# 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")
- ActiPal: 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
- ActiPal: 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")
- ActiPal3: high concurrent validity (ICC=.99) in moderate dysfunction MS (ROB: "Inadequate")
- Fitbit One & Actigraph: accurate and concurrent validity (ICC≥.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=.89-.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.

## 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: