ALZHEIMER'S DISEASE & RELATED DEMENTIAS

Digital Measures Development

DATAcc by DME DIGITAL MEDICINE SOCIETY

Digital Health Measurement Collaborative Community

Ontology of **non-sedentary behavior**

Keeping active, staying mobile

Type of measure: Passive measurement.

Definition of measure: The ability for a person with ADRD to continue to move around their environment freely and unimpeded.

Considerations: This measure is defined as the amount of non-sedentary behavior in the active window.

Outcomes to be measured: Ratio/percent of active time in the active window, average non-sedentary time in the active window.

Example: Using a wrist-based or other harnessed accelerometer, estimating how much of an individual's most active (X number, e.g., ten) hours of the day is spent in non-sedentary behavior.

Non-sedentary behavior measurement in the literature: A review of physical behavior in AD, non-sedentary behavior using metabolic equivalents

From patients and care partners:

"If my Mobility got worse all around, I wouldn't be able to do anything whether at home or abroad, and I really wouldn't even be able to go abroad or outdoors in order to accomplish tasks or socialize. If my Mobility were to worse than at home, I may become a further fall risk, and I wouldn't be able to enjoy all of the rooms and areas of my home. I would simply sit on the couch and wait for my bedtime." - *Patient, USA*

"If this area improved, [they] will be able to do things independently or with little assistance as compare to now." - *Care partner, Ghana*

"[If her mobility worsened,] I would have to be there all the time to care for her needs and that would also affect my work." - *Care partner, Ghana*

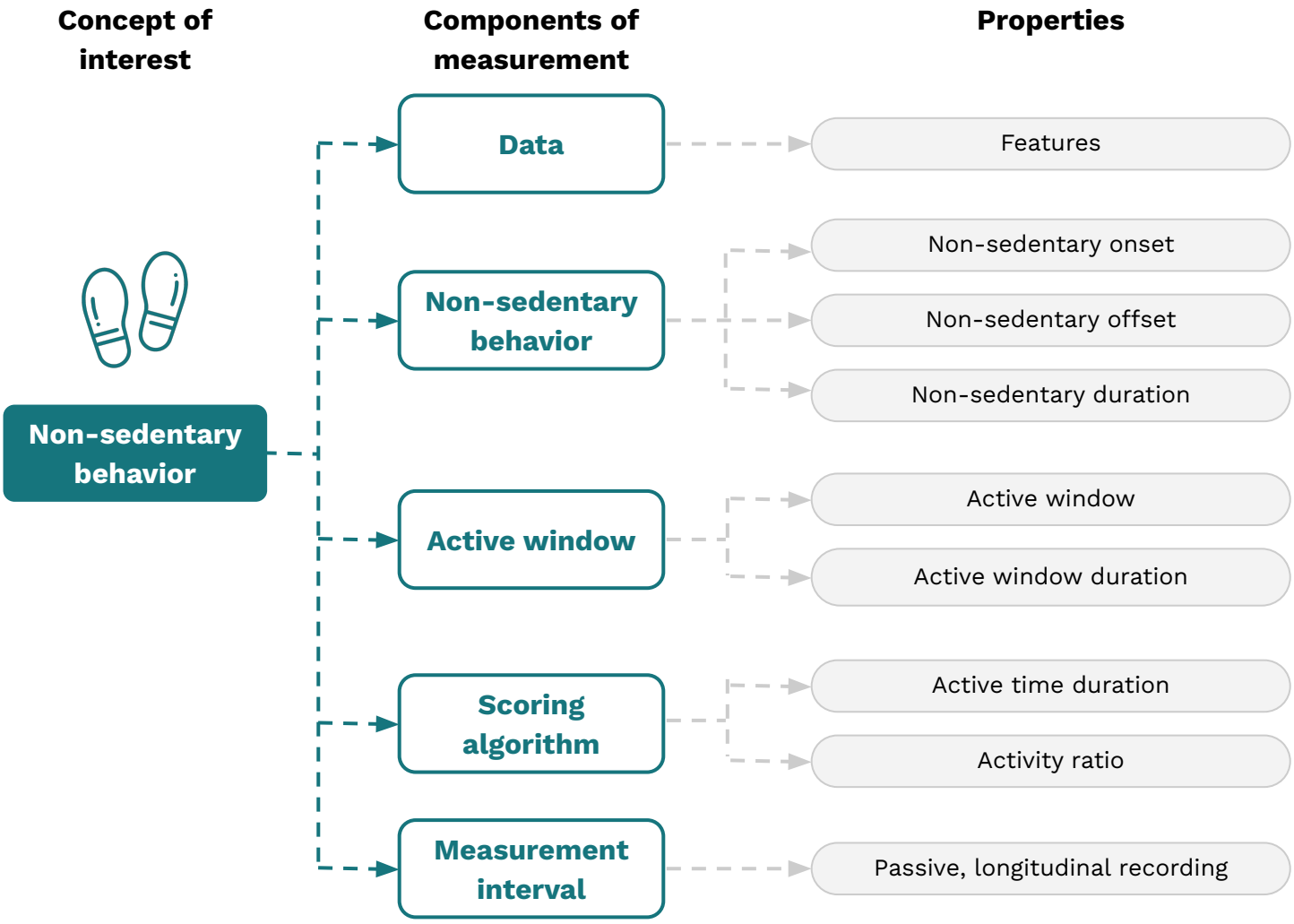
"[If his mobility worsens,] it allows me to spend even less quality time with my dad as his daughter I'm already his full-time caregiver and there's no greater joy in the world but I miss spending quality time with my dad and I can actually spend be present and not be worried the whole time about me having chores to do and housework to be present for any of my family because I'm always next step out my head." - *Care partner, USA*

Resource quicklinks

View the full Core Digital Measures of ADRD conceptual model or jump to another ontology:

Visuospatial memory | Expressive communication | Sleep disruption | **Non-sedentary behavior**

View the discussion guide for non-sedentary behavior



Data

It is necessary to report and specify the data collected by the technology employed. An additional advantage is that this data can then be available to individuals appraising the planned or conducted work. In research activities where data is made available for secondary research (i.e., data hosted on the Alzheimer's Disease Data Initiative), users can assess the feasibility of the data for their own study aims.

Features

Report the features output by the technology. Specify the epoch length of the output and the data labels that are output or derived. Evidence supporting the procedure and algorithms used to extract or derive features and data labels from the collected data must be provided.

Non-sedentary behavior

It is necessary to clearly define the parameters of non-sedentary behavior. Non-sedentary behavior can, for example, be defined as metabolic equivalent units (METs) above a given threshold or through other technology-specific metrics (activity count, etc.). When selecting a technology for the measurement of non-sedentary behavior, evidence should be presented or generated in support of both the selected cut-off criteria for defining non-sedentary behavior and any algorithms underlying the data that the cut-off criteria are employed on.

Non-sedentary onset

A timestamp that relates to inferred initiation of a non-sedentary event. Report any confirmation criteria (i.e., the first detected non-sedentary event that lasts longer than X minutes/epochs). Provide evidence supporting this criteria in the intended population along with evidence for the underlying estimation algorithm.

Many technologies will collect data in epochs (such as 15-second windows). Labels associated with each window will allow the user to define whether that window represented sedentary or non-sedentary behavior. The non-sedentary onset timestamp is the timestamp value of the first epoch in a series of epochs that contains a label for non-sedentary behavior and meets the confirmation criteria (i.e., is followed by a series of further epochs with a non-sedentary label).

Non-sedentary offset

A timestamp that relates to inferred termination of a non-sedentary event. Report any confirmation criteria and provide evidence supporting this criteria in the intended population.

Non-sedentary duration

The difference between non-sedentary onset and the next offset (minutes, seconds).

Active window

The active window is the most active (X number, e.g., ten) consecutive hours in the day. Defining an active window helps remove the measurement of non-sedentary behavior in the primary sleep period. It is necessary to define the length of this window and evidence the rationale for choosing this window length in the intended population. In addition, it is necessary to evidence how sleep vs. rest is determined and further describe how periods of sleep (i.e., napping behavior) will be removed from the active window (where appropriate).

Active window

The timestamp of the start and end of the most active (X number, e.g., 10) consecutive hours in the day.

Active window duration

The difference between the timestamp of the start and end of the active window, minus the duration of any detected sleep events (where appropriate). If adjusting for sleep events, provide a rationale as to why this adjustment is appropriate in the intended population.

Scoring algorithm

It is necessary to report how the data collected will be used to create a metric representing the individual's non-sedentary behavior in the active window.

Active time duration

Report the total time spent in non-sedentary behavior in the active window.

Activity ratio

Report the ratio or percentage of active time duration to active window duration (adjusted for detected sleep events where appropriate).

Measurement interval

It is necessary to specify the frequency of assessment. Although sensor-based technology, particularly wearable technology, can be used to collect continuous data, patient burden should still be considered. Maintaining the technology (charging, etc.) or remembering to wear it (e.g., after charging, after bathing) can be burdensome.

Deliberately selecting a set period of time, linked to time periods with rich clinical data (i.e., clinic visits), will help to increase the utility of the data collected (e.g., for validation efforts) and can aid in patient adherence to using the technology. The exact frequency of data collection is likely specific to the research question, and can be supported through a data-driven approach showing the ideal frequency for a specific measure, like reliability.

Passive, longitudinal recording

Daily for a period of time relevant to the needs of the study or health care provider (HCP) assessment.

Passive recording can take place continuously. However, to ensure compliance, a limited time window (e.g., seven days prior to clinic or trial visits) may be preferred.