Case study

Advancing digital biomarkers to accelerate Parkinson's disease drug development

About Merck

Merck aspires to be the premier research-intensive biopharmaceutical company. For over 130 years, we've brought hope to humanity by developing important medicines and vaccines. Merck is at the forefront of research to deliver innovative health solutions that advance the prevention and treatment of diseases in people and animals.

The opportunity

- Digital tools like wearables and smartphones offer an opportunity to measure motor function in Parkinson's disease (PD) more objectively, precisely, and frequently than the traditional clinical endpoint (Movement Disorder Society-Unified Parkinson's Disease Rating Scale, or MDS-UPDRS).
- Digital endpoints that improve the ability to detect the disease-modifying effects of new PD therapies could be developed, enabling smaller, shorter proof-of-concept trials and accelerated PD drug development.

The challenge

- Parkinson's disease (PD) is the fastest-growing neurodegenerative disorder in terms of rates of disability and death. There are currently no disease-modifying treatments for PD.
- Research is ongoing on new therapies that aim to slow the progression of PD. However, large and lengthy trials are needed to assess their efficacy using the traditional clinical registrational endpoint (MDS-UPDRS), which relies on infrequent, subjective, and categorical assessments.

The approach

- We developed a machine learning-based framework to construct composite digital biomarkers of disease progression from longitudinal digital measure data anchored to traditional clinical endpoints.
- We applied this framework to data collected in a longitudinal clinical study of PD patients using digital health technologies (DHT) (WATCH-PD). We developed preliminary composite digital biomarkers that tracked motor function progression indicative of MDS-UPDRS Part III progression but with more objectivity and precision.

The impact

- ✔ We constructed a preliminary composite digital biomarker with a >2-fold larger progression tracking effect size than MDS-UPDRS Part III.
- ✔ 73% fewer patients would be required to demonstrate a 20% disease-modifying effect in a one-year trial with this preliminary composite digital biomarker than would be needed with MDS-UPDRS Part III.
- ✔ Our results demonstrate that composite digital endpoints have the potential to reduce study size requirements for Parkinson's disease proof-of-concept trials and to accelerate PD drug development.

> "Digital health technologies offer tremendous opportunities to quantify the symptoms and progression of Parkinson's disease with more objectivity, precision, and frequency than traditional clinical rating scales. Our analysis demonstrates that composite digital endpoints hold promise to detect the effects of disease-modifying therapies with significantly smaller trials and to thereby accelerate Parkinson's disease drug development."

— Marissa Dockendorf, PhD

Executive Director, Head of Digital Clinical Measures, Merck

This case study was adapted from the poster **"Developing Composite Digital Measures for Tracking Parkinson's Disease (PD) Progression using a Comprehensive Machine Learning-based Framework"** by S. Zhai, J. Ren, J. Shen, S. Chatterjee, Y. Xu, A. Liaw, V. Svetnik, O. Patil, E.R. Dorsey, J. Adams, M. Dockendorf, and R. Baumgartner. The poster was presented at the 2024 Movement Disorder Society meeting. While the poster is not available online, the abstract can be found here.