

Application Fields and Innovative Technologies

Remote Technological Assessment of Medication Adherence in Older Adults R. Jenkins, L. Takahashi Dos Reis, D. J. Cook, & M. Schmitter-Edgecombe. *Gerontechnology* 25(s)

Purpose With an aging population and increasing polypharmacy, reliable and scalable methods to measure medication adherence are critical. Traditional approaches, such as MEMS bottles, have weaknesses as they require a standard-sized medication bottle that cannot be easily reset for future use. Sensor-based technology offers a promising solution with minimal clinician involvement. This study explores Metasensors, small motion sensors that produce acceleration vector magnitudes to track object use. Metasensors do not require a standardized pill bottle and can quickly be reset and attached to other medication. Metasensors produce raw accelerometer data, which allows clinicians to customize usage parameters for individuals, their environment, and the specific object (i.e., medication bottles vs. organizers). We hypothesize that Metasensors can effectively and accurately monitor medication usage in the homes of older adults without requiring special-purpose dispensers. **Method** Custom code was created to segment Metasensor time series readings into non-overlapping usage “bouts”. Segment features included segment length (in seconds), time of day, and day of week. Prelabeled data were used to train a decision tree to identify bouts of “functional” (medication taken) and “nonfunctional” (non-meaningful movement) item interaction based on segment features. Temporal variability, or amount of variance in daily time of use, was recorded for each taken medication. Training data included 80 clinician-logged medication-taking events with exact timestamps. The sensor data from these events were analyzed using the machine learning technique to identify when medication was taken and determine classification accuracy. Agreement between clinician-recorded and machine-identified events was calculated, with a target of >90% agreement. The model was then applied to one-week of medication data from 25 older adults across the cognitive continuum that were part of a larger in-home study. We computed medication adherence, the average time of day, and variability in when they took their medication. Model performance was assessed using macro and micro F1 scores. The relationship between adherence and cognition, measured with the Repeatable Battery of Neuropsychological Status, was analyzed through correlations. **Results and Discussion** The clinician Metasensor data produced 150 functional and non-functional bouts. The machine-learning classifier correctly identified 140 events, indicating 93.33% agreement and thus strong confidence in the use of Metasensors. The participant study data revealed F1 macro and micro scores of 0.9965, confirming robust model performance. Adherence ranged from 43% to significant over-adherence of 200%. The average temporal variability was 15,047.38 seconds. There was a nonsignificant relationship between adherence and cognition ($r = -.123$, $p = .541$) and between temporal variability and cognition ($r = -.322$, $p = .102$). Although future research is needed, the data suggest that Metasensors can be used as stand-alone, unobtrusive tools to measure and analyze daily medication patterns and events within the real-world environment. Future use will allow for a clinician to get an objective measure of medication adherence and collaborate with clients about how to improve adherence. Future work will examine whether the use of compensatory cognitive strategies might moderate the relationship between cognition and medication adherence. Other research should explore the cost-effectiveness of Metasensors compared with other marketed adherence measures.

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