Objective assessment of older adults' mobility using assistive devices through monitoring technologies: a scoping review M. A. Almeida, F. O. Medola. *Gerontechnology* 25(s)

Purpose Population aging increases the demand for mobility-assistive resources such as canes, walkers, and wheelchairs, which are essential for promoting independence and well-being in older adults [1]. Wearable monitoring technologies enable objective assessment of mobility and motor performance [2]. Data collected in real-life contexts can inform safer and more effective interventions, supporting device prescription and guiding design and ergonomic adaptations [3]. This scoping review aims to map and analyze the use of portable monitoring technologies in assessing mobility among older adults using assistive devices, identifying employed technologies and parameters, and examining how the resulting data can inform design and rehabilitation practices. **Method** The search was performed in PubMed and Scopus using terms related to older adults ("elderly", "older adults", "older people", "aging", "older individuals"), mobility-assistive devices ("mobility aid", "wheelchair", "walker*", "rollator*", "crutch*", "cane*"), and monitoring technologies ("accelerometer*", "inertial sensor*", "IMU", "movement detect*", "activity monitor*"). Articles published between 2015 and 2025, in English, that assessed older adults' mobility using assistive devices with movement-monitoring technologies were included. After removing duplicates, 22 articles were analyzed. **Results and Discussion** Overall, the studies aimed to monitor gait and the use of assistive devices, evaluating functional and safety aspects. Each study assessed an average of 43 older adults (±35), aged 65 years or older, with varying mobility levels and, in some cases, cognitive impairments. Most studies assessed a single device, while only six considered two or more types. The most commonly evaluated devices were canes (n = 8; 27.6%), rollators (n = 7; 24.1%), and walkers (n = 7; 24.1%), while forearm-supported walkers, intelligent walkers, crutches, and wheelchairs were less frequently investigated (n = 1 each; 3.4%). A complete overview of the assistive devices analyzed in the selected studies is shown in Figure 1. In summary, most studies focus on a limited range of devices, while other widely used aids, such as crutches and wheelchairs, remained underexplored. To monitor mobility, studies employed accelerometers (n = 12; 54.5%), multimodal systems combining two or more sensor types (n = 6; 27.3%), and inertial measurement units (IMUs) recording acceleration, orientation, and rotation (n = 4; 18.2%). Data collection protocols included structured laboratory sessions, standardized walking and daily activity tests, continuous monitoring over several days or weeks, and comparisons with clinical assessments or reference measures, such as video analysis. The findings indicate that monitoring technologies can detect subtle nuances in the gait of older adults using mobility aids, such as changes in acceleration, angular velocity, and symmetry of effort applied to the device, revealing frailty and fall risks not detected through conventional clinical observation. Sensor placement and device type influence measurement accuracy, while machine learning enables sensitive tracking of device usage and adherence. Adaptation to canes and walkers alters gait, increasing variability and demanding greater postural and cognitive control, while instrumented sensors quantify fine adjustments, differentiate mobility profiles, and identify higher-risk individuals. Objective mobility assessment allows assistive technology design to translate gait and risk data into concrete decisions regarding dimensions, types and levels of assistance, and sensory feedback, contributing to the advancement of gerontechnology by providing safer, more functional devices tailored to older adults.

References

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Affiliation: Faculty of Architecture, Arts, Communication and Design (FAAC), São Paulo State University (UNESP), Bauru, SP, Brazil
E-mail: mariana.anjos@unesp.br

Figure 1. Types of Mobility Assistive Devices Evaluated Using Monitoring Technologies in the Reviewed Studies