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Does the Effect of a Physical Activity Behavior Intervention Vary By Clinical Characteristics of Persons with Multiple Sclerosis?

Robert W. Motl, Deirdre Dlugonski, Lara A. Pilutti, Rachel E. Klaren

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Benefits of Physical Activity

- **Relapse rate (RR = 0.73)**
- **Walking mobility (ES = 0.19)**
- **Fatigue (ES = 0.45 or 1 point on FSS)**
- **Depression (ES = 0.36)**
- **QOL (ES = 0.23)**

PHYSICAL ACTIVITY AND MULTIPLE SCLEROSIS
the history of a disease

T. JOCK MURRAY, MD

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Snook & Motl (2008). Neurorehabil Neural Rep.
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Overall Physical Activity Rates

Physical activity and multiple sclerosis: a meta-analysis

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Using meta-analytic procedures, this study involved a quantitative synthesis of the difference in physical activity among individuals with multiple sclerosis (MS) compared with nondiseased and diseased populations and then examined factors (i.e., moderators) that explain variation in the overall difference in physical activity. We searched MEDLINE, PsycINFO and Current Contents Plus using the key words physical activity, exercise and physical fitness in conjunction with multiple sclerosis; conducted a manual search of bibliographies of the retrieved papers; and contacted study authors about additional studies. Overall, 53 effects were retrieved from 13 studies with 2360 MS participants and yielded a weighted mean effect size (ES) of −0.60 (95% CI = −0.44, −0.77). The weighted mean ES was heterogenous, Q = 1164.11, df = 52, P <0.0001. There were larger effects with objective versus self-report measures of physical activity, nondiseased versus diseased populations and primary progressive versus relapsing−remitting MS. The cumulative evidence suggests that individuals with MS are less physically active than nondiseased, but not diseased, populations.
Multiple Sclerosis (2005) 11, 459–463

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Physical Activity Declines

Longitudinal Change in Physical Activity and Its Correlates in Relapsing-Remitting Multiple Sclerosis

Robert W. Motl, Edward McAuley, Brian M. Sandroff

Table 1.
Model Fit Indexes and Parameter Estimates From the Latent Growth Curve Modeling Analysis of Linear Change in the Study Variables Across 6 Time Points in 269 People With Multiple Sclerosis[a]

Variable	Model Fit Indexes					Model Parameters				
	χ^2	df	P	CFI	SRMR	M_i	M_s	V_i	V_s	r
Accelerometer	63.35	16	.001	.96	.07	208,269[b]	−3,508[b]	84,299[b]	1,074[b]	−.34[b]
IPAQ	14.93	16	.53	1.00	.03	34.02[b]	−0.64[b]	345.43[b]	10.16[b]	−.40[b]
FSS	31.86	16	.10	.99	.05	4.77[b]	0.01	2.24[b]	0.04[b]	−.16
SF-MPQ	38.00	16	.001	.99	.06	9.75[b]	−0.13	56.98[b]	0.43[b]	−.04
HADS	28.82	16	.03	.99	.04	7.03[b]	0.01	6.29[b]	0.11[b]	−.13
EXSE	22.87	16	.12	.99	.03	72.01[b]	−0.76[b]	82.48[b]	0.14[b]	−.27[b]
MSWS-12	27.49	16	.04	.99	.03	35.98[b]	0.45[b]	712.14[b]	8.69[b]	.06
PDDS	28.19	16	.03	.99	.03	1.99[b]	0.05[b]	2.19[b]	0.03[b]	−.11

[a] IPAQ=International Physical Activity Questionnaire; FSS=Fatigue Severity Scale; SF-MPQ=Short-Form McGill Pain Questionnaire; HADS=Hospital Anxiety and Depression Scale, depression subscale; EXSE=Exercise Self-efficacy Scale; MSWS-12=12-Item Multiple Sclerosis Walking Scale; PDDS=Patient-Determined Disease Steps scale; CFI=Confirmatory Fit Index; SRMR=standardized root mean residual; M_i=mean intercept; M_s=mean slope; V_i=variance of initial status; V_s=variance of slope; r=correlation between initial status and slope factors.
[b] Statistically significant parameter estimate.

Behavioral Interventions

Internet intervention for increasing physical activity in persons with multiple sclerosis

Robert W Motl[1], Deirdre Dlugonski[1], Thomas R Wójcicki[1], Edward McAuley[1] and David C Mohr[2]

Abstract
Background: Physical activity has been associated with improvements in walking mobility and quality of life in persons with multiple sclerosis (MS), and yet this population is largely sedentary and inactive compared with the general population.
Objectives: We conducted a pilot, randomized controlled trial (RCT) for examining the effect of an Internet intervention based on social cognitive theory (SCT) for favorably increasing physical activity among persons with MS. We further examined variables from SCT as possible mediators of the Internet intervention.
Methods: We randomly allocated 54 persons with MS into either an Internet intervention condition or a waitlist control condition. The participants completed measures of physical activity, self-efficacy, outcome expectations, functional limitations, and goal setting before and after the 12-week period.
Results: The intervention group reported a statistically significant (p = 0.01) and large increase in physical activity over time (d = 0.72), whereas the control group had a small (d = 0.04) and non-significant change in physical activity (p = 0.71). The intervention group further reported a statistically significant (p = 0.001) and large increase in goal setting over time (d = 0.97), whereas the control group had a small (d = -0.13) and non-significant change (p = 0.17). The change in goal setting over time mediated the effect of the Internet intervention on physical activity behavior.
Conclusions: This pilot study sets the stage for a subsequent RCT that includes a larger sample of persons with MS, longer intervention period along with a follow-up, objective measure of physical activity, and secondary outcomes of walking mobility and QOL.
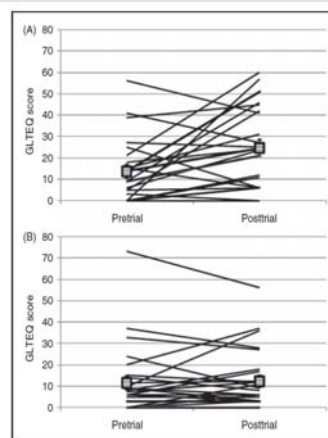
Figure 2. Paired individual trajectories of change in physical activity (i.e. GLTEQ score), along with mean (☐) and standard error, for the intervention (A) and control (B) conditions. GLTEQ: Godin Leisure-Time Exercise Questionnaire.

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Present Study

1. Intervention efficacy and variability

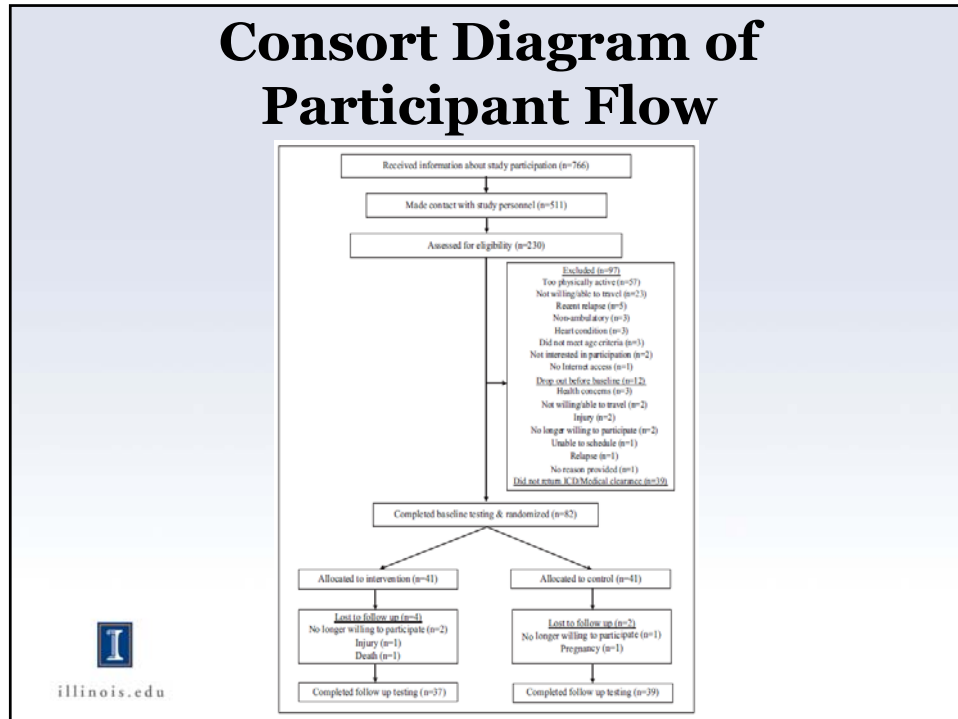2. Moderators of intervention efficacy

Jean-Martin Charcot

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Consort Diagram of Participant Flow

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Measures: Physical Activity

- **Three validated measures**
  - Godin Leisure-Time Exercise Questionnaire (GLTEQ)
  - Abbreviated International Physical Activity Questionnaire (IPAQ)
  - Minutes per day of MVPA from accelerometry (ActiGraph model 7164)

- **Composite score**
  - Transformed scale scores into *z*-scores
  - Averaged *z*-scores per time point

- **Benefits**
  - Interpreted in standardized units
  - Avoided compound error rate with multiple comparisons

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Measures: Moderators

- **Disease modifying medications (0=no, 1=yes)**
- **Symptomatic medications (0=no, 1=yes)**
- **Clinical course of MS based on physician (0=relapsing remitting MS, 1=progressive MS)**
- **Disability status based on EDSS scores (0=mild, 1=moderate)**
- **Weight status based on BMI (0=normal, 1=overweight/obese)**

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Intervention

Website
- **Social Cognitive Theory**
- **Components**
  - **Outcome expectations**
  - **Self-monitoring**
  - **Goal setting**
  - **Self-efficacy**
  - **Barriers/facilitators**

Video chats
- **Supportive accountability**
- **Content**
  - **Weekly reports**
  - **Website content**
  - **Strategies and facilitators**

Sit less, walk more!

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Procedure

- **IRB approval, written consent, and medical clearance**
- **Pre-study measures in lab, wore accelerometer for 7 days, and completed GLTEQ/IPAQ**
- **Matched on physical activity and disability, and then randomized into condition (blinded allocation)**
- **6-month intervention/control period**
- **Post-study measures in lab, wore accelerometer for 7 days, and completed GLTEQ/IPAQ**

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Data Processing and Analysis

- ***Z*-scores for baseline and follow-up physical activity measures (descriptive statistics menu)**
- **Composite variable (transformation menu)**

- **Preliminary analysis**
  - **One-way ANCOVA on post-test controlling for pre-test as covariate**
  - **Histograms of individual change per condition**
- **Main analysis**
  - **Two-way ANCOVA on post-test controlling for pre-test as covariate**

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Sample Characteristics

| Variable	Intervention (n=41)	Control (n=41)	P value
Age, years	48.4 (9.1)	49.5 (9.2)	.61
Sex, female/male	30/11	32/9	.61
Disease duration, years	10.6 (7.1)	13.0 (9.1)	.18
PDDS, mild/moderate	22/19	17/24	.38
Disease course, RRMS/SPMS & PPMS	31/10	34/7	.59
Disease modifying medication, yes/no	7/34	18/23	.02
Symptomatic medication, yes/no	23/18	19/22	.51
Physical activity			
GLTEQ, z-score	-0.04 (1.12)	0.05 (0.86)	.69
IPAQ, z-score	-0.14 (1.02)	0.14 (0.97)	.21
MVPA, z-score	0.02 (1.12)	-0.02 (0.88)	.87
Composite, z-score	-0.05 (0.95)	0.05 (0.74)	.59

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Intervention Efficacy and Variability

Overall Efficacy?
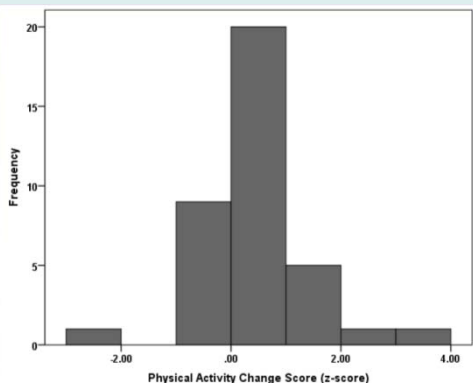
- $F_{1,73}=11.26, p<.001, \eta_p^2 = 0.13$
- Intervention mean = 0.27 (0.69)
- Control mean = −0.27 (0.69)
- Cohen's d = 0.54

Variability?
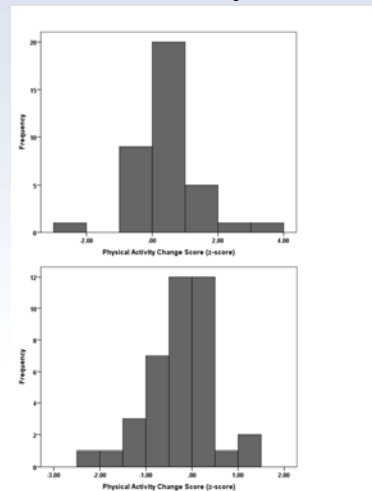
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Variability a Little Deeper

- 20 persons ↑ by < 1 *SD*
- 7 persons ↑ by ≥ 1 *SD*
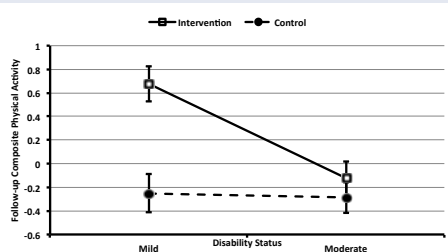- 9 persons ↓ by < 1 *SD*
- 1 person ↓ by ≥ 1 *SD*

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Intervention Moderators

Disability Status

$F_{1,73}=6.82$, *p*<.01, $\eta_p^2=0.09$

MS Clinical Course
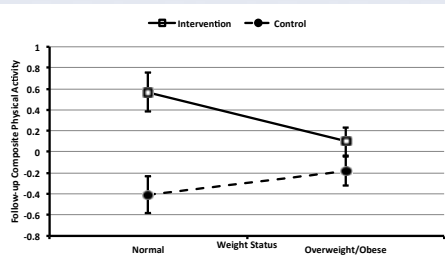
$F_{1,73}=6.99$, *p*<.01, $\eta_p^2=0.09$
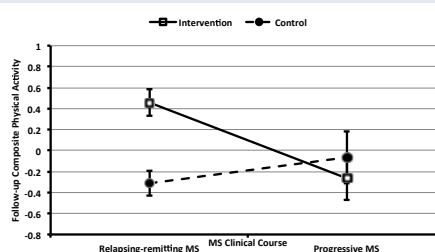
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Intervention Moderators

Weight Status

$F_{1,73}=4.74, p<.05, \eta_p^2=0.06$

- **DMT**
  - $F_{1,73}=1.96, p=.17, \eta_\rho^2=.03$
- **Symptomatic Meds**
  - $F_{1,73}=0.01, p=.87, \eta_\rho^2=.00$

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Summary of Primary Findings

- **Intervention efficacy on a composite measure of physical activity**
  - Clinically meaningful?
- **Heterogeneity in intervention efficacy**
  - Intervention vs. control conditions
- **Moderators of intervention efficacy**
  - Clinical course of MS, disability status, weight status

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Limitations

- **Unplanned, secondary analysis of data from RCT**
- **Few persons using DMTs, particularly in intervention condition**
- **Limited range of moderators**
  - **e.g., Internet experience**

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Conclusions

- **Behavioral interventions can increase physical activity, but there is variability and this can be explained by subject characteristics.**

- **Value in modifying and refining interventions for maximizing the likelihood of benefit.**

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Thank you!

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