

COMMENTARY

Cognitive impairments and activities of daily living in the Alzheimer's disease spectrum: the need to consider cognition and functional skills as separate related domains

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In this issue, Tabira *et al.* (2022) present a detailed assessment of the level of impairments in activities in daily living (ADLs) in individuals in the Alzheimer's disease spectrum whose cognitive impairments vary from mild to moderate to severe. Their analysis of activities is very comprehensive and detailed, with eight individual activity domains assessed in a graduated hierarchy with five levels of task complexity evaluated. What makes this paper particularly interesting is the careful separation of cognitive impairments from functional impairments and a presentation of the data in a way that is very accessible. Further, there are some recent targeted treatment efforts that may exert differential effects on cognition and functional skills, with evidence that impairments in everyday activities can be treated in a manner that is not dependent on the improvement of cognitive functioning.

A fairly recent issue of the journal in 2021, *International Psychogeriatrics*, volume 33, issue 11, targeted international advances in the identification, diagnosis, and assessment in dementia. One of the articles in that special issue, Zhang *et al.* (2021) presented a Chinese language version of the Relevant outcomes scale for Alzheimer's disease (ROSA; Holthoff *et al.*, 2011). The ROSA is an aggregate rating scale, which includes elements of the multiple domains of AD, including cognition, everyday functioning, and behavioral disturbances. That validation study suggested that there was a three-level separation based on scores on the CROSA, which is similar to the strategies being employed in the current study.

Where the present study goes beyond the CROSA is a detailed analysis of both ADL impairments that are graduated across levels of impairments in cognitive functioning and identification of those appear to be notably impaired even in the mildest cognitive impairment group. These two types of impairments may be critically different and,

in some ways, resemble the classic discoveries regarding the cognitive course of AD produced by the Consortium to Establish a Registry for AD (CERAD; Morris *et al.*, 1989). As reported in the very early reports from the CERAD study, some cognitive abilities are essentially completely deteriorated at the time of the first identification of Amnesic Mild Cognitive Impairment. As reported by Welsh *et al.* (1991), delayed recall memory is performed at essentially a zero level at the time of first detection of mild AD, meaning that it is a powerful indicator of the presence of dementia and (as is well known to neuropsychologists supervising cognitive assessments attempting to identify progression of disease) not vulnerable to further progression. Subsequent analyses of the CERAD database suggested that certain cognitive measures are more useful for staging because they decline at different levels of global cognitive impairment (Welsh *et al.*, 1992).

Turning to the ADLs examined by Tabira *et al.*, some skills seem markedly impaired even in cases with more limited cognitive impairments. For instance, composite scores on managing finances and using transportation were notably impaired even in the mildly impaired cases and were not performed relatively more poorly even by the group with very substantial cognitive impairments. In contrast, cooking, shopping, using the telephone, laundry, and medication management had a clear step by step increase in impairments with increasingly lower MMSE scores.

Within the different domains that manifested "stepwise" decline, there are individual component skills that themselves manifested either a complete loss of skills above the mild level of cognitive impairments and others that were themselves affected in a stepwise manner. While there are eight domains, so evaluation of all of them should be based on reading the article, some good examples

include shopping, where entering the store was independently performed by 71%, 48%, and 6% of the participants across the severity domains, while paying with cash was accomplished by 64%, 21%, and 0% of the participants across severity levels.

Beyond refining the assessment of activities of daily living, what do these findings tell us? A focus on the two domains, finances and transportation, where there were global impairments across levels of cognition may be informative. The financial skills assessed range from using cash to doing electronic banking, with only the use of cash performed by as many as 11% of the least impaired sample. It seems likely that decisions made by caregivers could drive some of the apparent inability to perform these skills (e.g., understand household expenses), but other elements of the inability to perform relevant financial skills may originate from a lack of earlier life exposure to the tasks. For instance, banking commonly involves the use of automatic teller machines (ATMs) for both depositing checks and obtaining cash and using electronic money involves a knowledge of the internet and internet banking. In the domains of transportation, taking a bus or train now commonly requires use of a ticket kiosk or advance on-line purchase and taking a taxi now also commonly involves an electronic order in advance.

These data suggest that lifelong lack of exposure to certain functional tasks can also appear to be an acquired deficit associated with cognitive changes; it may just be that these skills were never learned, or that rapidly changing technology leaves some people behind. In an example of an analysis of this phenomenon, we (Harvey and Nascimento, 2020) argue that commonly anticipated aging-related changes in cognitive abilities make it harder for older people to overcome the effects of rapid technological change. Expected changes in fluid intelligence make it harder for older people to learn new skills, both verbal and procedural. Many older people had no opportunity to acquire the skills that many younger people have now, which is the crystallized ability to learn how to operate the new technology. We pointed out that many older people retired even before voicemail was in common use, not to mention never having had the opportunity to gain the facility with wireless internet that is required to manage internet banking.

There is also an occasional conceptual confusion that conflates cognitive and functional skills and neglects to consider the difference between previously learned skills that may be dulled by cognitive decline and other skills that were never learned in the first place. Improving someone's cognition with a pharmacological or cognitive remediation intervention would not be expected to make it more likely that they could suddenly do something that they

have never done before. The results of the ACTIVE trial, which provided cognitive training to older individuals (Ball *et al.*, 2002), showed that this training facilitated performance in previously learned skills, such as timed activities of daily living and driving (Ball *et al.*, 2007). Participants in this study did not begin to drive for the first time at age 75 after cognitive training!

Recent meta-analyses have suggested improvements in cognitive functioning with computerized training during the earliest stages of AD. For instance, a very recent meta-analysis (Tulliani *et al.*, 2022) reported gains in cognition and previously acquired ADLs with computerized cognitive training. However, to learn novel skills, skills training is likely required. There are very few such interventions available. In a recent study, Czaja *et al.* (2020) delivered a computerized skills training intervention which included cognitive training for half of the participants and skills training for all of the older adult participants with cognitive impairments ($N = 43$) and healthy controls ($N = 51$). Technology-related functioning skills, including ATM and internet banking, ticket purchase from a kiosk, and medication refills and management improved in both participant samples and with both interventions, with improvements of over 50% for all six functional domains trained in the cognitively impaired subgroups. Adding computerized cognitive training led to equivalent functional gains with half of the training. Further, when cognitive outcomes were evaluated in this sample, Harvey *et al.* (2022) reported that the combination of cognitive training and skills training led to a synergistic effect on cognitive performance with a normed and validated performance-based measure.

Conclusions

Detailed assessments of activities of daily living are critically important in progressive conditions such as AD. Although cognitive impairments clearly impact on the ability to perform these skills, an additional important factor is an exposure to the skills earlier in life. Many older people have not used technology and changes in the world in reference to technology can make certain tasks challenging to highly educated older people with no evidence of cognitive impairments. It is also important to separate cognitive and functional deficits and realize cognitive enhancement will not lead to the spontaneous acquisition of novel skills. Dementia may not be the cause of a failure to perform a skill that was never learned before. A further consideration in the detailed assessment of functional skills is a

differentiation of skills that were previously performed from those that would be novel.

Conflicts of interest

Dr. Harvey has received consulting fees or travel reimbursements from Alkermes, Bio Excel, Boehringer Ingelheim, Karuna Pharma, Merck Pharma, Minerva Pharma, and Sunovion (DSP) Pharma in the past year. He receives royalties from the Brief Assessment of Cognition in Schizophrenia (Owned by WCG Verasci, Inc. and contained in the MCCB). He is chief scientific officer of i-Function, Inc and Scientific Consultant to EMA Wellness, Inc.

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