Why Does Intensity Matter in Stroke Rehabilitation?

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Brain Reorganization

• The brain has significant capacity to reorganize itself to recover from loss of function following a stroke

• Reorganization depends on training or rehabilitation and will not occur spontaneously
Rehabilitation training (enriched environments with animals) increases brain reorganization with subsequent functional recovery.

In animal studies key factors promoting recovery include *increased activity and a complex, stimulating environment*.

Lack of rehab causes decline in cortical representation and delays recovery.
What Evidence Do We Have That Therapy Intensity Is Important?
- RCT of 146 “middle band” strokes to stroke unit (SU) or gen med (GM) unit
- Median Barthel Index = 4/20 initially in both
- Stroke Unit - BI = 15 after 6 wks; discharged at 6 wks
- General Medical Unit - BI = 12 after 12 wks; discharged at 20 wks

Kalra et al. 1994
Frontloading (Kalra et al. 1994)
Frontloading (Kalra et al. 1994)
Amount of Physiotherapy and Occupational Therapy
Therapy Intensity: Front Loading

Kalra et al. 1994
Role of Intensity of Therapy

• Post-stroke rehab increases motor reorganization while lack of rehab reduces it; more intensive motor training in animals further increases reorganization

• Clinically greater therapy intensity improves outcomes; reported for PT, OT, aphasia therapy, treadmill training and U/E function in selected patients (i.e. CIMT)

• One exception is VECTORS trial (Dromerick et al. 2009); showed high intensity U/E CIMT (6 hrs/day) starting day 10 showed less improvement at 3 mos than less intense Rx; Rationale uncertain – not a large trial

Number of Repetitions in the Upper Extremity

• No study has systematically determined a critical threshold of rehab intensity needed to obtain a benefit (MacLellan et al 2011)

• Research involves thousands of repetitions – EXCITE trial involved 196 hours of therapy per patient

• Threshold not reached, recovery affected arm less; patients develop compensatory movements (Han et al 2008; Schweighofer et al 2009)

• Lang et al. (2007) found practice of task-specific, functional U/E movements occurred in half of U/E rehab sessions: Average number of reps = 32

• Technology (video gaming, robotics) may be necessary to achieve the maximum number of reps (Saposnik et al. 2010)

MacLellan et al. NeuroRehab and Neural Repair 2011; 25(8):740-748
Han et al. PLoS Comput Biol 2008; 4e1000133
Schweighofer et al. Phys Ther 2009; 89:1327-1336
Saposnik et al . Stroke 2010; 41(7):1477-184
In a therapeutic day
• >50% time in bed
• 28% sitting out of bed
• 13% in therapeutic activities
• Alone for 60% of the time

Contrary to the evidence that increased activity and environmental stimulation is important to neurological recovery

Bernhardt et al. Stroke 2004; 35:1005-1009
Recommendations Regarding Inpatient Therapy Intensity Following Acute Stroke

• International recommendations made regarding therapy intensity variable

• 3 guidelines recommended daily minimum amounts of therapy, ranging from 45 to 60 minutes per day each of physical therapy (PT) and occupational therapy (OT) (or all relevant core therapies)

• 3 guidelines made nonspecific statements indicating that increased intensity of therapy was either recommended or in the case of one not recommended

Foley et al. Topics Stroke Rehabil 2012; 19(2):96-103
Best Practice Recommendation 5.3
Delivery of Inpatient Stroke Rehabilitation

ii. Patients should receive a **minimum of three hours of direct task-specific therapy, five days a week**, delivered by the inter-professional team [Evidence Level C].

- *Average therapy hours of direct PT, OT and SLP 5 days per week is about 1.5-2 hours per day; most rehabilitation units do not supply 3 hours of therapy per day*

Parkwood Hospital (Foley et al. 2012)

- 123 pts from May - Oct 2009 workload measurement Infomed data for PT, OT and SLP and associated therapy aids measured
- A multivariable model to predict FIM gains achieved during hospital stay was also developed.
- The model explained 34% of the variance in FIM gain; total amount of therapy provided by OT and PT combined emerged as a significant predictor; days from stroke onset and admission FIM scores were also significant predictors.
- Intensity makes a difference

Three Issues in Providing Intensity

Resources
Innovation
Accountability
Ontario Resources

• Facilities were asked about staffing levels for 7 rehabilitation professions
• Estimated staffing levels were provided as a ratio of rehab beds per FTE to reflect the average case-load experienced by research staff across each region
• Only facilities for which complete bed and FTE information were available were used in the calculations
• Slow stream or LTLD beds not included in analysis

<table>
<thead>
<tr>
<th></th>
<th>Number of Rehab Beds per FTE in LHINs (median)</th>
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<tbody>
<tr>
<td>Physiotherapy</td>
<td>6.7 - 26.4 (10.0)</td>
</tr>
<tr>
<td>Occupational Therapy</td>
<td>8.2 - 26.4 (11.7)</td>
</tr>
<tr>
<td>Speech Language Pathology</td>
<td>15.8 – 60.0 (33.3)</td>
</tr>
<tr>
<td>Social Work</td>
<td>16.3 – 125 (30.0)</td>
</tr>
<tr>
<td>PT/OT Assistant</td>
<td>9.7 – 24.1 (13.6)</td>
</tr>
<tr>
<td>Dietician</td>
<td>64.0 – 236.7 (227.3) *NA in 6 LHINs</td>
</tr>
<tr>
<td>Recreational Therapist</td>
<td>28.8 – 166.3 (63.7) **NA in 2 LHINs</td>
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</tbody>
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Ontario Hrs of Therapy Per Day

Approximately how many hours of therapy a day were provided for PT, OT and SLP?

- Of 54 facilities surveyed, only 2 reported officially documented number of hours of therapy provided to patients
- **Estimated** therapy per patient ranged from 20 minutes to 4 hours per day
- 17 rehab units had SLP available on a consult basis only

Replacement of Therapists in Sickness and Holidays

- 45% of rehabilitation units had access to resources to cover therapists when they were sick
- Only 28% indicated they were successful in replacing a sick therapist 80% of the time
- 56% reported access to adequate resources for therapist replacement during holidays and extended sick leaves
- 24% reported availability of some form of weekend therapy

Resources for Stroke Rehab in Ontario

• Therapist to patient ratios are low
• Limited documentation of therapy time spent with patient
• Therapists are not consistently replaced when sick or on holidays

Innovation (Doing Things Differently)

Therapy is Cheap; Length of Stay is Not

• Core Therapies of PT, OT and SLP are most sensitive to intensity
• Only 25% of total hospital budget in subacute rehab is spent on core therapies
• Average length of stay is about 35 days
• Limited weekend or evening therapies

Need for Innovation: Using Resources More Efficiently

• Right-size staff numbers and standardize therapy intensity
• Establish better accountabilities for intensity
• Standardize and simplify assessments
• Simplify and tighten charting
• Reduce non-therapeutic activities
• Utilize Weekend and Group Therapy
• Explore Use of Technologies (i.e Robotics, Gaming)
• Intensify Outpatient Therapy
Current interdisciplinary stroke rehab team concept developed in the 1950-60’s
- Very discipline-specific
- No longer as relevant – rigid, expensive, inefficient
Program and Transdisciplinary Team

- Increasing therapy aids and volunteers
- Large influx of therapy aids or rehab aids (cross between therapy and nursing aids)
- The lines between the therapies becoming blurred and how rehabilitation is done redefined
- Rehab becoming less discipline specific
Accountability

Collaborative Evaluation of Rehabilitation in Stroke Across Europe (CERISE) Trial

• Study compared motor and functional recovery after stroke between 4 European Rehab Centers

• Gross motor and functional recovery was better in Swiss and German than UK center with Belgian center in middle

• Time sampling study showed avg. daily direct therapy time of 60 min in UK, 120 min in Belgian, 140 min in German and 166 min in Swiss centers

• Differences in therapy time not attributed to differences in patient/staff ratio (similar staffing)

De Wit et al. Stroke 2007:38:2101-2107
Average daily direct therapy time

De Wit et al. Stroke 2007:38:2101-2107
European CERISE Trial

• No differences were found in the content of physiotherapy and occupational therapy

• In German and Swiss centers, the rehabilitation programs were strictly timed (therapists had less freedom), while in UK and Belgian centers they were organized on an ad hoc basis (therapists had more freedom to decide)!

“More formal management in the German center may have resulted in the most efficient use of human resources, which may have resulted in more therapy time for the patients”

De Wit et al. Stroke 2007:38:2101-2107
Intensity: The 3 Hour Rule

- In Canada we struggle to provide adequate therapy
- The 3 hour rule is an American invention
- Not from the insurers – it is from Medicare
- States that all rehabilitation patients should get 3 hours of therapy per day of patient-therapist direct or face time
- In Ontario/Canada the estimate is the average rehabilitation patient gets 1-2 hours of direct patient-therapist time
- To ensure compliance it is tied to funding

PSROP Centers (Brendan Conroy @ NIH)

U.S. Inpatient Stroke Rehabilitation is driven by Medicare which expects:

1. Participation (“the 3 Hour Rule”)
2. Progress (FIM Gain of 1-1.5/day)
3. Expedited Discharge Home or to SNF if progress is too slow or family unwilling/unable to take home

- Therapist must record face-to-face interactions with pt in 15 min increments
- Manager responsible at end of day to ensure patient received their full 3 hrs of therapy
- Any missed therapy must have a strong medical justification documented by MD and therapist
- Failure to deliver enough time means loss of payment