Supplementary Materials for:
Passive monitoring at home: a pilot study in Parkinson disease

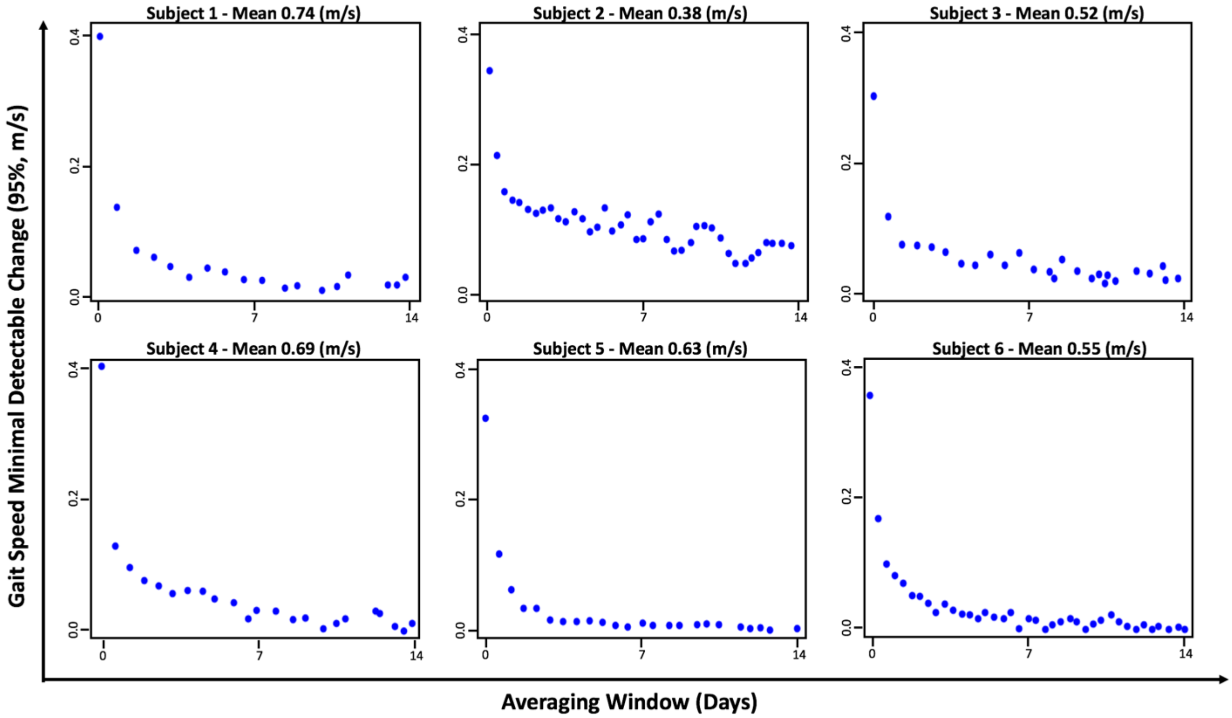
Zachary Kabelac, PhD[1]**; Christopher G. Tarolli, MD[2,3]**; Christopher Snyder[2], Blake Feldman[2]; Alistair Glidden, BS[2]; Chen-Yu Hsu, MS[1]; Rumen Hristov, MEng[1]; E. Ray Dorsey, MD[2]; Dina Katabi, PhD[1]
** Co-first authors

1. Department of Computer Science and Artificial Intelligence, Massachusetts Institute of Technology, Massachusetts, USA
2. Department of Neurology, University of Rochester Medical Center, Rochester, New York, USA
3. Center for Health + Technology, University of Rochester Medical Center, Rochester, New York, USA

Corresponding author
Zachary Kabelac, PhD
MIT Computer Science & Artificial Intelligence Lab
32 Vassar Street, 32-268
Cambridge, MA 02139
Phone: (301)-448-0090
Email: zek@mit.edu

This file includes:
Supplementary Figure 1: Minimal detectable change of gait speed versus averaging window size among study participants.
Supplementary Methods: Gait speed analysis
Supplementary References

Supplementary Figure 1: Minimal Detectable Change of Gait Speed versus Averaging Window Size for different study participants.



Supplementary Methods:

Gait Speed Analysis

A single gait speed measurement recorded during a standardized in clinic assessment (e.g. 10-Meter Walk Test) is reproducible and representative of a subject's overall functional capacity.[1] In contrast, gait speed measured in a real-world environment varies substantially based on the task being carried out, limiting the ability of a single measurement to adequately reflect overall functional ability. We see this variability reflected in data collected by the Emerald device, with a large and consistent standard deviation in gait speed (0.17 m/s) across the cohort when averaging all gait speed measurements over the monitoring period.

Averaging real world gait speed measurements over time offers a better estimate of functional capacity by capturing a wider sample of the person's activities. Comparison of these averaged measurements reduces variability and allows longitudinal tracking of changes in gait speed. However, the optimal averaging window to capture overall function and reduce variability, while limiting monitoring time is unique to the method and frequency of measurement. Minimal detectable change is a statistical estimate of the sensitivity of a measure to change over time and is calculated as 1.96 times the standard deviation.[2] This implies that any new measurement outside that range of the mean is a statistically significant change in the measure with 95% confidence. Here we describe the methods used to determine the optimal averaging window and describe the results of the analysis with the Emerald device. In addition, we calculate the minimal detectable change in gait speed between epochs of the derived duration.

We first sought to determine the minimum duration of an inclusive monitoring window for gait speed with the Emerald device. We evaluated averaging window sizes from 0-14 days by calculating the standard deviation of the average gait speed in non-overlapping windows. We then plotted the window size in days (x-axis) against the derived minimal detectable change (y-axis (**Supplementary Figure 1**). As expected, the variability in mean gait speed across windows decreases with longer averaging periods. By visual assessment, we observe that each curve approaches its asymptote by an averaging window of five days. This implies that the optimal averaging window is 5 days: the minimum length of an epoch needed to capture a representative set of gait speed measurements and minimize variability between windows.

If we apply the optimal 5-day epoch size to each subject, we find a mean minimal detectable change of 0.07 m/s across participants. This means that with 95% confidence, a change in averaged gait speed of more than 0.07 m/s between subsequent 5-day monitoring periods is a true change in gait speed.

Supplementary References:

1. Hass CJ, Bishop M, Moscovich M, et al. Defining the clinically meaningful difference in gait speed in persons with Parkinson disease. *Journal of neurologic physical therapy : JNPT*. 2014;38(4):233-238.
2. Lang JT, Kassan TO, Devaney LL, Colon-Semenza C, Joseph MF. Test-Retest Reliability and Minimal Detectable Change for the 10-Meter Walk Test in Older Adults With Parkinson's disease. *Journal of geriatric physical therapy (2001).* 2016;39(4):165-170.