

Technology to Track Adherence: Smartwatches Can Detect Walker and Cane Use in Older Adults at High Risk of Falls

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ABSTRACT

The following abstract is the winning platform presentation from the Combined Sections Meeting (CSM) 2018 HPA The Catalyst Platform Competition in New Orleans, LA. Be sure to attend the HPA The Catalyst platform presentations at CSM 2019 Jan. 23-26, 2019, in Washington, D.C.

Purpose/Hypothesis. To reduce the risk of falling, physical therapists commonly prescribe assistive devices such as walkers or canes. However, assistive devices may not be used as often as prescribed. Physical therapists rely on patient self-report to determine assistive device adherence. Smartphones and smartwatches have sensors that capture movements and enable computer algorithms to detect differences in physical activity. Because an individual's movement can change while using a walker or cane, we hypothesized that smartphones or watches can detect whether an older adult is using their assistive device.

Number of Subjects. 9.

Materials/Methods. We recruited nine community dwelling older adults receiving adult day center services (6M, mean age 78.3 ± 9.1 SD, Berg Balance Score 39.8 ± 6.0 , Mini-Mental State Exam 23.0 ± 6.5). Each participant completed the following outcome measures on five separate days with and without their assistive device: 6 Minute Walk Test, 10 Meter Walk Test, and Timed Up and Go. We used onboard sensor data from the smartphone and smartwatch to train machine learning algorithms to detect whether the participant was walking with their walker or cane. We then tested the reliability of our detection algorithms by using across-day cross-validation for each participant.

Results. When using smartwatch sensors, we were able to detect whether a participant was using their walker or cane with greater than 98% accuracy across days. Notably, our algorithms were trained with data collected during common physical therapy outcome measures, and maintained high detection accuracy with only a single day of training for all participants. However, when using smartphone sensors, we were unable to reliably detect walker or cane use across days, with accuracies close to chance (50%) for all but one subject (where we achieved 96% accuracy).

Conclusion. Smartwatches offer a robust platform to detect whether an older adult is walking with their walker or cane. Smartphones may perform well in individuals with pronounced gait deviations, but are unreliable for most individuals.

Clinical Relevance. Smartphones and smartwatches are available to both physical therapists and the general public, making them powerful and scalable tools to understand and monitor patient mobility. Our findings show the potential of these technologies to augment traditional physical therapy practice by providing clinically useful, objective measurements of assistive device adherence. Such information can enable timely interventions such as education, proper device fitting, or further training prior to a fall occurring.

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