Optimal Digital Endpoint Selections of Movement in Parkinson's disease

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Objectives

Wearable sensors enable precise, sensitive, and reliable digital endpoint capture of movement impairment in Parkinson's disease (PD). As there are thousands of digital movement endpoints available for use in clinical trials, selecting those most optimal per each unique study can be challenging. We offer guidelines, aligned with regulatory guidance, and supported by the latest scientific evidence.

Methods

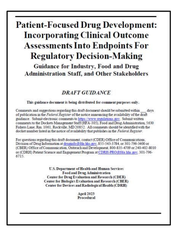
An approach to selecting the best digital movement outcome for a clinical trial is outlined considering the following criteria:

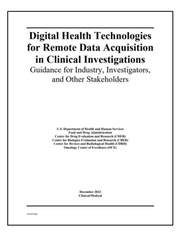
1. Meaningfulness to participants
2. Sensitivity/specificity to disease
3. Related to the conventional stage of disease and patient-reported scales
4. Reflective of pathophysiology
5. Detects longitudinal motor progression
6. Sensitivity to change with intervention

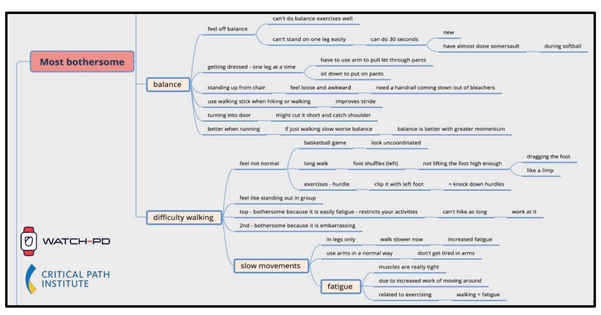
A review of the literature on gait and balance digital outcomes for newly diagnosed PD was performed.

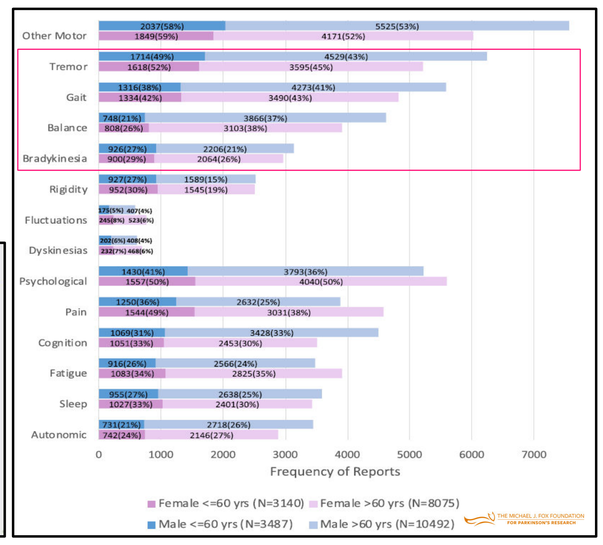
Results

Meaningful to participants

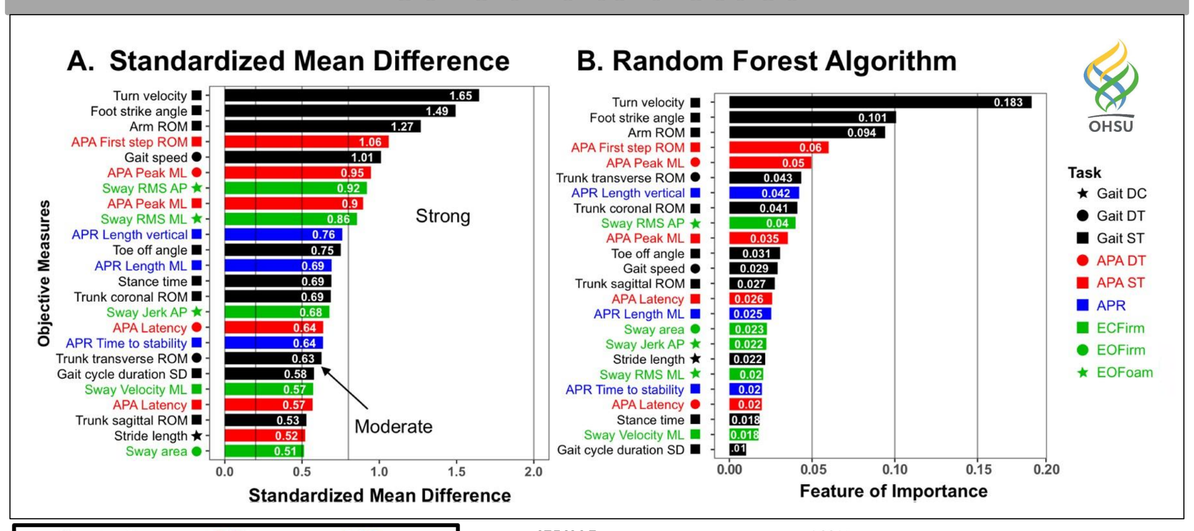


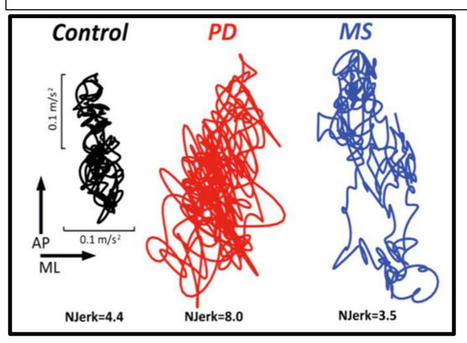


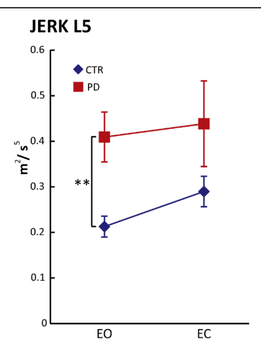


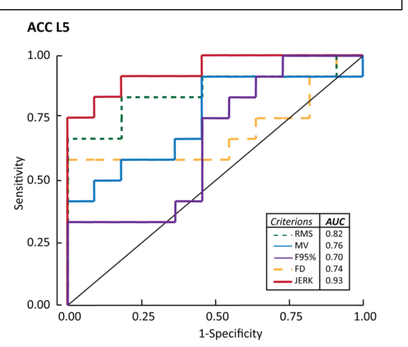


Sensitive to disease

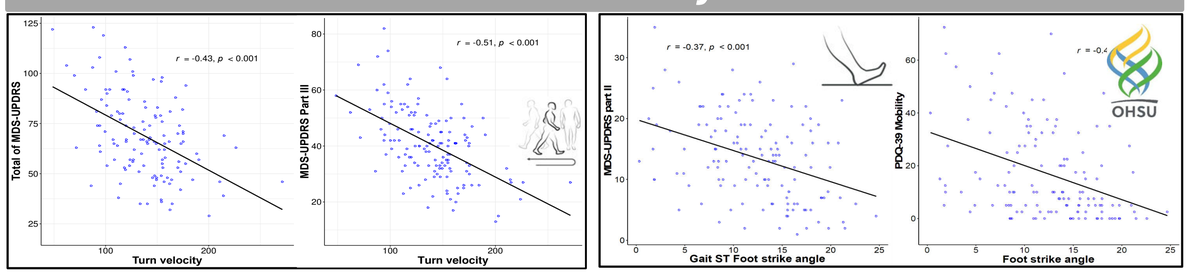




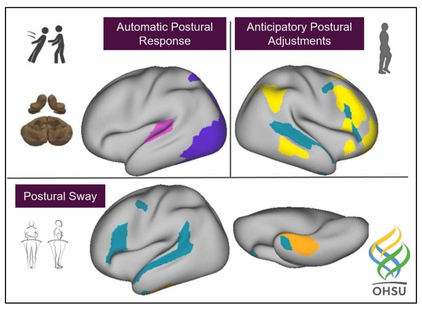


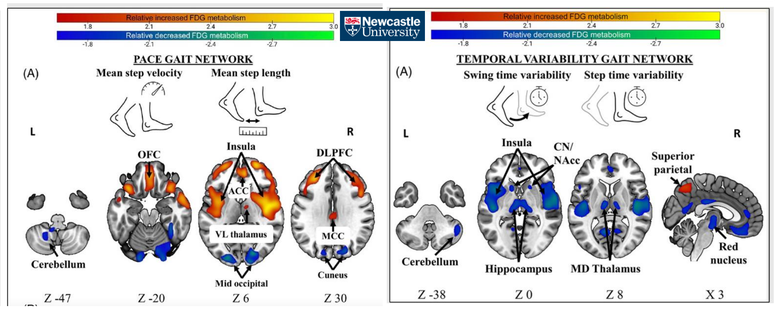


Related to Severity & QoL



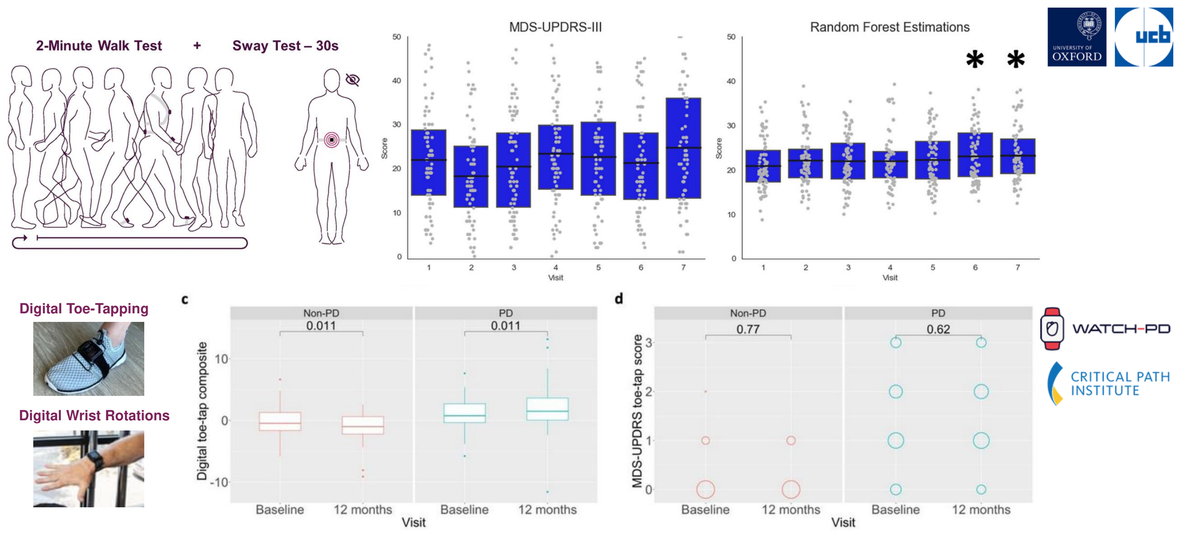
Reflective of Pathophysiology



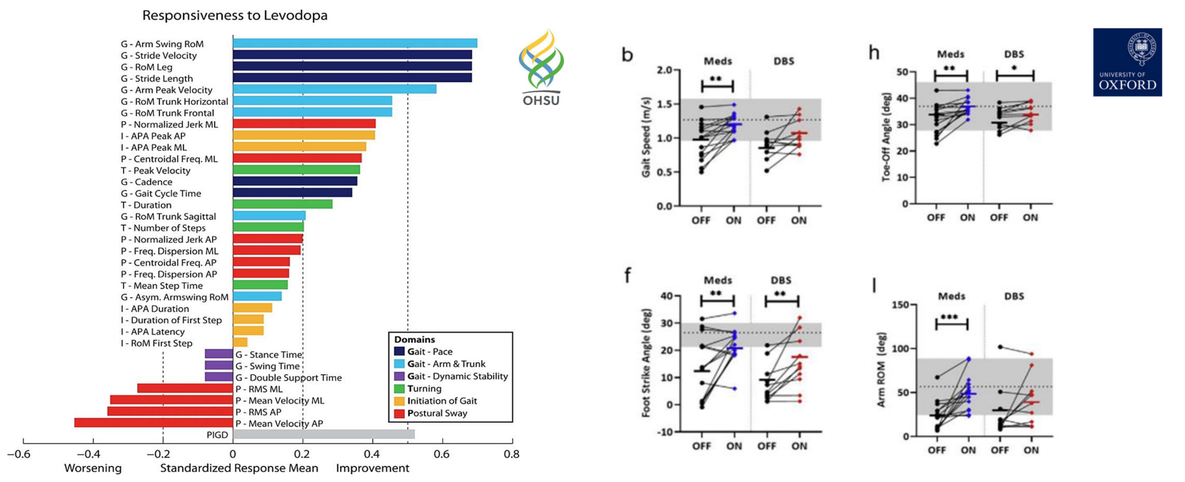


Results cont.

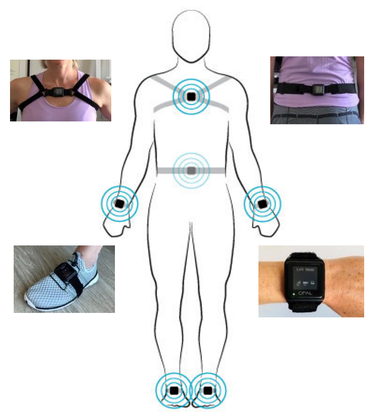
Detects Longitudinal Motor Progression

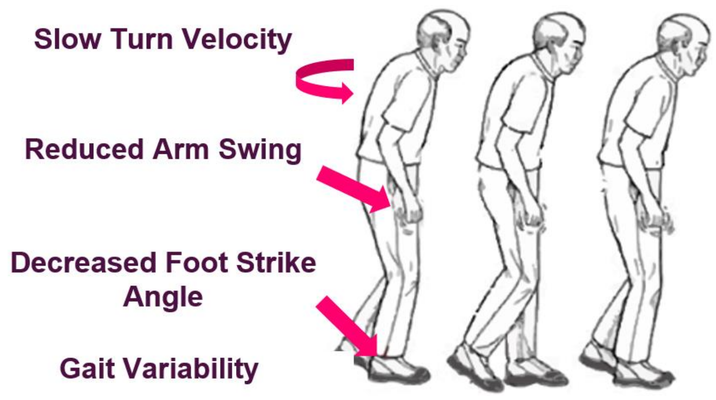


Sensitive to Change with Intervention



- Digital endpoints of gait captured with **inertial sensors on the feet, lower back, and wrists** have the most scientific support.
- The majority of evidence is available from **short walking** and **standing** tasks performed in a **controlled setting**, while evidence for passive, real-world data is growing.
- **Foot strike angle, turn velocity, arm swing reduction**/asymmetry, gait variability, and **sway jerkiness** reflect the outlined criteria for early PD.
- Measures of bradykinesia and tremor, while having more limited evidence, are also promising.
- The hypothesized effect of the therapy under investigation must also be considered, as the sensitivity of specific gait and balance endpoints to change differ by treatment due to the underlying pathophysiology.





Conclusion

Digital endpoints of movement impairment specific to early PD are meaningful to patients, more sensitive to disease progression than conventional clinical scales, and a critical tool in the future success of clinical trials to provide effective treatments for PD patients.

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Conflict of Interest

Drs. Sowalsky, Shah, and Horak are employees of APDM Wearable Technologies, a Clario company that may have a commercial interest in the results of this research and technology. This potential conflict of interest has been reviewed and managed by OHSU.