



## Walking speed during daily living, a systematic review

C. TYCHON, M. POLEUR, L. SERVAIS



validation

## Introduction: why do we need new endpoints?

- Objective, quantifiable walking speed endpoints are lacking
- Real-life walking speed is a key factor of quality of life

**Current walking speed evaluation compared to wearable devices:** 

	Dedicated labs	6-minute walking test	Wearable
Cost	+++		+
Availability			
Workload	+++	++	
Hawthorne effect (Patients perform better when observed)	+++	+++	

## Methods:

We searched the MEDLINE database for studies on the assessment of real-life walking speed using a wearable device, in any population and for any disease.

66 papers **503 papers** After screening by Initial search title/abstract

 Small academic studies ++ No intent of achieving

10 papers

After screening by

full-text

## Results divided into 5 categories:

#### **Wearable devices offer:**

- Cost-effective and available solutions
- Reduce workload
- Eliminate biais
- ➡ Endpoints have to be validated by regulatory agencies such as the EMA or FDA before clinical use.

## **Results for Duchenne Muscular Dystrophy**

## **Validity:**

 Ability to distinguish patients from healthy controls

#### **Reliability:**

• Measurements are consistent for the same patient

### Feasibility:

 Affordability and patient adherence



### **Accuracy:**

 Comparison with validated gait assessment method

#### **Sensitivity to change:**

 Tracking patient performance changes



- Currently published data
- Focus on Duchenne Muscular Dystrophy
- What is missing for global validation?

What has been

**Pediatric focus:** 

proposed so far:

**Duchenne Muscular Disease (DMD):** 

endpoint by the EMA

Only disease with a validated digital

• Uses Sv95c : 95th percentile of walking speed

Validity confirmed : compared to controls

• Sensitivity to change : confirmed

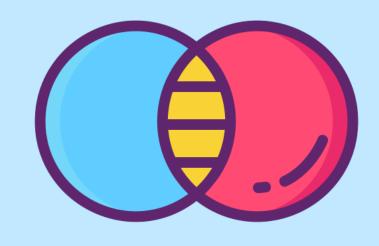
→ Insufficient data for official validation

These results are displayed in the main circle 1,2

• Good reliability: intraclass correlation coefficient > 0.9

Sv95c have also been used inFacioscapulohumeral dystrophy:

Insights on clinical application



#### **Validity**



Reliability

Intraclass correlation coefficient of 0.97

Walking speed is significantly reduced in patients compared to controls





**Sensitivity to change** 

#### Accuracy



Sv95c correlated with the 6-minute walk test



Sv95c correlated with movement laboratory measurements



Sv95c correlated with the North Star Ambulatory Assessment and the 4-stair climb test

## Discussion:

## Bridging the gap in digital endpoint validation:

### **Feasibility**



Wearable devices are cost-effective



Patients, including children<sup>6</sup>, show good compliance

### There is a clear interest from regulators:

- EMA has validated Sv95c for DMD before 4 years old
- FDA has accepted multiple letters of intent

#### **But what is missing?**

- Limited large-scale initiatives : mainly small, academic studies without clear interest or ressources for validation. Only MOBILISE-D and Sv95c generate extensive database
- Costly and long validation process: even MOBILISE-D, a \$50 million-funded project faced significant challenges that limited its ability to develop and implement a digital mobility assessment solution

#### How can validation be facilitated ?

- Streamlined regulatory pathways: the EMA has fast-tracking pathways for pain medication approval across various diseases - why not digital endpoints?
- Improved study framework: A unified approach would allow data integration across diseases, populations and devices

### What does the future hold:

- Early detection of decline though a clinician-friendly app, prompting therapeutic changes
- Tracking therapy impact by the clinician and the patient through the app, enhancing motivation and engagement
- Accelerate drug approvals and improve patient's quality of life

# And beyond pediatrics:

	Validity	Reliability	Feasibility	Accuracy	Sensitivity to change	Letter of intent
Parkinson's <sup>3</sup>	YES	Ś	YES	+/- (medium bouts did not correlate to MDS-UPDRS III)	YES	YES (FDA)
Sarcopenia	Ś	Ś	YES	YES (Medium correlation with 6-MWT)	Ś	YES (FDA)
Multiple sclerosis <sup>4,5</sup>	Ś	Ś	YES	+/- (Real-walking speed overestimate)	Ś	YES (FDA)
Huntington disease	Ś	Ś	Ś	Ś	Ś	YES (but rejected by FDA)

Scan the QR code for references

