Sensor-based assessment of Katz-defined care needs to support ageing in place: methodological lessons from the SANDRA project. S. Al Omari, B. Jansen, J. Lambert Cause, K. Giacomino, K. De Vliegher, J. Cooreman, J. Stiens, D. Beckwée. *Gerontechnology* 25(s*)*

Purpose As more older adults age in place, home nursing faces the challenge of detecting evolving *care needs* in a timely and objective manner. Currently, these needs are assessed using the Belgian version of the Katz scale, based on episodic, often subjective observations during home visits. The SANDRA project, initiated through a bottom-up request from Wit-Gele Kruis van Vlaanderen, explored whether sensor technology could capture behavioural indicators of Katz-defined care needs within a domestic environment. This presentation outlines the user-centred methodology developed to translate the Katz items [1] into sensor-measurable behaviours and presents lessons learned from validating these concepts in a realistic home-like setting. **Method** A four-stage development process was followed: (1) a systematic literature review to identify behavioural markers of Katz Activities of Daily Living (ADLs) and candidate sensors suitable for unobtrusive home use; (2) development of a multimodal sensor library, balancing technical feasibility and user acceptability in older adults; (3) pilot bench and functional testing to assess sensor reliability, interpretability, and ecological validity; and (4) a proof-of-concept “apartment protocol” conducted in a therapeutic simulation apartment representative of ageing-in-place conditions. To align with homecare practice, Katz ADLs were decomposed into sensor-relevant sub-activities. Bathing included shower entry/exit, washing, drying, and grooming. Toileting comprised mobility to the toilet, clothing management, sitting, wiping, flushing, and exit. Dressing involved clothing preparation, donning and doffing garments, fastening, footwear, and use of assistive devices (e.g. glasses, hearing aids). Feeding covered meal preparation, utensil use, food and drink intake, and chewing/swallowing. Transfers and mobility included bed mobility, sit-to-stand transitions, floor transfers, walking between rooms, turning, obstacle negotiation, and object handling. Participants self-annotated activities using room-specific clocks, complemented by synchronised RGB video in non-private areas. Usability and user experience were assessed using the USE, SUS, UEQ, and IMI questionnaires. **Results and discussion** The overall methodology proved feasible at organizational level. The structured decomposition of Katz items allowed sensor engineers to target specific behavioral signatures relevant for home-based care-need assessment. Continuous multimodal recording in the simulation apartment was achievable with stable sensor functioning. Participants were able to complete the full apartment protocol and use the clock-based annotation system, and questionnaire data showed high usability and perspicuity, with low perceived burden but only moderate perceived usefulness in healthy adults. Together, these findings support the feasibility of the chosen sensors, annotation approaches, and simulation-apartment setting as an intermediate step towards deployment in older adults ageing in place. ***Lessons learned*****:** *(1) Self-annotation* was feasible but lacked sufficient temporal resolution to separate closely spaced ADL segments. Synchronised RGB video improved interpretability, indicating that future home-based studies should rely on semi-automated annotation or intelligent event detection to reduce participant burden. (2) *Hand-based IMUs for ADL detection*. Bilateral hand-worn IMUs were essential to distinguish ADL-specific actions from general physical activity or sedentary behaviour. Many Katz-relevant tasks require dominant-hand use (e.g. grooming), and bilateral sensing improved detection of functionally meaningful hand activity rather than overall movement alone. (3) *Need for an additional testing layer.* A dedicated experimental phase in which individual ADLs are performed in isolation is needed prior to the apartment protocol. Such single-ADL sessions would provide cleaner reference data to train and validate activity-specific machine-learning models before testing combined, naturalistic ADL patterns. (4) *Simulation apartment relevance*. The apartment provided a realistic proxy for ageing-in-place environments and enabled observation of naturalistic ADL behaviour. However, task clustering was observed; future protocols should allow more time and clearer prompting per activity to better reflect everyday routines. (5) *Feasibility for home deployment.* The system was technically robust and rated as highly usable, but perceived usefulness was limited in healthy adults. This underscores the need for evaluation in older adults with actual care needs to assess acceptability, privacy concerns, and real-world value for supporting ageing in place. Overall, these findings demonstrate how a user-centred, stepwise methodology can support the development of sensor-based indicators of Katz-defined care needs and contribute to safer, more sustainable ageing in place.

References

1. Katz S. Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living. J Am Geriatr Soc. 1983;31(12):721-7.

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