Greater Exercise Dose During Stroke Inpatient RehabilitationImproves Walking Recovery

Tara Klassen, PT, PhD
Research Associate, GF Strong Rehabilitation Research Program
Vancouver, Canada

On behalf of the DOSE Study Team:
Janice Eng, PT/OT, PhD; Sean Dukelow, MD, PhD; Oscar Benavente, MD; Mark Bayley, MD; Michael Hill, MD; Andrei Krassioukov, MD; Teresa Liu-Ambrose, PT, PhD; Marc Poulin, PhD; Sepideh Pooyania, MD; Jennifer Yao, MD
Presenter Disclosure Information

Tara Klassen, PT, PhD
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No relevant financial relationship exists
Walking Is A Critical Component of Stroke Rehabilitation

- Walking is the most commonly stated rehabilitation goal post-stroke
- Primary reason for referral to inpatient rehabilitation
- Dictating factor in determining hospital discharge destination
- Walking re-training improves functional outcomes, but optimal walking prescription parameters not known.

(Bohannon et al. 1988; Dobkin 2005; Mees et al. 2014; French et al. 2010)
Knowledge Gaps: Walking and Stroke Rehabilitation

Repetitions (Step Count)

Aerobic Intensity

Timing

Optimal

Acute

Chronic

Sub-Acute

( Lohse et al. 2014; English et al. 2015; Mackay-Lyons et al. 2015; Stoller et al. 2012; Krakauer et al. 2012)
Knowledge Gaps: Walking and Stroke Rehabilitation Timing

“Sweet spot” for stroke rehabilitation?

( Bernhardt et al., 2017)
DOSE Study Objective:

To determine whether varying doses of a higher intensity (double and quadruple step count + aerobic minutes) walking-specific, physical therapy intervention program applied during stroke inpatient rehabilitation improves walking recovery and other secondary outcomes compared to standard physical therapy care.
Methods: Study Design

- National, multi-site, 3-arm, randomized controlled trial
- Single-blind (evaluators)
### Methods: Participants

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
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<tbody>
<tr>
<td>• Within 10 weeks post-stroke with leg hemiparesis</td>
<td>• Pre-stroke or current health condition (other than stroke) contributing to:</td>
</tr>
<tr>
<td>• Pre-stroke disability &lt;2 on Modified Rankin Scale</td>
<td>o Walking disability</td>
</tr>
<tr>
<td>• Able to walk at least 5m with up to 1 person max assist.</td>
<td>o Unstable medical status</td>
</tr>
<tr>
<td>• Overground walking speed less than 1.0 m/s</td>
<td>• Inability to follow commands.</td>
</tr>
<tr>
<td>• Pass exercise stress test</td>
<td>• &lt; 19 years old.</td>
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</tbody>
</table>
Methods: Intervention

Usual Care
Regular Physical Therapy
X 4 weeks

DOSE1
DOSE exercise protocol
1hr/day, 5x/week, 4 weeks
≥ 30 minutes walking
≥ 40% HRR
≥ 2000 steps

2x Usual Care
(DOSE1 (a.m. and p.m.))

4x Usual Care
(DOSE2)
Methods: Outcome Measures

Walking Recovery

6 minute walk (6MWT)
5 meter walk (5m walk)
Functional Ambulation Classification (FAC)

Impairment
- Isometric Knee Extension

Function
- Berg Balance Scale

Overall Well-Being
- EQ-5D-5L
- PHQ-9

Cognition
- MoCA
- Trails A+B
- DSST
Methods: Statistical Analyses

• Multiple linear regression for the outcome at post-evaluation, controlling for baseline evaluation.

• Analysis of:
  – Usual Care to DOSE1
  – Usual Care to DOSE2
**Results:
Study Flow**

- **Recruitment**
- **Baseline Evaluation (T1)**
- **Randomization**
- **Intervention**
  - **USUAL CARE**
  - **DOSE1**
  - **DOSE2**
- **Post-Evaluation (T2)**
- **6 Month Evaluation (T3)**
- **12 Month Evaluation (T4)**

**Admissions = 2387**
**Assessed for eligibility = 2141**
**Excluded = 2066**
- No LE hemiparesis
- > 10 weeks post-stroke
- < 15 feet ambulation

**N = 75**
25/group

1 participant removed from DOSE 2 by study PIs for suspected cardiac arrhythmia

Determine Optimal Post-Stroke Exercise (DOSE)
# Results: Patient Characteristics

<table>
<thead>
<tr>
<th></th>
<th>USUAL CARE (n=25)</th>
<th>DOSE1 (n=25)</th>
<th>DOSE2 (n=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>57±14</td>
<td>56±11</td>
<td>58±10</td>
</tr>
<tr>
<td>Male sex</td>
<td>15 (60)</td>
<td>16 (64)</td>
<td>14 (56)</td>
</tr>
<tr>
<td>Time from stroke to randomization (days)</td>
<td>25±11</td>
<td>27±10</td>
<td>29±10</td>
</tr>
<tr>
<td>Type of Stroke</td>
<td>Ischemic=21</td>
<td>Ischemic=22</td>
<td>Ischemic=19</td>
</tr>
<tr>
<td></td>
<td>Hemorrhagic=4</td>
<td>Hemorrhagic=3</td>
<td>Hemorrhagic=6</td>
</tr>
<tr>
<td>Baseline 5m walk (m/s)</td>
<td>0.40±0.22</td>
<td>0.44±0.25</td>
<td>0.42±0.25</td>
</tr>
<tr>
<td>Baseline MOCA (/30)</td>
<td>24±5</td>
<td>23±7</td>
<td>24±5</td>
</tr>
</tbody>
</table>
Results: Intervention Intensities Achieved

- Mean time ≥ 40% HRR/PT session (minutes)
  - Usual Care
  - DOSE1
  - DOSE2

- Mean Fitbit Step Count/PT session
  - Usual Care
  - DOSE1
  - DOSE2

*p < 0.005
Results: Significant Improvements with DOSE1 and DOSE 2 in the 6MWT

* \( p=0.021 \)

** \( p=0.030 \)
Results: Significant Improvements with DOSE 2 in the 5m walk

* p=0.037
RESULTS: Significant Improvements with DOSE1 and DOSE2 in EQ-5D-5L VAS
RESULTS: Significant Improvements with DOSE1 and DOSE2 in EQ-5D-5L Index

<table>
<thead>
<tr>
<th>Activity</th>
<th>Usual Care</th>
<th>DOSE1</th>
<th>DOSE2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
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<tr>
<td>Self-Care</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Usual Activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain/Discomfort</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Anxiety/Depression</td>
<td></td>
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*p = 0.001
**p = 0.002
RESULTS: Perceptions to DOSE Intervention

It was amazing when I had patients that had a stroke two months ago and they were getting more steps per day than most of the Canadian population. (Physical Therapist)

The first thing I went in and I started to build up a sweat and I felt like myself. I don’t know how to explain it; I felt positive, I felt like I was doing something to make myself feel better. (Patient)

(Delivering Intensive Rehabilitation in Stroke: Factors Influencing Implementation. Connell et al., 2018)
Discussion: Impact of DOSE

• Patients could tolerate DOSEs that were more than 2-7x the amount of Usual Care.

• Using wearable sensors to quantify exercise intensity is feasible.

• Very pragmatic intervention protocol: can be administered by front-line therapists and tolerated by patients.

• Next step = Phase III trial
Acknowledgements

DOSE Study Investigators

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Sepideh Pooyania, MD
Jennifer Yao, MD

DOSE Study Sites and Team Members

Vancouver, British Columbia
GF Strong Rehabilitation Centre
Holy Family Hospital
Laurel Place (Surrey Memorial)

Calgary, Alberta
Foothills
Vernon Fanning

Toronto, Ontario
Toronto Rehabilitation Institute

Winnipeg, Manitoba
Riverview Hospital

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Canadian Institutes of Health Research
"What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?"
DISCUSSION:
Why did DOSE1 and DOSE2 have a similar recovery on the 6MWT?
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