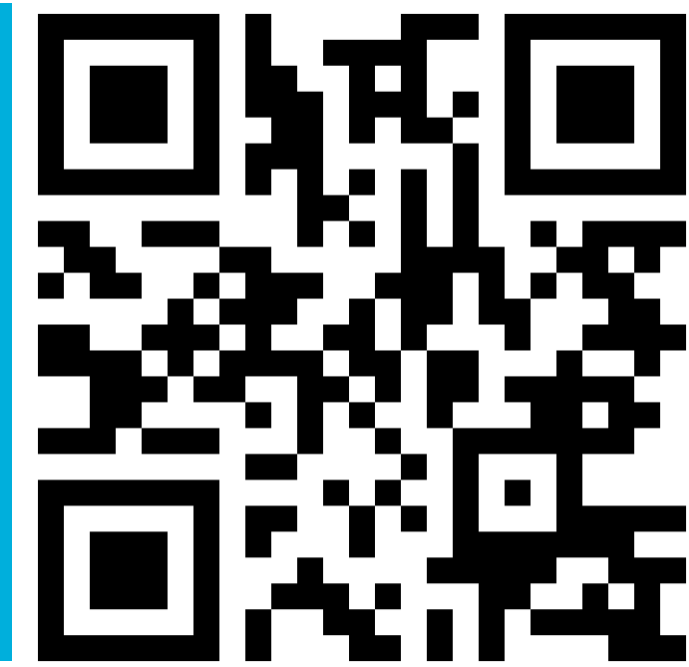


Longitudinal progression of digital arm swing measures during free-living gait in early Parkinson disease



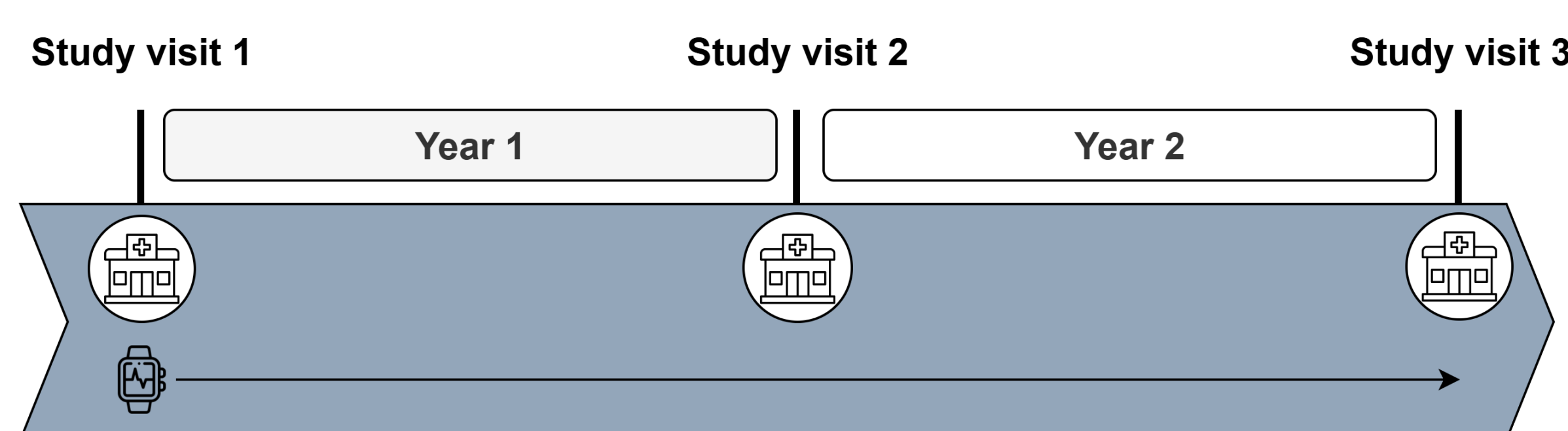
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Introduction

- Reduced arm swing during gait is an early and progressive motor sign of Parkinson's Disease (PD), making it a promising biomarker for disease progression and treatment response.
- Wrist sensors can be used to reliably measure the arm swing range of motion in daily life¹.
- This study evaluates the sensitivity to disease progression of such measures in a large, longitudinal free-living PD cohort.

Study design



- 320 early-stage ambulatory PD participants wore a wrist sensor on their preferred side continuously (median 21 hours/day) for at least 2 years in free-living conditions in the Personalized Parkinson Project².
- Participants either used dopaminergic medication (*medicated*) or not (*unmedicated*) during the study; those who initiated treatment were excluded.

Table 1: Number of participants per stratification

	Medicated	Unmedicated
Most affected side	184	18
Least affected side	113	5

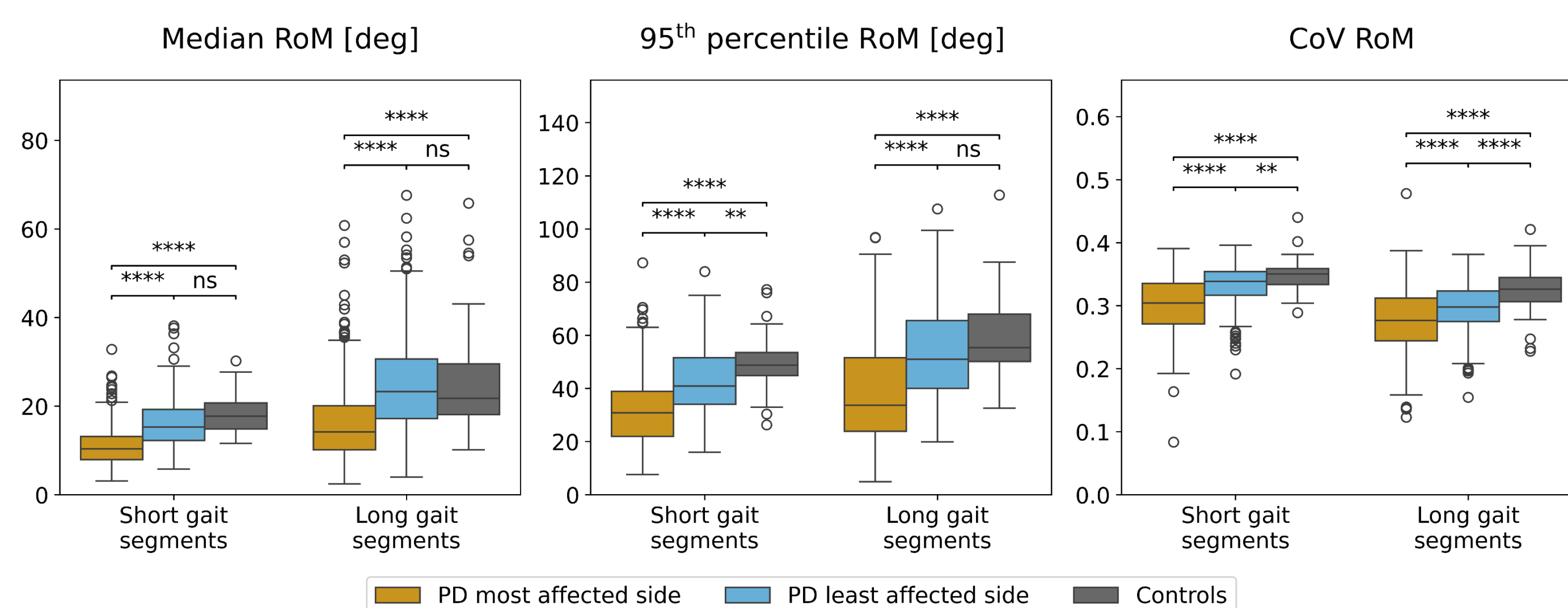
- Weekly (1) median, (2) 95th percentile, and coefficient of variation (CoV) range of motion (RoM) were derived from accelerometer and gyroscope data using the *ParaDigMa* toolbox³.

Methodology

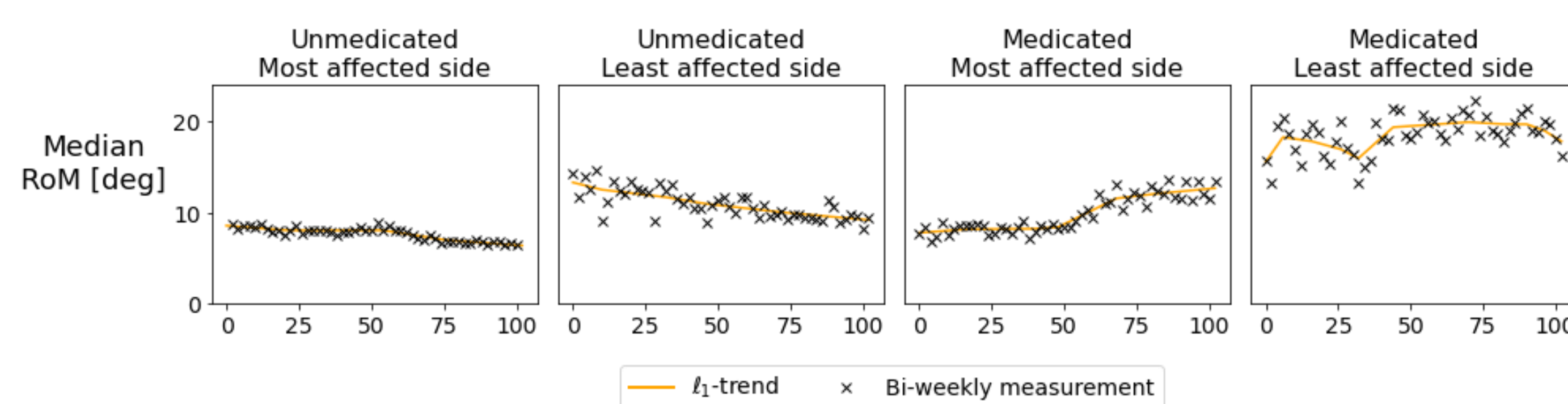
- Bootstrapped one- and two-year standardized response mean (SRM) with 95% CI to assess sensitivity to change.
- Comparison with the sum of MDS-UPDRS Part III unilateral bradykinesia/rigidity items (subscore).
- Ordinary least squares (OLS) regression to examine the impact of clinical covariates on observed changes.

Results

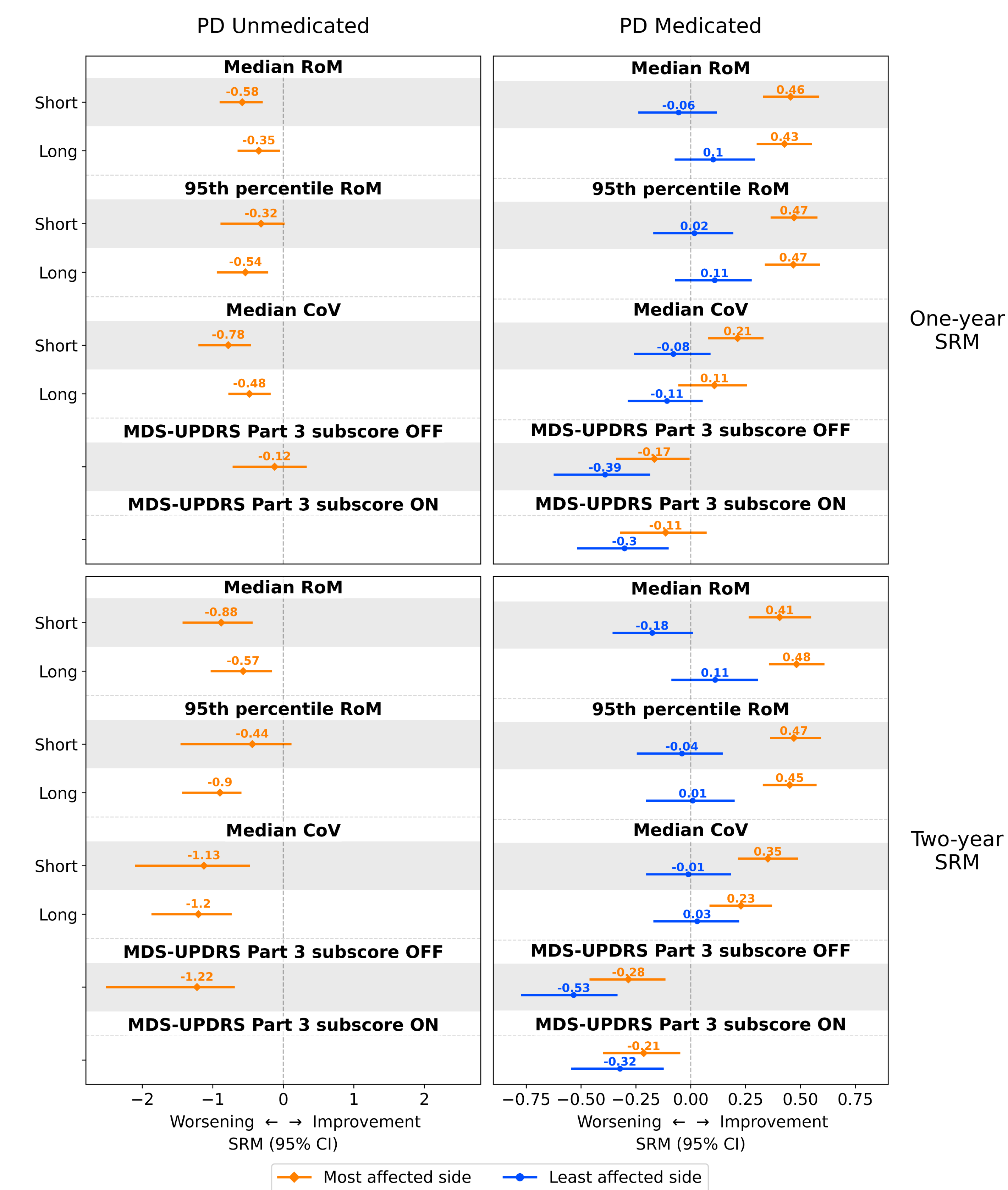
1. Cross-sectional between-group differences



2. Two-year trajectories of sample participants



3. Sensitivity to one- and two-year change



Conclusions

- In unmedicated participants, digital arm swing measures of the most affected side are more sensitive to one-year progression than conventional clinical scales, and comparably sensitive over two-years.
- Dopaminergic treatment masks the progression signal captured by digital measures.

References

- Post et al. Quantifying arm swing in Parkinson's disease: a method accounting for arm activities during free-living gait. *J NeuroEngineering Rehabil* 22, 37 (2025).
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- Post et al. ParaDigMa: A toolbox for deriving Parkinson's disease Digital Markers from real-life wrist sensor data (v1.0.0). Zenodo.

Acknowledgements

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