Comparison of ActiGraph, Fitbit and Manual Step Count During a Two-Minute Walk Test in People with Multiple Sclerosis: A Pilot Study

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Background:

- Multiple sclerosis (MS) commonly leads to impairments in gait
- *Remote physical activity monitoring* in the patient's natural environment has the potential to augment measurement of MS-related disability and disease progression and might have prognostic value.
- Neurological disability may influence the fidelity of step count monitoring

Objective:

Compare remote physical activity monitoring using commercially available devices in people with MS with a broad range of ambulatory impairments.

Methods:

Subjects:

- 61 adults with MS at UCSF MS Center.

Exclusion criteria:

- Recent clinical relapse (≤30 days), physical comorbidities that could contribute to gait impairment and confound results.

Measures of step count during 2-minute walk (2MW):

- Fitbit Flex®
- Research-grade accelerometer (ActiGraph)
- Manual step counting (by a physical therapist)

Fitbit Flex®

ActiGraph GT3X

Manual Counting

Table 1: Participant Demographic Data

	All	Progressive	Relapsing
N	61	19	42
Age (y)*	50 (14.4)	58.5 (8.4)	46.3 (15.0)
EDSS †	4.0 (0-6.5)	6.0 (3.0-6.5)	2.8 (0-6.0)
DD (y)†	10 (4-21)	15 (8-20)	9 (4-22)

* Mean (standard deviation); † median (range)
EDSS = Kurtzke Expanded Disability Status Scale; DD = disease duration

**References:** www.fitbit.com. *ActiGraph LLC, Pensacola, FL.*

Results:

Bland- Altman plots showed:

- *No systematic difference* between the number of steps measured by Fitbit vs. manual counts (across the range of step counts).
- ActiGraph measurements tended to *under-record actual steps taken* at slower gait speeds.
- Interclass correlation coefficients (ICC) comparing total step counts across methods during the 2MW revealed *moderate correlations.*

Bland- Altman Plots Comparing the Step Count Measuring Techniques
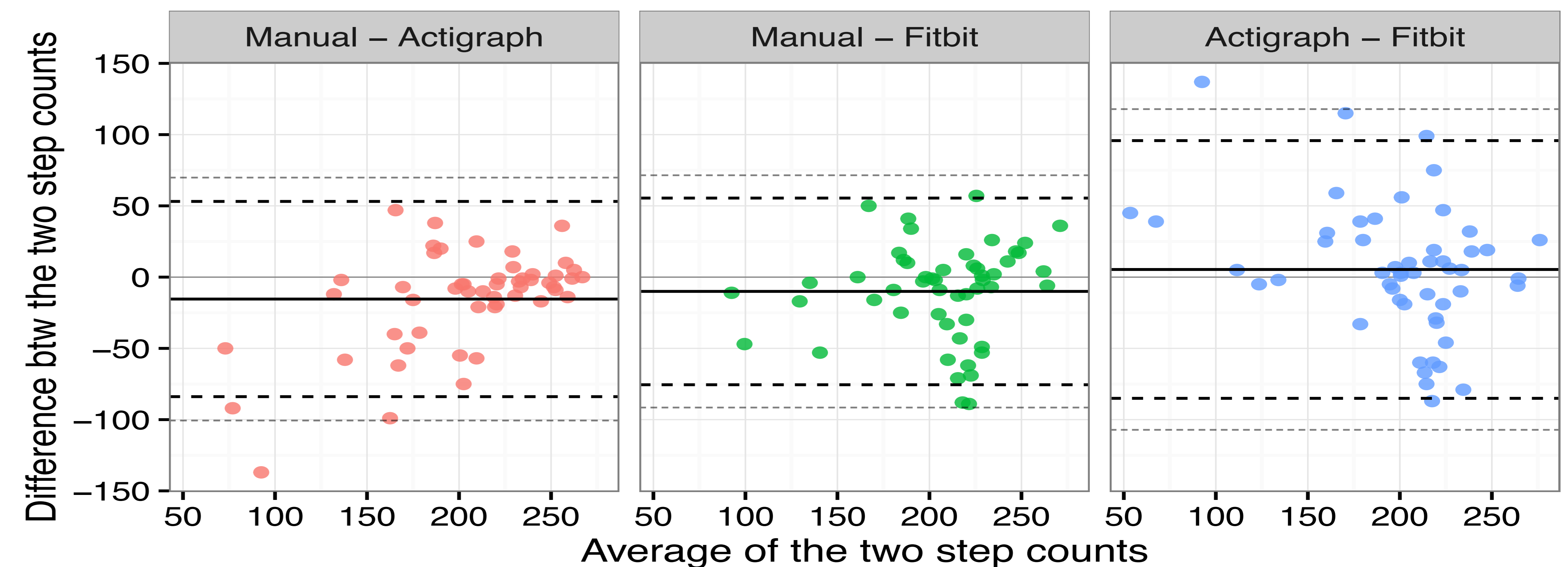
Table 2: Interclass Correlation Coefficients

Step Count Measures	Fitbit vs. manual	Fitbit vs. ActiGraph	ActiGraph vs. manual
ICC (95% CI)	**0.69** (0.53 - 0.80)	**0.59** (0.40 – 0.73)	**0.76** (0.63 - 0.85)

Discussion:

- Wrist-worn commercial accelerometers (Fitbit® Flex) appear to *provide a valid alternative* to more expensive, research grade accelerometers for determining step count in people with MS, particularly at slower gait speeds.
- Further study is ongoing in the community setting to evaluate associations with longer-term patterns of neurological impairment and gait abnormalities.