

## Preserving cognitive vitality: Value of cognitive rehabilitation in addressing cognitive deficits in the elderly

Furqan Ahmed Siddiqi<sup>1</sup>, Muhammad Ehab Azim<sup>2</sup>, Muhammad Furqan Hassan<sup>3</sup>, Farooq Azam Rathore<sup>4</sup>

### Abstract

The recent advancements in medical sciences has resulted in not only increasing life expectancy of the elderly but has also improved survival rate in elderly with neurological disorders including those with head trauma. This has resulted in an increasing number of persons with cognitive deficits. Cognitive functions such as executive functioning and memory play an important role in success of a rehabilitation programme and therefore can positively contribute to public health goals. Considering cognitive decline at present has no cure and pharmacological therapies have a limited role, efforts are usually made to delay the onset and progression of cognitive decline and improve quality of life. Literature suggests that active life style, regular exercise, actively performing activities of daily living can have a significant impact on cognitive skills. In addition different models of cognitive rehabilitation and approaches can be integrated into practice to improve cognitive reserve and cause neuroplastic changes to facilitate cognitive function by providing cognitive stimulus and training. Moreover with technological advancements, the computerized cognitive intervention field is growing. This usually integrates conventional cognitive intervention with digital smart devices to provide an engaging and cost effective alternate approach. This review aims to highlight the importance of cognitive rehabilitation and suggest a few evidence based approaches that may be considered by rehabilitation professionals to promote and improve cognitive rehabilitation in Pakistan.

**Keywords:** Cognition, Cognitive Decline, Cognitive Rehabilitation, Elderly, Executive functions, Memory.

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### Introduction

Cognitive deficits, encompassing impairments in memory, attention, executive functions, and other cognitive processes, pose significant challenges for not only individuals but also their families, caregivers and health care professionals.<sup>1</sup> One out of 9 adults (11.1%) are at a risk

<sup>1-3</sup>Foundation University College of Physical Therapy, Foundation University Islamabad; <sup>4</sup>Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi, Pakistan.

**Correspondence:** Farooq Azam Rathore. e-mail: farooqrathore@gmail.com  
ORCID ID: 0000-0002-4759-0453

of developing cognitive decline. The prevalence of cognitive decline among elderly aged 65 years and above is 11.7% in comparison to 10.8% among those aged 45-64 years.<sup>2</sup> Dementia is one of the most prominent impairments resulting from cognitive decline. More than 50 million people throughout the world suffer from dementia, among which more than 60% are living in low to middle income countries. Every year, around 10 million new cases are reported and this number is expected to rise to >150 million by 2050, making it a public health priority.<sup>3,4</sup>

Cognitive impairment including memory, attention deficits and executive function affects multiple aspects of an individual's daily life, making it difficult for them to retain important information, focus and make decisions effectively.<sup>2</sup> Dementia and cognitive impairment not only result in emotional and physical toll, but the financial implications are also quite significant and burdensome. This results in increasing stress, emotional strains, and decreased quality of life for persons with cognitive impairment as well as their family members. Worldwide, dementia is currently the 7th leading cause of death and a major cause of dependency among the elderly. In 2019, the global economic burden of cognitive impairment was approximately 1.3 trillion USD, with the family caregivers being responsible for 50% of this cost, highlighting their significant contribution to the provision of care.<sup>3</sup> The burden of cognitive deficits also extends to the healthcare system. Global statistics have shown that the cost of dementia alone on healthcare systems was around 594 billion USD in 2019, and is projected to further rise to 1.6 trillion USD by the year 2056. This includes the cumulative costs of diagnosis, treatment, rehabilitation and other support services, as well as the increased demand for specialized health care professionals such as neurologists, neuropsychologists, physical therapists and occupational therapists, for provision of cognitive rehabilitation (CR) interventions.<sup>5,6</sup> However, with advancements in cognitive rehabilitation approaches, there is growing optimism about the potential for improving cognitive functioning and reducing the burden of cognitive deficits.

### Benefits of Cognitive Rehabilitation

Cognitive rehabilitation, a systematic and evidence-based

approach to address cognitive deficits, has shown promising results in improving cognitive functioning, promoting independence, and reducing the burden associated with cognitive deficits.<sup>6,7</sup> It includes multiple different interventions and strategies targeting specific domains and functional abilities. The key feature of cognitive rehabilitation is to improve cognitive skills through different exercises and techniques including cognitive training programmes, computer-based exercises, compensatory strategies, and environmental modifications.<sup>7</sup>

In addition to these specific interventions, cognitive rehabilitation also emphasizes a holistic approach. It recognizes the integration between cognitive functioning and other aspects of an individual's life, such as emotional well-being, physical health, and social engagement. Thus, cognitive rehabilitation may include interventions that address psychological factors like anxiety and depression, promote physical exercise and healthy lifestyle habits, and encourage social participation and engagement.<sup>7</sup>

Multiple studies have supported cognitive rehabilitation by demonstrating improvements in cognitive activity, daily functioning, and quality of life following cognitive rehab interventions.<sup>7,8</sup> Furthermore, advancements in technology including computer-based programmes, virtual reality, and mobile applications have expanded the possibilities of delivering cognitive rehabilitation interventions. These technological innovations have the potential to reach a larger population, increase convenience, and promote long-term engagement in cognitive rehabilitation.<sup>9,10</sup>

### Interventions for cognitive rehabilitation

Clare and Woods classification classified cognitive rehabilitation into three categories: Cognitive Stimulation (CS), Cognitive Training (CT), and Cognitive Rehabilitation (CR).

- i. **Cognitive Stimulation (CS):** It is a strategy that focusses on activities of daily life, stimulating cognitive and societal functioning in a non-specific manner. For example, group discussions, reading, playing chess, drawing, and painting.
- ii. **Cognitive Training (CT):** It involves learning standard tasks to focus on specific domains of cognition at different levels. For example, training applied memory strategies like cueing, as well as repetitive cognitive exercises.
- iii. **Cognitive Rehabilitation (CR):** It is an approach that focusses on meaningful activities to improve the performance of daily activities by optimising compensatory and environmental strategies. It

does not focus specifically on improving cognitive function, instead it addresses problem-based activities. For example, memory retrieval techniques, activity or environment modification, and errorless learning.<sup>7,8</sup>

### Strategies to improve cognitive impairment

Following strategies can be used to train cognitive decline:

- i. **Compensatory strategies:** It focusses on teaching alternative methods like memory aids, organizational techniques, and assistive technologies to manage tasks and compensate for cognitive impairment.
- ii. **Environmental modifications:** It also plays a significant role in cognitive rehabilitation by creating environments such as organising living spaces, establishing routines, and reducing distractions thus decreasing cognitive burden and supporting optimal functioning.
- iii. **Collaborative multidisciplinary approach:** It is crucial for the successful implementation of cognitive rehabilitation. Collaborations of different health professionals, including neuropsychologists, physical therapists, occupational therapists, speech-language pathologists, and social workers is crucial for successful assessment, designing and implementation of cognitive rehabilitation.<sup>8</sup>

### Physical Therapy Interventions for Cognitive Rehabilitation

Physical therapy plays a significant role in improving cognition, enhancing daily functioning, and decreasing the burden of cognitive decline. Results of a systematic review reported that physical therapy plays a beneficial role in improving memory, attention, and executive function of a person with cognitive decline. Both conservative and technological based interventions can be used for training cognition.<sup>11</sup>

#### Conservative methods

- i. Aerobic exercise has shown positive effects on cognitive function. Activities including walking, cycling, swimming, or treadmill training can improve memory, attention, and executive functioning of a person. A study conducted on elderly population depicted that aerobic training has potential in improving cognitive functioning.<sup>11</sup>
- ii. Balance training activities such as single leg stance or ball training and other activities can also improve cognitive functions.<sup>11</sup>

- iii. Activities that focus on Functional and task-specific training such as engaging individual in meaningful and purposeful activities requiring mental processing, problem solving, decision making, can improve cognition by transferring skills to daily life activities.<sup>11</sup>
- iv. Dual task training requires performing two tasks at a time which involves executive cognition processing. Thus incorporation of such activities can also be beneficial for cognitive rehabilitation. Studies have also shown that dual-task training can improve cognitive performance and functional outcomes.<sup>11</sup>

#### **Technological advancements in cognitive rehabilitation**

- i. **Computerised Cognition training programmes:** Cognitive exercises that are game based and can be performed on computers or mobiles, have been widely used for the last two decades. At present video games available commercially or programmes for brain-training, such as Lumosity, Brainer1, and Nintendo Wii Big Brain Academy, are being used for healthy elderly population and also for the treatment of patients with either Mild Cognitive Impairment or dementia.<sup>12</sup>
- ii. **Virtual Reality interventions:** It is the interaction of an individual with reality-based scenarios through an artificial computer-based system. It is further categorised into non-immersive VR such as exergaming, which utilizes a two-dimensional virtual environment where individual interacts with the virtual entities and immersive VR, which generates a greater sense of presence and requires more brain resources for cognitive or motor control than non-immersive VR. In a study conducted in 2019, the authors reported that VR improves cognitive functioning in elderly population by making them practice various activities of daily life in a secure and controlled environment.<sup>12</sup>
- iii. **Robot-assisted interventions:** In VR, user is provided with a virtual world of socially assistive robots (SARs) with the feeling of interacting with a "real person". Van Patten conducted a study in 2020 and reported that robot assisted cognitive rehabilitation helps in improving functioning. Most research utilised humanoid robots which display human like body language and emotional expressions to establish an immersive and close interaction with older adults during cognitive interventions.<sup>12</sup>

#### **Benefits of technology-based cognitive interventions**

In comparison to conservative interventions, rehabilitation based on technology has an additional advantage of increased motivation and real time feedback. Different systematic reviews and meta-analysis have reported the positive effects of interventions-based technology in improving cognitive functions including memory attention, visuospatial ability, processing speed and executive function in elderly population.<sup>12</sup>

#### **Challenges in applying technologies**

Technology based dependency is an issue that is faced by the elderly population. VR creates a virtual real time environment and robots can now imitate human interactions by expressing human emotions, displaying appropriate body language, and showing empathy to the user. This might make elders confused about real and virtual environment and reluctant to participate in real societal activities. Thus, regular follow up between real and virtual environment is necessary for successful transition between the two.

Secondly, it is challenging for caregivers and practitioners to accept replacement of human caregivers to robotic companionship. There should be a proper communication of effectiveness of this replacement by developing a sound cooperation between researchers, practitioners, developers, elderly population and their families for proper development of this field.

Finally, it is sometimes difficult for elderly to use technology for their rehabilitation by themselves. The companies designing such technologies should focus on creating more user friendly elements, such as big font sizes, understandable designs, and timely feedback.<sup>12</sup>

#### **Barriers for cognitive training**

Even though CR shows significant beneficial effects in improving quality of life, till date it is not readily available. It can be due to multiple reasons including timely identification of cognitive impairment followed by proper intervention, which is still not considered a priority by health care professionals as well as lack of funding to support this process. Another important barrier is that many clinics lack proper resources for targeting the unique requirement of CR, resulting in a gap between research and clinical practice.<sup>13</sup>

#### **Cognitive Rehabilitation in Pakistan**

Cognitive rehabilitation plays a vital role in addressing cognitive deficits and promoting functional independence and quality of life for individuals with cognitive impairments. In Pakistan, Elderly population is usually neglected with reference to health which often results in

isolation and cognitive impairments.<sup>14</sup> This along with various factors such as traumatic brain injuries, stroke, neurodegenerative diseases, and mental health conditions, can have huge impact on cognition due to which the importance of cognitive rehabilitation cannot be overstated.

Numerous studies underscore the significance of cognitive rehabilitation in enhancing cognitive functioning, improving daily functionality, and alleviating the burden associated with cognitive deficits.<sup>1,2</sup> It is crucial for health professionals in Pakistan to be aware of evidence-based approaches that can be implemented to promote and improve Cognition in elderly.

Incorporating technological interventions is another promising avenue for promoting and advancing cognitive rehabilitation in Pakistan. Leveraging mobile applications, virtual reality platforms, and telehealth services can facilitate the remote delivery of cognitive rehabilitation interventions, effectively reaching individuals in even the most remote areas and significantly improving access to healthcare.<sup>15</sup>

## Conclusion

Cognitive rehabilitation holds great promise in enriching cognitive functioning and enhancing the lives of elderly individuals with cognitive impairments. By adopting a comprehensive and individualised approach that encompasses cognitive training, environmental adaptations, and psychosocial support, cognitive rehabilitation can effectively bridge the gap between research and clinical practice, yielding improved cognitive outcomes and heightened well-being for the elderly population. By incorporating evidence-based methodologies, such as cognitive training, compensatory strategies, environmental modifications, psychoeducation, collaborative multidisciplinary care, and leveraging technological advancements; healthcare professionals can actively promote and enhance cognitive rehabilitation, ultimately leading to enhanced functioning, independence, and overall quality of life for individuals in Pakistan.

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