

Measurement Properties of Activity Monitors Across Neurological Patient Populations: A Systematic Review

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Background

- Adults with neurological conditions demonstrate reduced walking activity and community participation post diagnosis
- Decreased activity and participation is a serious public health concern
- Traditional clinical outcome measures such as comfortable gait speed do not predict walking activity in the community
- A need for technology that can reliably measure physical activity in research, clinical, and real-world settings

Purpose

To examine the reliability and validity of available activity monitors across neurologic populations including stroke, spinal cord injury, multiple sclerosis, and Parkinson's disease

Methods



Data Sources

- Pubmed, EMBASE, and Scopus



Inclusion Criteria

- Research or commercial grade activity monitors
- Stroke, Spinal Cord Injury, Multiple Sclerosis, or Parkinson's Disease



Outcomes

- Reliability, validity (criterion, concurrent, construct, convergent), and accuracy



Data Extraction and Critical Appraisal

- Standardized, pre-piloted extraction form
- Modified COSMIN risk of bias (ROB) tool



Selected Results



Stroke

22 studies

- ActiGraph: more reliable worn ≥ 3 consecutive days (ICC=.99) and at ankle (ICC=.97) (ROB: "Very Good")
- ActivPal: more reliable at fast pace (ICC=.90) versus comfortable pace (ICC=.66) (ROB: "Adequate")
- StepWatch: more reliable when worn ≥ 3 consecutive days (ICC=.99); Valid when worn on non-paretic ankle (ROB: "Inadequate")



Spinal Cord Injury

7 studies

- ActivPal: wheel turn concurrent validity (ICC=1.0) (ROB: "Very Good")
- SMARTWheel: highest validity for push strokes when worn on non-dominant arm (ICC=.98) (ROB: "Very Good")
- SAM: highest reliability for 6MWT and 10mWT (ICC=.99 and .97, respectively) (ROB: "Doubtful")



Multiple Sclerosis

14 studies

- Actical: Reliability with standardized testing and vigorous activities (ICC=.75-.90) (ROB: "Very Good")
- ActivPAL3: high concurrent validity (ICC=.99) in moderate dysfunction MS (ROB: "Inadequate")
- Fitbit One & Actigraph: accurate and concurrent validity (ICC \geq .90) in persons with mild dysfunction if worn ≥ 4 consecutive days (ROB: "Inadequate")



Parkinson's Disease

9 studies

- FitBit Zip: good accuracy; concurrent validity in 2MWT, obstacle, home simulations (ICC>0.90) (ROB: "Very Good")
- Garmin vivosmart HR and FitBit Charge HR: reliability (ICC=.88-.97) for outdoor>indoor self-selected walking speeds (Garmin > Fitbit) (ROB: "Very Good")
- StepWatch: more reliable when worn ≥ 2 consecutive days (ICC>.90) (ROB: "Doubtful")

Conclusions

- Some but not all activity monitors demonstrated reliability, validity and/or accuracy in our neurological patient populations
- Activity monitor outcomes are diagnostic specific
- High degree of variability in testing procedures and heterogeneity in this large data pool limited generalizability across all or comparisons between diagnostic groups

Next Step:

More standardized studies needed to make comparisons and recommendations



Clinical Relevance

- Findings can be used by researchers and clinicians as a diagnostic specific resource for the use of activity monitors
- Consider diagnostic specific considerations for level of disability, type of monitor, wear time, body location, and specific outcome or activity being monitored
- With the use of reliable, valid, and accurate activity monitors, researchers and clinicians may be able to:
 - Assess activity levels in clinical and community settings
 - Prescribe physical activity levels for their patients
 - Motivate and engage their patients in physical activity

For a full list of references please visit:

