokomat: 325k
  - Staffing: 1 PT and 1 Tech
    - Tech not needed for entire session
  - Financial considerations vs. Optimal training?

- Manual LTing
  - 12-15 hours/week
  - 6 patients/day
  - Therastride 90k
  - Zero G: 250k
  - Over ground BWS
  - Staffing: 1 PT and 3 Tech
    - Volunteers
  - Financial considerations vs. Optimal Training

Inpatient ABT Program: Locomotor Training

Evaluate:
- Spasticity
- Step Initiation
- Trunk Control

Transition:
- Robot → Manual

LTing Algorithm

1. Can only require 1 person physical contact during the gait assessment.
2. Determinations will be made on 2 out of 3 for agreement.
3. Transition will be made based on criteria.
4. Minimal control appropriate with no additional support to maintain trunk control.
5. Transition criteria are to be determined by an Inpatient Locomotor Team.

Spasticity (SCATS and/or Modified Ashworth MA)

- AIS C and D, BI, or CVA
- ≥ 50 ft with or without AD
- 3-4 steps with or without AD
- Extremity control and coordination

Over Ground Ambulation

- Trunk Strength and Control

- Manual LTing
- Robotic LTing
- Manual LTing
- Robotic LTing
- Manual LTing
- Robotic LTing

- Manual LTing
- Robotic LTing
- Manual LTing
- Robotic LTing
- Manual LTing
- Robotic LTing

- Manual LTing
- Robotic LTing
- Manual LTing
- Robotic LTing
- Manual LTing
- Robotic LTing
Out Patient Locomotor Training

- Locomotor Training Program (Manual vs. Robotic)
  - Capital
  - Staffing
  - Payor Mix
  - Coding
  - 10% profit margin (Morrison et al. 2007)

<table>
<thead>
<tr>
<th></th>
<th>Commercial Insurance</th>
<th>Medicare</th>
<th>Medicaid</th>
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<tbody>
<tr>
<td>N</td>
<td>22</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Profit Margin</td>
<td>19%</td>
<td>-57%</td>
<td>-65%</td>
</tr>
</tbody>
</table>

Community ABT Programs

- Wellness, fitness and preventing secondary complications of immobility
- Intensive activity to promote recovery of function

Community ABT Programs

- Out Patient Program for Acute and Chronic Neurological Impairment
  - Physical Therapists: Evaluates, designs and oversees intensive program
  - Exercise Specialists: Carries out intensive strengthening program under supervision of PT and/or independently
  - Structured rigorous individualized program:
    - Resistance training
    - Cardiovascular training
    - Developmental sequencing
    - Locomotor training
Wellness

- Wellness is an active process of becoming aware of and making choices toward a more successful existence
- Process means that improvement is always possible
- Aware means that we are continuously seeking more information about how we can improve
- Choices means that we consider a variety of options and select those in our best interest
- Success is determined by each individual to be their collection of life accomplishments

Mission:
- Fully adapted Wellness Center
- Intensive Recovery Center
- Continuum of Care

Program Overview:
- Staffing: Physical Therapists and/or Exercise Specialists
- Outcomes: QOL (Wellness) and Recovery measures

Market Analysis:
- >30 programs in over 18 states
- Wellness: $30-50/month
- Specialized classes: $25-50/class
- Intensive 1:1 training: $75-128/hour
Business Plan:
- Physical space
  - Dependent on equipment and staffing
- Start up Expenses: Direct Costs
  - Capital Equipment: $88
  - Staffing
  - Physical space
- Growth potential
  - "Prevalence of Paralysis": 304,228,000 persons in the US reported to have some level of paralysis
  - "If we don't provide it, someone else will."

Tiers of Service
- Gym Membership
  - 1 hour evaluation with PT
  - Krank cycle classes, adapted yoga, Tai Chi
  - Educational seminars
  - Health and Wellness questionnaire (may or may not need medical clearance)
- FES Cycling Classes:
  - May require medical clearance
- 1:1 Personal Training:
  - Medical clearance may be required

Logistics:
- Large space required (basketball gym)
  - Technology
  - Variety of diagnosis
  - Class structure vs. 1:1
- Operating Hours:
  - Mon-Fri: 10am-7pm
  - Saturday: 10am-2pm
- Staff
  - Wellness Coordinator: Physical Therapist
  - Exercise Specialists
Research...

The ACTION Clinical Trial

- Evaluating the effects of ACTivity On Neuro-recovery
- NIDRR Field Initiated Research grant
  - Randomized Controlled Trial
  - Experimental/Control group comparison
  - 50 subjects rolling enrollment
  - 24 weeks of active therapy
  - 5 hours/week
- Primary outcome – Improved walking ability
- Examine durability of gains 12 and 24 months post-treatment

Sampling Frame and Study Design

<table>
<thead>
<tr>
<th>Sampling Frame for Participant Selection</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetraplegia (C2-T1)</td>
<td>8/8</td>
<td>8/8</td>
</tr>
<tr>
<td>LEMS &lt;25</td>
<td>9/9</td>
<td>9/9</td>
</tr>
<tr>
<td>LEMS &gt;25</td>
<td>3/4</td>
<td>4/4</td>
</tr>
<tr>
<td>Paraplegia (T2-T12)</td>
<td>1/4</td>
<td>0/4</td>
</tr>
<tr>
<td>LEMS &lt;35</td>
<td>3/4</td>
<td>4/4</td>
</tr>
<tr>
<td>LEMS &gt;35</td>
<td>3/4</td>
<td>4/4</td>
</tr>
</tbody>
</table>

Figure 1: Graphical representation of delayed treatment control group design
## Therapy “Dose” Based on Functional Status

<table>
<thead>
<tr>
<th>Level</th>
<th>Client Functional Status</th>
<th>Developmental Sequencing</th>
<th>Strengthening Exercise</th>
<th>Lokomat Training (LT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstrates complete loss of motor and sensory function below level of injury (LOI)</td>
<td>4 hours</td>
<td>6 hours</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>Motor incomplete with sparing of motor function &gt; 3 levels below LOI; Unable to initiate 1 step w/out assistance</td>
<td>3 hours</td>
<td>6 hours</td>
<td>1 hour over ground &amp; 5 hours on flat FES; 3 hour bible. LT</td>
</tr>
<tr>
<td>3</td>
<td>Able to initiate one step without assistance and walk &lt;= 50 ft. w/out physical assistance</td>
<td>2 hours</td>
<td>6 hours</td>
<td>1 hour robotic LT or 2 hours OG training or 1 hour FES</td>
</tr>
<tr>
<td>4</td>
<td>Able to walk &gt; 50 ft. with one person assistance</td>
<td>1 hour</td>
<td>6 hours</td>
<td>2 hours robotic LT or 2 hours OG training or 1 hour FES</td>
</tr>
<tr>
<td>5</td>
<td>Able to walk &gt; 150 ft. without physical assistance</td>
<td>1 hour</td>
<td>6 hours</td>
<td>2 hours LT with or without body weight support; 2 hours OG training or 1 hour FES</td>
</tr>
</tbody>
</table>

### Therapy “Dose” Based on Functional Status

May include the following:
- Supported plyometrics (Power Tower)
- Core and UE strengthening (Tilt Table)
- Vibration Plate
- Weight Room (Leg press, knee extension and hamstring curl machines)
- Core and LE strengthening (TRX)
- Standing Ther Ex and plyometrics (Smith Machine)

### Resistance and Plyometric Training

May include the following:
- Plank positioning
- Quadruped
- Crawling
- Tall kneeling
- Walking on knees with or without UE support
- ½ kneeling
- Standing Exercises with and without AD

### Developmental Sequencing

May include the following:
- Plank positioning
- Quadruped
- Crawling
- Tall kneeling
- Walking on knees with or without UE support
- ½ kneeling
- Standing Exercises with and without AD
Retro analysis of first 30 patients who went through Beyond Therapy program
Evaluated weekly treatment plans; compared to weekly progression
Evaluated clinical decisions: dosage/frequency of locomotor training, strength training and developmental sequencing
Consulted outcome assessments as well as treatment notes for evaluation

Group 1:

- Subjects include patients who require more than 1 person physical assist to ambulate bilaterally without assistance
- Grouping is based on ability to ambulate with 1 or 2 physical assistants

Group 1:

- Subjects unable to ambulate 1 step bilaterally without assistance
- 3 hours of Robotic LTing
- 3 hours of Developmental Sequencing
- 2 hours of Robotic LTing
- 1 hour Over Ground Gait Training using FES
- 6 hours of intensive strengthening
- 1 hour resistance training
- 1 hour developmental sequencing

Group 1:

- Robotic LTing
  - Staffing, repetition, biofeedback
- Over ground training
  - Platform walker with FES to assist with stepping and/or stabilization
- Developmental Sequencing
  - Quadruped and crawling: tall kneeling focusing on core stabilization with UE support
- Resistance Training
  - LE strengthening with manual assistance and weights
Group 2:

- Robotic or Manual LTing
  - Refer to LTing algorithm (spasticity, assistance, trunk control)
- Over ground walking
  - ↑ 2 hours/week less labor intensive and > ability to initiate movement (FES algorithm LRAD)
- Developmental Sequencing
  - Tall kneeling walking and begin working on independent standing
- Resistance Training
  - LE strengthening > focus on unilateral strengthening:

Group 3:

- Subjects ambulate > 50 ft but < 150 ft with 1 person assist
  - Robotic or Manual LTing using algorithm
  - 2 hours of Robotic or Manual LTing
  - 2 hours Over Ground LTing using FES algorithm
  - 3 hours Over Ground Gait Training using FES algorithm
  - 4 hours of intensive strengthening
  - 2 hours resistance training
  - 2 hours developmental sequencing

Subjects able to initiate 1 step without assist; < 50 ft with 1 person assist

Group 2:

1. Subjects able to ambulate with only person physical assist, but less than 50 ft and no assist for AD management.
2. Progress to treatment group 3 when able to ambulate > 50 ft with 1 person physical assist and no assistance needed for AD.

Group 3:

1. Subjects able to ambulate > 50 ft but < 150 ft with 1 person assist
2. Progress to treatment group 3 when able to ambulate > 150 ft with mod I assist.
Group 3

- Robotic or Manual Lting
  - Refer to Lting and FES algorithms (spasticity, assistance, trunk control)
- Over ground walking
  - ↑ 3 hours/week less labor intensive and > independence (FES algorithm and community friendly AD)
- Developmental Sequencing
  - tall kneeling walking without UE support and > time in standing
- Resistance Training
  - LE strengthening; begin gravity eliminated plyometrics

Group 4

- Manual Lting on treadmill
  - With or without BWS; Refer to FES algorithm (spasticity, assistance)
- Over ground walking
  - ↓ 2 hours/week as already “practicing” walking at home and in the community (FES algorithm)
- Developmental Sequencing
  - Focusing on independent static and dynamic standing
- Resistance Training
  - Unilateral LE strengthening; Unilateral gravity eliminated plyometrics; standing plyometrics with UE support
### Demographic and Baseline Information

<table>
<thead>
<tr>
<th></th>
<th>Experimental (n=20)</th>
<th>Control (n=21)</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) [mean ± SD]</td>
<td>42.2 ± 13.03</td>
<td>34.14 ± 12.03</td>
<td>0.046</td>
</tr>
<tr>
<td>Gender</td>
<td>M = 19 / F = 1</td>
<td>M = 11 / F = 10</td>
<td>0.002</td>
</tr>
<tr>
<td>Time Post Injury (months)</td>
<td>77.8 ± 122.6</td>
<td>75.3 ± 88.3</td>
<td>0.935</td>
</tr>
<tr>
<td>Tetraparesis/paraparesis</td>
<td>15/5</td>
<td>16/5</td>
<td>0.931</td>
</tr>
<tr>
<td>AIS Classification</td>
<td>C = 7 / D=13</td>
<td>C = 11 / D = 10</td>
<td>0.274</td>
</tr>
<tr>
<td>ASIA Motor Score</td>
<td>62.6 ± 19.8</td>
<td>64.8 ± 16.3</td>
<td>0.719</td>
</tr>
<tr>
<td>ASIA LEMS</td>
<td>25.2 ± 13.7</td>
<td>28.1 ± 11.6</td>
<td>0.468</td>
</tr>
<tr>
<td>SCIM II</td>
<td>62.7 ± 18.9</td>
<td>60.6 ± 25.5</td>
<td>0.891</td>
</tr>
</tbody>
</table>

### Pre-/Post- Change in Primary Outcome

<table>
<thead>
<tr>
<th></th>
<th>Experimental (n=14)</th>
<th>Control (n=19)</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASIA Motor [mean ± SD]</td>
<td>5.2 ± 6.4</td>
<td>0.9 ± 6.0</td>
<td>0.021</td>
</tr>
<tr>
<td>ASIA LEMS</td>
<td>3.8 ± 5.4</td>
<td>0.6 ± 4.2</td>
<td>0.006</td>
</tr>
<tr>
<td>10-Meter Walk (elapsed time)</td>
<td>-41.9 ± 110.5</td>
<td>1.3 ± 13.1</td>
<td>0.099</td>
</tr>
<tr>
<td>6-Minute Walk (ft)</td>
<td>118 ± 122.0</td>
<td>9.9 ± 83.7</td>
<td>0.002</td>
</tr>
<tr>
<td>Timed Up &amp; Go (sec)</td>
<td>-35.5 ± 62.2</td>
<td>-6.2 ± 18.1</td>
<td>0.130</td>
</tr>
<tr>
<td>SCIM II</td>
<td>1.4 ± 5.2</td>
<td>3.9 ± 18.0</td>
<td>0.553</td>
</tr>
<tr>
<td>CHART Mobility</td>
<td>-0.1 ± 15.1</td>
<td>2.9 ± 10.2</td>
<td>0.463</td>
</tr>
<tr>
<td>CHART Physical Independence</td>
<td>5.2 ± 22.1</td>
<td>15.3 ± 31.5</td>
<td>0.261</td>
</tr>
<tr>
<td>RHL</td>
<td>0.5 ± 1.4</td>
<td>-0.2 ± 1.0</td>
<td>0.086</td>
</tr>
<tr>
<td>QUICKI</td>
<td>-0.002 ± 0.02</td>
<td>0.012 ± 0.05</td>
<td>0.358</td>
</tr>
<tr>
<td>Weight</td>
<td>14.4 ± 68.75</td>
<td>20.4 ± 96.2</td>
<td>0.107</td>
</tr>
<tr>
<td>BMI</td>
<td>-1.3 ± 9.1</td>
<td>2.0 ± 10.5</td>
<td>0.303</td>
</tr>
</tbody>
</table>

Pearson Chi-Square, $p = .027$

### Functional Walking Outcomes

Status change between non-walker, home-walker, and community walker based on 10-meter walking speed of > 0.44 m/sec

<table>
<thead>
<tr>
<th></th>
<th>Experimental (n = 14)</th>
<th>Control (n = 19)</th>
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<tbody>
<tr>
<td>Worse</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No Change</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Improved</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

Pearson Chi-Square, $p = .027$
Who responds to therapy?

6-Minute Walk Test

**Initial Evaluation**

- 1.5 years post C4-C5 SCI
- AIS C
- Dependent for all mobility except power wheelchair
- Goals: Increase Independence, Walk, Return to Work

**Drew**

**6 months post ABT program**
12 months post ABT Program

18 months Post ABT Program

Assessments
L-Force (Nms)

<table>
<thead>
<tr>
<th>SCATS</th>
<th>5/01/07</th>
<th>7/24/08</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hip Flexion</td>
<td>6.66</td>
<td>59.33</td>
<td>640.0%</td>
</tr>
<tr>
<td>Right Hip Extension</td>
<td>7.02</td>
<td>72.33</td>
<td>320.0%</td>
</tr>
<tr>
<td>Left Hip Flexion</td>
<td>2.05</td>
<td>47.54</td>
<td>225.0%</td>
</tr>
<tr>
<td>Left Hip Extension</td>
<td>0.77</td>
<td>59.04</td>
<td>654.0%</td>
</tr>
<tr>
<td>Right Knee Extension</td>
<td>18.7</td>
<td>58.34</td>
<td>212.0%</td>
</tr>
<tr>
<td>Right Knee Flexion</td>
<td>18.66</td>
<td>52.31</td>
<td>180.0%</td>
</tr>
<tr>
<td>Left Knee Extension</td>
<td>2.34</td>
<td>31.09</td>
<td>679.0%</td>
</tr>
<tr>
<td>Left Knee Flexion</td>
<td>4.3</td>
<td>29.75</td>
<td>630.0%</td>
</tr>
</tbody>
</table>

SCATS

<table>
<thead>
<tr>
<th>SCATS</th>
<th>5/01/07</th>
<th>7/24/08</th>
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<tbody>
<tr>
<td>Clonus</td>
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<td>1</td>
</tr>
<tr>
<td></td>
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<td>2</td>
</tr>
<tr>
<td>Flexor</td>
<td>0</td>
<td>0</td>
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</table>
Thank You!!!