

Chapter 11

Cognitive Fitness, Assessment, and Cognitive Rehabilitation of Older Population: From MMSE to Computerized and VR Based Tools

Unai Diaz-Orueta

Nesplora Technology & Behavior, Spain

ABSTRACT

In recent years, it has been assumed that brain may be trained as a muscle (use-it-or-lose-it hypothesis) so the higher amount of cognitively stimulating activities we are involved at, the better the cognitive status will be when we reach the old age. Though this assumption needs to be properly verified with additional scientific evidence, there has been an increasing number of studies on cognitive intervention (training, stimulation, rehabilitation) that have obtained diverse results with regards to their efficacy in maintaining cognitive function over time and transfer their gains to older people's daily life activities and challenges. The current chapter revises latest years of research on cognitive tests and interventions, and incorporates the added value of the latest developments in computerized and virtual-reality based assessment and training tools, to respectively measure and improve cognitive status in older populations. Moreover, key recommendations on how existing tools could be improved will be provided.

INTRODUCTION

Revisiting the Model of Successful Aging

Whether aging is necessarily related to a general decline of function is a matter of controversy. One of the most studied models of successful aging, the model by Rowe and Kahn (1997), described successful aging with the following ingredients:

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1. Absence of disease, absence of disability or risk factors;
2. Maintenance of physical and cognitive functioning; and
3. Active involvement with life (described as connections with people including close friends or relatives).

In more operative terms, Vaillant and Mukamal (2001) point out that successful aging at the ages of 70 to 80 years old can be predicted by variables measured and controlled by the person prior to being 50 years old: not smoking more than 30 daily cigarettes, absence of alcohol abuse, stable marriage, a mass body index between 21 and 29, regular exercise and high education level. The only factor that could appear after the fifties and considered to affect successful aging is depression. Finally, Moraes and Souza (2005), according to their results, describe the successful ager as a person with an optimistic view of the future, ability to accept changes, high self-esteem, positive self-image, sense of autonomy, well-developed mechanisms to choose meaningful goals, as well as to optimize resources and compensate loss (to develop strategies that compensate errors), and a reserve of capacity and resistance (also known as resilience), that allows them to recover, adjust and readapt to novel situations emerging in their daily lives.

However, this successful aging profile looks ideal and most of the criticism derives from the fact that this definition would apply to a very scarce segment of the general population. In other words, it is very difficult for any older person to fulfill all the requirements indicated in the model of successful aging by Rowe and Kahn, and in their subsequent reviews. Hence, there is a need to rethink the approach to successful aging and consider a flexibilization of this ideal profile proposed by Rowe and Kahn at the end of the last century.

Cognitive Decline in Old Age: The Truth About ‘Use It or Lose It’ Hypothesis

Cross-sectional comparisons of people of different ages have revealed that increased age is associated with lower levels of performance on a wide variety of cognitive measures (Midkiff, 2004). Research has suggested two possible causes or natures for this decline.

The first one understands decline as an inevitable factor in aging due to a reduction of resources available for information processing (Cognitive Load Theory), that is, a decline in the efficient use of working memory capacity (which is a system that momentarily stores information available for ongoing cognitive processes) with age. According to Salthouse (2000, 2004), this can be proved with a mental rotation task, a simple task in which subjects are shown a series of letters that have been rotated 45, 90 or 180 degrees, and have to recognize which the letter is at every moment, showing a gradual speed and efficiency decline with age.

The second explanation states that decline is a result of cognitive inactivity, hence, it is argued that if cognitive activity is maintained, older people will subsequently maintain cognitive functioning, but without this maintenance, cognitive operations will begin to atrophy from disuse much like physiological structures that are not used (e.g. muscles). In the latest years, the work of Stern (2002, 2003, 2009) on cognitive reserve, recently reviewed by Diaz-Orueta, Buiza-Bueno, and Yanguas-Lezaun (2010), suggests that older people have a reserve capacity that allows them to maintain and benefit from exposure to performance enhancing environments (by means of achieving a higher education level, literacy, more cognitively complex occupation, bilingual or multilingualism, and moderate physical and cogni-

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