Efficacy of a behavioral intervention for reducing sedentary behavior in persons with multiple sclerosis: A pilot examination

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Physical Activity Behavioral Interventions in MS

• Benefits of PA in persons with MS¹
• Exceedingly low levels of PA in MS²
• Involve teaching persons the skills, resources, and strategies for successful behavior change
• Three RCTS of behavioral interventions based on social cognitive theory³ and delivered through the internet have increased PA and yielded symptomatic and functional benefits in persons with MS⁴-⁶

¹Motl & Pilatti, 2014; ²Klaren et al., 2013; ³Bandura, 2004; ⁴Motl et al., 2011; ⁵Pilatti et al., 2014; ⁶Sandroff et al., 2014
Table 2. Physical activity and mediator variables pretrial and post-trial for intervention and control conditions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention (n = 23)</th>
<th>Control (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretrial</td>
<td>Post-trial</td>
</tr>
<tr>
<td>Physical activity</td>
<td>13.8 (1.5)</td>
<td>24.7 (1.8)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>77.4 (27.8)</td>
<td>61.8 (29.6)</td>
</tr>
<tr>
<td>Physical outcome expectations</td>
<td>20.8 (2.2)</td>
<td>20.7 (1.3)</td>
</tr>
<tr>
<td>Social outcome expectations</td>
<td>11.6 (2.2)</td>
<td>12.8 (2.1)</td>
</tr>
<tr>
<td>Self-evaluative outcome</td>
<td>18.3 (1.7)</td>
<td>18.5 (1.6)</td>
</tr>
<tr>
<td>Functional limitations</td>
<td>69.3 (11.2)</td>
<td>60.0 (17.0)</td>
</tr>
<tr>
<td>Goal setting</td>
<td>15.4 (0.6)</td>
<td>23.8 (10.9)</td>
</tr>
</tbody>
</table>

Note: Physical activity = Godin Leisure-Time Exercise Questionnaire; Self-efficacy = Exercise Self-efficacy Scale; Physical outcome expectations = Multidimensional Outcome Expectations for Exercise Scale, Physical subscale; Social outcome expectations = Multidimensional Outcome Expectations for Exercise Scale, Social subscale; Self-evaluative outcome expectations = Multidimensional Outcome Expectations for Exercise Scale, Self-evaluative subscale; Functional limitations = Law-Lifefunction and Disability Inventory, Goal setting = Exercise Goal setting Scale.

*Significantly different compared with pretrial value as p < 0.01.
**Significantly different compared with pretrial value as p < 0.001.

Table 2. Post-trial data from intervention and control conditions and tests for condition effect controlling for pre-trial outcome scores. Values are estimated marginal means (SE).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intervention (n=37)</th>
<th>Control (n=39)</th>
<th>η²</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GLTEQ</td>
<td>27.2 (3.0)</td>
<td>13.0 (3.0)</td>
<td>.13*</td>
<td>.77</td>
</tr>
<tr>
<td>MVPA, minutes</td>
<td>19.5 (2.3)</td>
<td>13.8 (2.2)</td>
<td>.05</td>
<td>.43</td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSS</td>
<td>4.6 (0.2)</td>
<td>5.4 (0.2)</td>
<td>.15*</td>
<td>.82</td>
</tr>
<tr>
<td>MFIS Total</td>
<td>35.7 (1.8)</td>
<td>40.5 (1.8)</td>
<td>.05</td>
<td>.43</td>
</tr>
<tr>
<td>MFIS Physical</td>
<td>16.0 (0.9)</td>
<td>15.3 (0.8)</td>
<td>.09*</td>
<td>.63</td>
</tr>
<tr>
<td>MFIS Cognitive</td>
<td>14.7 (1.0)</td>
<td>18.0 (0.9)</td>
<td>.01</td>
<td>.22</td>
</tr>
<tr>
<td>MFIS Psychosocial</td>
<td>3.0 (0.3)</td>
<td>3.3 (0.3)</td>
<td>.01</td>
<td>.24</td>
</tr>
<tr>
<td>HADS Depression</td>
<td>5.0 (0.4)</td>
<td>6.6 (0.4)</td>
<td>.10*</td>
<td>.64</td>
</tr>
<tr>
<td>HADS Anxiety</td>
<td>4.1 (0.4)</td>
<td>5.4 (0.4)</td>
<td>.10*</td>
<td>.64</td>
</tr>
<tr>
<td>SF-MPQ</td>
<td>8.1 (0.7)</td>
<td>9.8 (0.6)</td>
<td>.04</td>
<td>.42</td>
</tr>
<tr>
<td>PSQI</td>
<td>4.4 (0.4)</td>
<td>7.4 (0.4)</td>
<td>.05</td>
<td>.45</td>
</tr>
<tr>
<td>Health-related quality of life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSIS-29 Physical</td>
<td>29.1 (1.5)</td>
<td>31.2 (1.5)</td>
<td>.05</td>
<td>.45</td>
</tr>
<tr>
<td>MSIS-29 Psychological</td>
<td>27.6 (2.4)</td>
<td>33.1 (2.3)</td>
<td>.04</td>
<td>.30</td>
</tr>
</tbody>
</table>

FSS: Fatigue Severity Scale; GLTEQ: Godin Leisure-Time Exercise Questionnaire; HADS: Hospital Anxiety and Depression Scale; MFIS: Modified Fatigue Impact Scale; MSIS-29: 29-item Multiple Sclerosis Impact Scale; MVPA: moderate to vigorous physical activity; PSQI: Pittsburgh Sleep Quality Index; SF-MPQ: Short-Form McGill Pain Questionnaire. *Notes statistically significant difference between intervention and control groups post-trial (p<0.05).
Sedentary Behavior

- Defined as sitting or lying that does not increase energy expenditure during the waking hours\(^7\)
- Sitting time (ST)
  - Adults on average engage in ~8 hours of ST/day\(^8\)
  - Associated with morbidity and mortality in the general population, independent of PA\(^9,10\)
  - Reduced through a behavioral intervention based on SCT in older obese women\(^11\)

\(^7\)Sed Behav Res Net, 2011; \(^8\)Matthews et al., 2008; \(^9\)Bauman et al., 2011; \(^10\)Patel et al., 2010; \(^11\)Adams et al., 2013
Sedentary Behavior

• Persons with MS engage in high amounts of sedentary behavior\(^{12}\)
• Associated with mobility disability, fatigue, walking performance, and cognitive processing speed in MS\(^ {13}\)
• Importance of examining effects of behavioral interventions on sedentary behavior in MS

\(^{12}\)Cavanaugh et al., 2011; \(^{13}\)Hubbard & Motl, 2014

Purpose & Hypothesis

• The current study involved a secondary analysis of previously published data to examine the effect of a behavioral intervention based on SCT for reducing ST in persons with MS
  – We expected that persons with MS in the intervention condition would demonstrate a reduction in ST compared with the waitlist control
**Participant Inclusion Criteria**

- Physician diagnosed MS and approval for participation
- Ability to walk with or without an assistive device
- Age between 18-64 years
- Physical inactivity defined as <60 minutes/week
- Relapse free for past 30 days
- Low risk of contraindications based on Physical Activity Readiness Questionnaire (PAR-Q)\(^{14}\)

\(^{14}\) Thomas et al., 1992

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**Participants**

- Final sample included 70 participants who were randomly assigned into intervention (n=33) or wait-list control (n=37) conditions and provided baseline ST data
Primary Measure

• ST
  – Question seven of the abbreviated International Physical Activity Questionnaire (IPAQ)\textsuperscript{15}
  – “During the last 7 days, how much time did you spend sitting on a weekday?”

\textsuperscript{15}Craig et al., 2003

Procedure

• All participants provided informed consent approved by University IRB
• Participants provided demographic/clinical information and completed a battery of tests during a one-hour session in the laboratory at baseline (pre-intervention) and six-months (post-intervention)
• Participants were grouped based on disability and PA data and then randomly assigned into intervention or wait-list control conditions
Procedure

• Intervention:
  – Over a six-month period, participants visited a study website, wore a pedometer, completed a log book along with Goal Tracker software, and participated in one-on-one video coaching sessions

• Wait-list control:
  – Participants completed the study measures before and after the six-month period and received the intervention once the study reached completion

Intervention Components

• Study website
  – Content based on SCT focused on teaching behavioral strategies for changing PA and ST
  – Outcome expectations, goal setting and self-monitoring, self-efficacy, facilitators and barriers for PA and ST
  – Guided participants to online materials and videos of examples and ideas for reducing ST and increasing PA

• Video coaching sessions
  – Semi-scripted and based on principles of supportive accountability
  – Review of goal-setting and progress towards goal attainment
  – Stressed the importance of identifying opportunities for reducing ST and moving more and co-developed approaches for reducing relevant examples of ST
Data Analysis

• Data were analyzed in IBM SPSS v21.0
• Examined baseline differences between groups in demographic/clinical characteristics using independent samples t-tests and χ² statistics
• Intent-to-treat and completers analyses
• Examined group differences in ST using ANCOVA on post-intervention scores controlling for pre-intervention values
• Provide the parameter estimate, standard error (SE), and associated t-value along with p-value per analysis

Participant Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention (n=33)</th>
<th>Control (n=37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>49.4 (9.2)</td>
<td>50.3 (9.1)</td>
</tr>
<tr>
<td>Sex (% female)</td>
<td>73%</td>
<td>82%</td>
</tr>
<tr>
<td>Race (% Caucasian)</td>
<td>100%</td>
<td>95%</td>
</tr>
<tr>
<td>Employment (% employed)</td>
<td>64%</td>
<td>59%</td>
</tr>
<tr>
<td>MS Type (% RRMS)</td>
<td>82%</td>
<td>84%</td>
</tr>
<tr>
<td>Disease Duration (years)</td>
<td>11.1 (7.1)</td>
<td>13.2 (9.4)</td>
</tr>
<tr>
<td>PDDS score (median, IQR)</td>
<td>2.0 (3.0)</td>
<td>3.0 (3.0)</td>
</tr>
<tr>
<td>Daily ST (minutes)*</td>
<td>550 (233)</td>
<td>412 (193)</td>
</tr>
</tbody>
</table>

Note. Values are mean (standard deviation), unless otherwise noted.
* Represents statistical significance.
Group Differences

- **Intent-to-treat analysis:**
  - Significant difference between groups ($F(1,67)=4.03, p<0.05, \eta^2=0.06$)
    - Parameter estimate of 98.9 min ($SE=49.3, t=2.01, p<0.05$)
    - Adjusted mean scores for intervention and control groups were 429.2 (201.2) and 528.2 (200.7) minutes of ST ($d=0.49$)

- **Completer’s analysis:**
  - Significant difference between groups ($F(1,54)=5.15, p<0.05, \eta^2=0.09$)
    - Parameter estimate of 128.9 min ($SE=56.8, t=2.27, p<0.05$)
    - Adjusted mean scores for intervention and control groups were 405.4 (211.6) and 534.3 (211.4) minutes of ST ($d=0.61$)
Primary Findings

• Daily ST was reduced in the intervention group compared to the control group
  – The amount of reduction was 1.65 hours based on the intent-to-treat analysis; the difference was even larger in the completer's analysis and exceeded 2 hours
• To our knowledge, we provide the first data of the efficacy of a behavioral intervention for reducing ST in persons with MS.

Why is this important?

• Sedentary behavior is common in persons with MS\textsuperscript{10-12} and has been associated with mobility disability, fatigue, walking performance, and cognitive processing speed in MS\textsuperscript{13}
• These preliminary data support future investigations aimed at reducing ST and other sedentary behaviors in MS
What to do we need to do next?

• More information about sedentary behavior in persons with MS
  – Identify what types of sedentary behavior are most common in persons with MS and who is more likely to engage in sedentary behavior
• Determine if reductions in sedentary behavior affect other outcomes in persons with MS

Strengths and Limitations

• Strengths
  – Large sample size for a pilot study
  – Validated ST measure in healthy adults\textsuperscript{17,18}
• Limitations
  – Secondary analysis of existing data
  – No objective assessment of sedentary behavior

\textsuperscript{17}Craig et al., 2003; \textsuperscript{18}Rosenberg et al., 2008
Acknowledgements

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THANK YOU!

Questions?