

Monitoring Activities of Daily Living for Maintaining Independent Living in Dementia

Jonathan Turner, Ciarán Nugent, Damon Berry,
Dympna O’Sullivan
Department of Computer Science
Technological University Dublin
Dublin, Ireland
Emails: jonathan.turner@tudublin.ie,
ciaran.nugent@tudublin.ie, damon.berry@tudublin.ie,
dympna.osullivan@tudublin.ie

Michael Wilson, Julie Doyle
NetwellCASALA
Dundalk Institute of Technology
Dundalk, Ireland
Emails: michael.wilson@dkit.ie, julie.doyle@dkit.ie

Abstract—Our ability to live independent meaningful lives depends on our ability to perform various activities and to maintain our cognitive functions. Maintaining independent living is important for persons with dementia; it increases self-worth and allows to remain independent and in their own homes for longer. In this article, we describe the activities established as being important for the maintenance of independent living, and methods for monitoring these activities using technology.

Keywords- dementia; self-monitoring; activities of daily living; independent living.

I. INTRODUCTION

Our work is focused on the development of a tool to extend the period of independent living for Persons Living With Dementia (PLWD) and to enhance Quality of Life (QoL). An integral part of our proposed tool is monitoring of performance of basic activities and cognitive functions. In previous work, we have reviewed tools for monitoring activities for PLWD [1]. In this paper, we describe established measures of activity, together with the reasons for their adoption, with a focus on the importance of maintaining these for PLWDs. We also outline our proposed methods to measure achievement of activities by PLWD in the tool we are developing. Sections II and III give information on means of discovery of measures and how they are used in dementia care. Section IV discusses the use of these measures in our work. We conclude with a discussion in Section V.

II. METHODS

We conducted interviews and focus group with those with expertise in the field (specialist dementia care nurses, occupational therapists from an affiliated University hospital) and conducted a systematic literature review to determine which activities were important in the maintenance of independent living, and which activities were important in maintaining QoL.

III. RESULTS

Activities and functions required for independent living with QoL fell into several clear groups: basic activities necessary for survival; more sophisticated activities requiring a higher level of thought that are necessary for independent living; activities that bring pleasure; and mental abilities that underpin the activities already listed.

A. Activities of Daily Living

Basic survival skills were described by Katz [2] as ‘Activities of Daily Living’ (ADL). These activities are the most basic activities required to ensure day-to-day survival but are not, in themselves, sufficient to allow for independent living or for a higher quality of life. The activities defined by Katz are shown in Table 1. This table also shows the methods by which we intend to track performance of these activities for PLWD. Where possible, non-invasive sensors are used to track activity; where necessary, PLWD will be asked at intervals about performance of activities via an app.

TABLE I. KATZ’S ACTIVITIES OF DAILY LIVING

Activity name	Activity description	Tracking method
Bathing	assistance only out of bed independently in bathing a single part or bathes self completely	Humidity sensor in bathroom
Dressing	gets clothes from closets and drawers; puts on clothes, outer garments, braces; manages fasteners; act of tying shoes is excluded	Switch sensor on drawers and/or wardrobe doors
Toileting	gets to toilet; gets on and off toilet; arranges clothes; cleans organs of excretion	Motion sensor in bathroom, flush sensor attached to toilet
Transferring	Moves in and out of bed independently and moves in and out of chair independently	Pressure mat sensor on floor by bed/chair
Continenence	urination and defecation entirely self-controlled	App
Feeding	gets food from plate or its equivalent into mouth	App

B. Instrumental Activities of Daily Living

The more sophisticated activities that allow an individual to continue living independently (albeit with some assistance if required) were described by Lawton and Brody [3] as ‘Instrumental Activities of Daily Living’ (IADL). These are shown in Table 2. Note that the activity description shows the highest level of performance; for example, the Transportation activity allows for ‘Travels on public transportation when assisted or accompanied by another’ as achieving that IADL. More details on levels of performance for each IADL is given in [5]. We will track these activities by sensor where practical or by asking the PLWD to self-report. Note some IADLs may not be appropriate for some individuals if they have never previously routinely performed an activity (e.g., preparing meals).

TABLE II. INDEPENDENT ACTIVITIES OF DAILY LIVING

Activity name	Activity description	Tracking method
Telephone	Operates telephone on own- , looks up and dials numbers	Beacon sensor on handset
Shopping	Takes care of all shopping needs independently	App
Food	Plans, prepares and serves adequate meals independently	App
Housekeeping	Maintains house alone or with occasional assistance	App
Transportation	Travels independently -public transportation or drives car	App
Finances	Manages financial matters independently	App
Laundry	Does personal laundry	App

C. Meaningful Activities

The Pleasurable Events Schedule [4] focuses particularly on PLWD; examples include ‘being outside’ or ‘friend visiting’. Note that an ADL or IADL may also be a Meaningful Activity (MA), for example ‘Food’ (i.e., preparing a meal) may bring a reward of meaning beyond that of the preparing a meal. In our work, we allow PLWD to define their own MAs. For each MA, we determine which IADLs and cognitive functions are required to be exercised.

D. Cognitive Functions

The ability to perform activities that fall in the above groups is underpinned by mental abilities. These have been described in [5] and are shown in Table 3. We do not plan to explicitly track performance of these functions, but instead we determine which IADLs and MAs implicitly exercise these functions and track the performance of these activities to ensure that essential cognitive functions are exercised.

TABLE III. COGNITIVE FUNCTIONS

Table Column Head	
Function name	Function description
Perceptual-Motor	Combining sensory input with motor skills
Learning and Memory	Ability to record and retrieve information
Complex Attention	Ability to focus on multiple things
Executive Function	Sequencing, planning and organizing tasks
Language	Communicate and receive communication
Social Cognition	Controlling behavior, recognize social cues

IV. DISCUSSION

There exist long-established sets of ADLs and IADLs. In our proposed tool, we will monitor, and encourage performance of these for PLWDs, and extend an existing set of dementia-specific MAs by allowing PLWDs to suggest their own MAs, to extend their period of independent living for as long as possible with as much QoL as possible.

V. CONCLUSION

Our work is focused on developing a tool to extend the period of independent living for PLWD. Following consultations with dementia specialists and a systematic literature review, we plan to incorporate ADLs, IADLs and MAs into a tool for PLWD. Monitoring performance of activities will be by sensors, where possible, or self-reported by app. Future work will focus on development of the combined app and activity detection via sensors.

ACKNOWLEDGMENT

This material is based on works supported by the Science Foundation Ireland under Grant No. 19/FFP/6917.

REFERENCES

- [1] J. Turner, C. Nugent, D. Berry, J. Doyle, M. Wilson, and D. O’Sullivan, ‘Individualised Self-Care for Early-Stage Dementia: A Framework for Activity Attainment and Replacement’. *International Journal On Advances in Life Sciences*, vol. 14, 2022 (in press).
- [2] S. Katz, A. B. Ford, R. W. Moskowitz, B. A. Jackson, and M. W. Jaffe, ‘‘Studies of illness in the aged. The Index of ADL: a standardized measure of biological and psychosocial function,’’ *JAMA*, vol. 185, pp. 914-919, Sep. 1963, doi:10.1001/jama.1963.03060120024016.
- [3] M. P. Lawton and E. M. Brody, ‘‘Assessment of older people: Self-maintaining and instrumental activities of daily living,’’ *The Gerontologist*, vol. 9, pp. 179-186, 1969, doi:10.1093/geront/9.3_Part_1.179
- [4] L. Teri and R. G. Logsdon, ‘‘Identifying pleasant activities for Alzheimer’s disease patients: the pleasant events schedule-AD,’’ *The Gerontologist*, vol. 31, pp. 124-7, Feb. 1991, doi:10.1093/GERONT/31.1.124
- [5] American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)*, Arlington: American Psychiatric Association, 2013.