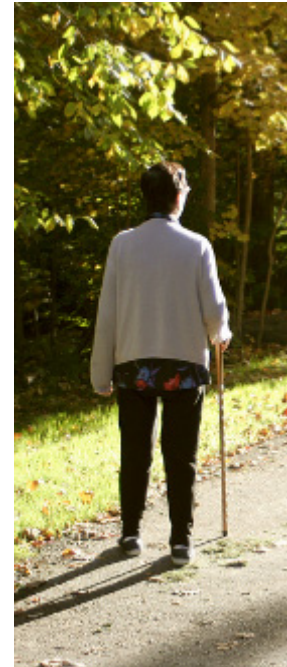


Physical Activity and Physical Function in Older Adults with Multiple Sclerosis

Katie Cederberg, MS; Robert W. Motl, PhD; Edward McAuley, PhD

Worldwide Shift in the Age Distribution of Persons with multiple sclerosis (MS)

- **Peak Prevalence:**
 - Between 35-39 years with no cases above age 64 in 1984
 - Increased to 55-59 years of age in 2004, with cases beyond age 80 ¹
- **Impact:** Normal effects of aging compounded with symptoms of a chronic, disabling neurological disease.
- **Consequences:** poorer health and functioning, limitations with ADLs, faster rate of disability progression, and reduced physical function



Physical Function Data in Older MS

Physical Function in Older Adults With Multiple Sclerosis: An Application of the Short Physical Performance Battery

Robert W. Motl, PhD¹; Gioella Chaparro, MS²; Manuel E. Hernandez, PhD²; Julia M. Balto, BA²; Brian M. Sandroff, PhD³

Characteristic	Sample With MS (n = 20)	Sample Without MS (n = 20)
Age, y	61.5 (10.8)	63.0 (7.8)
Sex, female, n	15, 75%	15, 75%
Height, m	1.66 (0.16)	1.64 (0.11)
Weight, kg	68.2 (15.8)	72.6 (22.9)
Education (higher education beyond high school), y	4.0 (5.1)	5.5 (2.0)
EDSS	4.5 (3.0)	

SPPB Score	Sample With MS (n = 20)	Sample Without MS (n = 20)
Total (0-12)	10.0 (3.8)	11.5 (2.0)
Balance (0-4)	3.5 (1.0)	4.0 (0.0)
Gait speed (0-4)	4.0 (1.0)	4.0 (0.0)
Lower extremity strength (0-4)	2.5 (1.8)	3.5 (2.0)

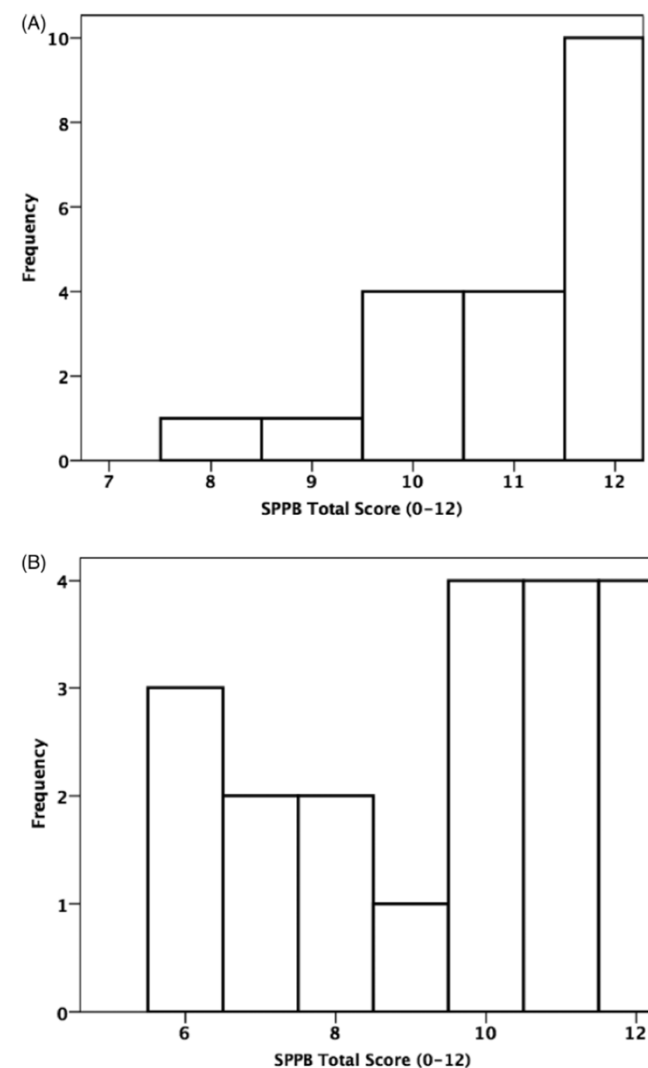


Figure. Distribution of total Short Physical Performance Battery scores in the samples of older adults without multiple sclerosis (Panel A) and older adults with multiple sclerosis (Panel B).

Physical Activity (PA) for Managing Declines of Physical Function

- Increasing PA improves physical function in older adults without MS ¹
- Older adults with MS are not engaging in enough PA ²
 - ↓ moderate-to-vigorous PA (MVPA) ³
 - ↑ sedentary behavior ³
- The rate and distribution of PA and sedentary behavior might be associated with a concomitant reduction of physical function among older adults with MS

1. McAuley, Wojcicki et al. 2012, McAuley, Wojcicki et al. 2013, Wojcicki, Fanning et al. 2015

2. Motl, Sebastiao et al. 2016

3. Klaren, Sebastiao et al. 2016

Present Study

- **Purpose/Objective:** We examined the associations between objectively-measured levels of physical activity (i.e., MVPA and LPA) and sedentary behavior with performance measures of physical function in older adults with MS.
- **Hypotheses:** Those with higher levels of physical activity and lower levels of sedentary behavior would demonstrate better physical function.

Sample

- **Inclusion Criteria:** (a) definite diagnosis of MS confirmed in writing by a neurologist; (b) relapse free in the last 30 days; (c) ambulatory with or without assistance (i.e., walk independently or walk with a cane/rollator); (d) age of 55 years or older; and (e) Expanded Disability Status Scale (EDSS) score ≤ 6.5 (i.e., constant bilateral assistance)
- **Screening:** 131 persons for eligibility
- **Enrollment:** 48 volunteered, 40 completed all measures

Measures

- **ActiGraph GT3X+ Accelerometer** ¹
- **Expanded Disability Status Scale (EDSS)** ²
- **Short Physical Performance Battery (SPPB)** ³
- **Timed 25-Foot Walk** ⁴
- **Six-Minute Walk Test** ⁵

1. Sandroff et al., 2014; 2. Kurtzke, 1983; 3. Motl, Chaparro, et al., 2016; 4. Fischer, Rudick, Cutter, & Reingold, 1999; Motl et al., 2017; Motl & Learmonth, 2014; 5. Goldman, Marrie, & Cohen, 2008

Measures

- **Physical Activity/Sedentary Behavior:**
Participants wore an ActiGraph GT3X+ accelerometer during waking hours for a 7-day period (min/day)
 - Cut-point for MVPA = 1,584 counts/minute and ¹
 - Cut-point for LPA vs sedentary behavior = 100 counts/minute ¹
- **Neurological Disability (EDSS):**
Neurological disability status ranging from 0 (normal) to 10 (death due to MS)





This ICD-9-MCM procedure includes the administration and scoring of the Short Physical Performance Battery and is performed according to the National Institute on Aging (NIA) for the Geriatrics Program for Longevity Studies of the Center for Disease Control.

Physical Function Measures

- **Short Physical Performance Battery**
(SPPB)

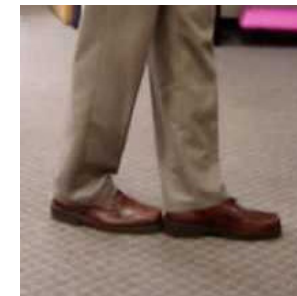
- **Standing Balance**

- **Gait Speed**

- **Lower Extremity Strength**

- **Scoring**

- (a) Each test recorded a categorical score ranging from 0 (inability to complete a test) to 4 (highest level of performance) using standardized scoring; and (b) Reported as a sum of the scores, ranging between 0 and 12.



Physical Function Measures

- **Timed 25-Foot Walk (T25FW)**: Time to walk 25 feet as quickly and safely as possible; mean of two trials (ft/sec)
- **Six-minute Walk Test (6MW)**: Distance traveled in six minutes by walking as fast and as far as possible in a single corridor (ft)

Procedure

- **IRB approval and written Informed Consent**
- **Single session in a laboratory setting**
 - **Measures of Physical Function**
 - **Neurological exam for EDSS**
 - **Provided with accelerometer and instructions**
 - **Returned via mail**
- **Participants were compensated for completing all measures and returning the accelerometer.**

Statistical Analysis

- **SPSS Statistics, Version 22**
- **Descriptive characteristics as median (IQR)**
- **Spearman rho rank-order correlations (r_s) between physical activity scores and scores from measures of physical function with 95% CI**
- **Multiple linear regression whereby we regressed function outcomes on physical activity**
 - **Reported crude, standardized beta-coefficients and squared multiple correlation (R^2) as effect size estimates**

Results: Sample Characteristics

Characteristic	Descriptive Statistic
Age (years)	60 (5.0)
Sex [n (%)]	30 F (75%), 10 M (25%)
MS Type [n (%)]	
Relapsing-Remitting MS	28 (70.0%)
Secondary Progressive MS	3 (7.5%)
Progressive MS	1 (2.5%)
Unknown/Missing	8 (20.0%)
MS Duration (years)	18 (14.0)
Expanded Disability Status Scale (0-10)	4.5 (2.5)

Note: Data are presented as median (IQR) unless otherwise specified; *F* Females, *M* Males, *MS* multiple sclerosis

Results: Descriptive Characteristics

Category	Variable	Median (IQR)	Normative Values
Behavior			(Hart, Swartz et al. 2011)
	Sedentary (min/day)	542.6 (86.0)	422.7
	LPA (min/day)	221.4 (56.4)	314.2
	MVPA (min/day)	4.6 (9.9)	13.8
Physical Function			(Guralnik, Ferrucci et al. 2000)
	SPPB (0-12)	8.0 (3.0)	9.0 F / 10.0 M
	6MW (ft)	1,288.5 (563.3)	
	T25FW (ft/sec)	4.1 (1.9)	

Note: IQR Interquartile Range, *LPA* Light Physical Activity, *MVPA* Moderate-to-Vigorous Physical Activity, *SPPB* Short Physical Performance Battery, *6MW* Six Minute Walk Test, *T25FW* Timed 25-Foot Walk.

Results: Bivariate Associations

Physical Function Outcome	Behavior		
	Sedentary	LPA	MVPA
SPPB	.040 (-.274, .347)	.551 (.290, .736) *	.311 (0, .567)
6MW	.060 (-.256, .364)	.660 (.439, .805)*	.529 (.261, .721)*
T25FW	-.019 (-.328, .294)	.623 (.387, .782)*	.403(.105, .634)*

Note: * $p < 0.01$; SPPB Short Physical Performance Battery, 6MW Six Minute Walk Test, T25FW Timed 25-Foot Walk, LPA Light Physical Activity, MVPA Moderate-to-Vigorous Physical Activity

Results: Multiple Linear Regression Analysis

	SPPB			6MW			T25FW		
	B	SE B	β	B	SE B	β	B	SE B	β
LPA	.020	.006	.583*	3.781	.972	.613*	.012	.003	.627*
MVPA	-.008	.045	-.029	4.728	7.239	.099	-.004	.023	-.030
R ²	.306			.420			.370		
F	4.991*			8.210*			6.654*		

Note: *p < .01; SPPB Short Physical Performance Battery, 6MW Six Minute Walk Test, T25FW Timed 25-Foot Walk, Sed Sedentary, LPA Light Physical Activity, MVPA Moderate-to-Vigorous Physical Activity

Discussion

- **This is the first study to examine the relationship between physical activity, sedentary behavior, and physical function in older adults with MS**
- **Primary Results:**
 - Older adults with MS
 - ↓ moderate-to-vigorous PA (MVPA)
 - ↓ Light PA (LPA)
 - ↑ sedentary behavior

Discussion: Primary Results

- **There were no associations between MVPA and physical function when controlling for LPA.**
 - **Higher levels of MVPA don't necessarily correlate with better physical function in older adults with MS.**
- **There were no significant associations between sedentary behavior and physical function.**
 - **Movement might be a better correlate of physical function in older adults with MS.**

Discussion: Primary Results

- LPA was strongly and independently associated with physical function.
- The growing population of older adults with MS could benefit from behavioral interventions targeting LPA.

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ORIGINAL RESEARCH

Long-Term Maintenance of Physical Function in Older Adults Following a DVD-Delivered Exercise Intervention

Sarah Roberts, Elizabeth Awick, Jason T. Fanning, Diane Ehlers, Robert W. Motl, and Edward McAuley

Limitations

- **No non-MS control group**
 - **Small sample size**
 - **We used MS-specific accelerometer cut-off points**
- Cross-sectional design**

Conclusions

- **Older adults with MS who engage in more LPA demonstrate better physical function.**
- **Future research should examine the benefits associated with increasing light physical activity in older adults with MS.**

Thank You and Questions

