



Role of Non-Pharmacological Cognition Building Techniques in Delayed Progression of Alzheimer's Disease: A Matter of Blood-Brain Barrier Dysfunction

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Abstract

Cognitive rehabilitation treatments for Alzheimer's disease and early-stage dementia are increasingly accessible to older adults and aim to slow the progressive decline in functional performance and cognitive abilities associated with ageing. Alzheimer's disease may involve disruption of affected brain systems, impaired self-awareness, general difficulties performing daily activities, reduced motivation, despondency and lethargy. These symptoms may result directly from the disease or may be associated with depressive episodes. Cognitive rehabilitation exercise programmes are labour-intensive and rely heavily on repetition to reinforce memory, particularly because patients must repeatedly confront their memory impairments and the consequences associated with them. Therefore, patients must be adequately committed and motivated both to begin a rehabilitation programme and to remain engaged throughout the intervention. Achieving an appropriate treatment dosage is also essential for cognitive rehabilitation techniques to be effective. This review investigated the efficacy and effects of cognitive training and cognitive rehabilitation interventions in patients in the early stages of Alzheimer's disease or vascular dementia. The aim of the current study was to improve memory and other aspects of cognitive functioning in individuals with early-stage dementia and Alzheimer's disease.

Key words: Alzheimer disease; Therapy; Dementia; Education; Orientation; Cognitive therapy; Blood-brain barrier.

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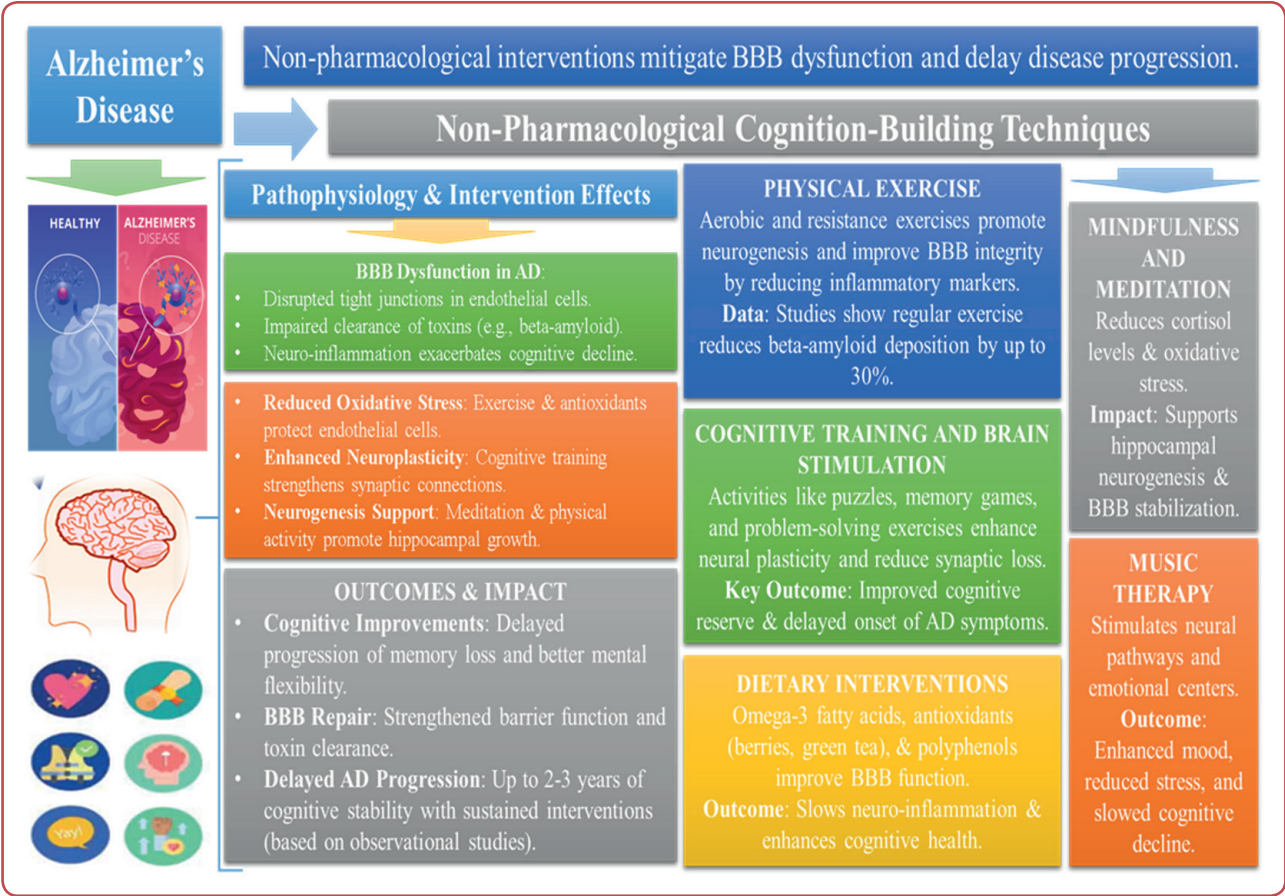
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Graphical abstract

Introduction

The term dementia refers to a collection of neurodegenerative diseases that typically manifest themselves later in life and worsen over time.¹ The World Alzheimer Report 2025 highlights the critical global impact of dementia, with 55 million people currently affected and 75 % of cases remaining undiagnosed. The number of people diagnosed with dementia increases more than doubles every 6.3 years, going from 3.9 per thousand people (aged 60 to 64) to 104.8 per thousand people per year (aged 90 and older).² Differences in incidence and prevalence rates among countries and generations are linked to alterations in lifestyle, which are directly related to the health status and life expectancy of a person.³ Monitoring the incidence of dementia poses a number of difficult challenges. Due to the diagnostic process, which includes neuropsychological evaluation, interviews and observation and is guided by changing diagnostic criteria, it is difficult to smoothly evaluate the results collected from different regions and across a variety of studies.⁴ There are

many conditions that can lead to dementia, such as Alzheimer's disease (AD) which is the prevalent reason for causing dementia, taking account for roughly 62 % of patients and those accompanied by vascular dementia is 17 % and a combination of both AD and vascular dementia accounting for remaining 10 percent of cases. Parkinsonian dementia, behavioural and semantic variants of fronto-temporal dementia are examples of less common types of dementia (2 %).⁵

The interface b/w blood and brain are known as blood-brain barrier (BBB) and it is both dynamic and selective. The specialised endothelial cells of the brain's microcirculation are responsible for its formation. These cells are accompanied on their journey through the brain by perivascular cells, pericytes, glial cells and neurons. This helps to keep the brain in a microenvironment that is properly maintained.^{6,7} BBB is an important component of the neurological processes in the brain that are accountable for perceptual activity, motor activity and cognitive activities. This is a connection that may be traced back to couplings in the neurovascular system, the neurometabolic

system and neuro barrier system.⁸ Alterations to the brain's structure and function are common in both ageing and AD. Sensitive neuroimaging techniques have revealed that ageing causes a decrease in microvascular density, a lack of pericytes and a loss in global and local parameters of cerebral blood flow.⁹ Through an increase in BBB permeability with albumin and IgG leakage that contributes to pathological abnormalities and the functions of BBB gradually deteriorate over time (eg white matter lesions).¹⁰ Memory loss and a decrease in learning ability were found to be connected with an increased generation of reactive oxygen species (ROS) and proinflammatory cytokines (such as TNF- α) in endothelial cells¹¹ of the brain which can be treated with the help of cognitive therapy. There are some studies reported that cognitive stimulation improved blood-brain barrier function, reduces amyloid-beta deposition in brain and also reduces inflammation in brain,^{12, 13} which thus decreases the severity of AD.

Severity of cognitive impairment was found to have a linear correlation with the increased risk of mortality, which was 2.3 times higher for older people who had dementia. Another study came to similar conclusion, that patients with poststroke

dementia had a mortality rate that was 2.65 times higher than that of stroke survivors who did not suffer from cognitive dysfunction.^{14, 15} Cognitive evaluations at the bedside, relatively short constructed equipment for cognitive evaluation and comprehensive neuropsychological evaluations are all viable options for conducting direct evaluations of patients' cognitive abilities (more helpful for patients with earlier stages of dementia).^{16, 17} Although different types of dementia in their early to moderate stages each have their own distinct profile of cognitive changes, which can be demonstrated through neuropsychological testing, as dementia becomes more advanced, these differences become less clear.¹⁸ In the early, moderate stages of dementia, cognitive deficits are often most disabling and painful aspects of person with dementia and their loved ones.¹⁹

American Psychiatric Association (APA) says that there are four distinct categories of non-pharmacological therapies that can be used for the management of dementia. These categories are as follows: (1) cognitively focused therapeutic approaches (a few examples include: reality orientation and skills training), (2) therapies that focus on emotions (such as supportive therapy

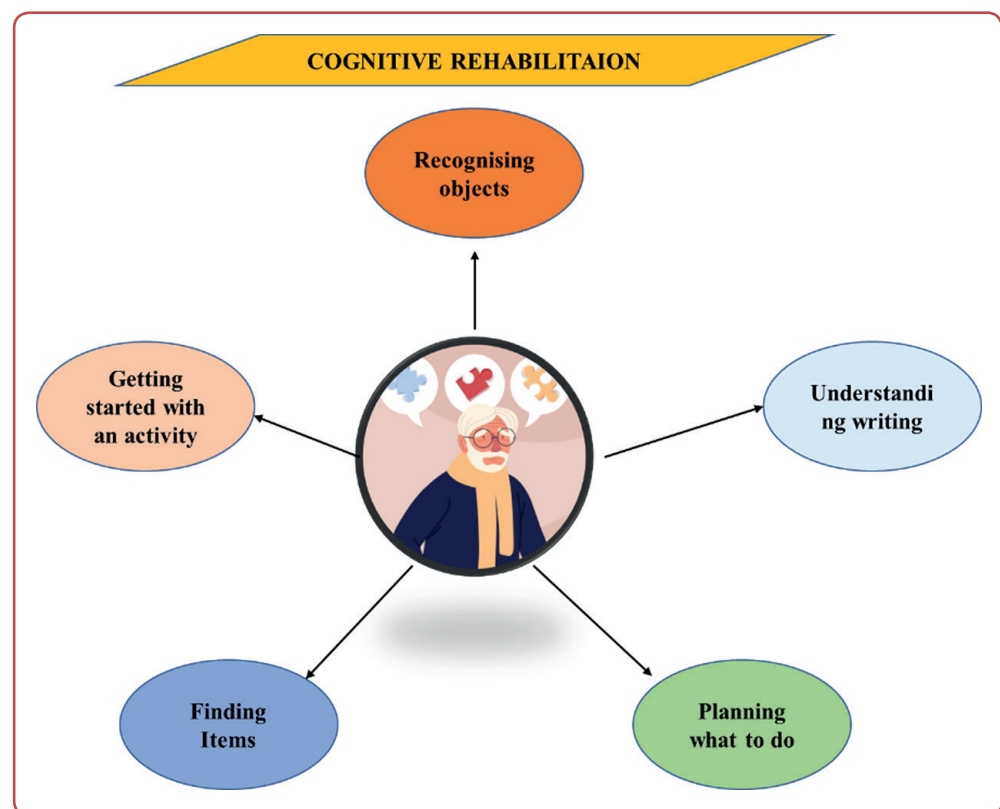


Figure 1: Cognitive rehabilitation

and integrated emotion-oriented), (3) treatments focused on characteristics or behaviour and (4) treatment methods that focus on stimulation (eg art therapy, music therapy, psychomotor therapy).¹⁶ Therefore, enhancing the cognitive functioning of individuals with dementia can delay need for hospitalisation, thereby lowering the costs of national health care while also improving the well-being of patients (Figure 1).²⁰ Treatments that take a cognitive approach are aimed at restoring cognitive function, the aspect of dementia that is both the most common and the most significant for patients.²¹ Cognitive therapy is primarily theory-based; it employs specific exercises aimed at improving one's cognitive functioning in attempt to optimise one's wellbeing and quality of life in daily life²² and it has become an increasingly popular method for treating a variety of dementia-related symptoms.²³ The prevailing review will concentrate on current scientific data on cognition-oriented strategies for guiding individuals with dementia and will conduct a comprehensive overview of findings of studies that tested effectiveness of these treatments.²⁴

An examination of the behavioural and mental symptoms of dementia

The majority of people who have dementia, at some point during the course of illness, exhibit some sort of behavioural or psychological symptom. Behavioural and psychological symptoms of dementia, also known as BPSD, are considered by plenty of dementia patients to be more discomforting than the cognitive decline that is associated with the disease.²⁵ Other behaviour problems that are usually observed in individuals with dementia include agitation, aggression, hallucinations and sleep disturbances.²⁶ To properly manage BPSD, one must have a comprehensive understanding of the condition. The collection of in-depth clinical information on both the patient and the caregiver is a necessary component of the assessment of BPSD.^{27, 28}

Methods

To conduct the literature review, electronic databases such as *PubMed*, *Scopus* and *Google Scholar* were searched, with the results limited to articles published in English up to the year 2023. The literature search was carried out using the following keywords combined with Boolean operators:

"AD OR Alzheimer's disease OR Neurodegenerative disorders OR Neurodegenerative diseases OR NDD" AND "Non-pharmacological AND Cognition building OR Cognitive rehabilitation OR Cognitive rehab AND Cognitive therapies OR Cognitive interventions OR Cognitive techniques." These terms were applied while searching the titles, abstracts and keywords of the articles. Effective non-drug cognitive therapies for AD were researched and the most promising were chosen from the search results. Articles meeting the following criteria were considered for inclusion criteria: studies that report the use of cognitive therapies other than medication for the treatment of AD. In this review, however, it was sought to incorporate non-pharmacological strategies for enhancing cognition that have been shown to slow the onset of AD.

Discussion

Examination of activities involved in everyday life

People suffering from dementia have a diminished capacity to perform self-directed and arduous tasks involved in living one's daily life, such as managing, finances, driving, medication and cooking responsibilities.²⁹ When a person's dementia has proceeded to a moderate or extreme phase, they may have trouble performing even the most fundamental tasks of activities essential to daily life, like feeding and getting dressed, moving around and performing their bathroom activities.^{29, 30} Some examples include the Everyday Abilities Scale for India, the Barthel Index and the Independent Activities of Daily Living Scale mentioned in the Table 1.³¹

Evaluation of patient's individual qualities and characteristics

A strategy known as "person-centred care" was a kind of approach that should ideally be used in the management of dementia patients in a clinical setting. There is a chance of active interaction on the part of the patient with dementia, despite the severe cognitive impairment that they are experiencing.³² Evaluation of the patient's individual qualities and characteristics is shown in Figure 2. Acknowledging the patient's individual prejudices, including preferences both positive and negative as well as life experiences, the characteristics of the work, unique interests and hobbies

Table 1: Fundamental evaluations related to dementia

Fundamental evaluations about dementia
The evaluation of dementia has been verified
Characterisation of factors that may be modifiable in the future
A comprehension of the cognitive domains that are primarily impacted and those that are relatively relieved
The severity of cognitive impairment
Symptoms of behaviour and mental health conditions
Impairment in the functional aspects of daily living activities
Impairment in one's ability to perform the essential tasks of life daily

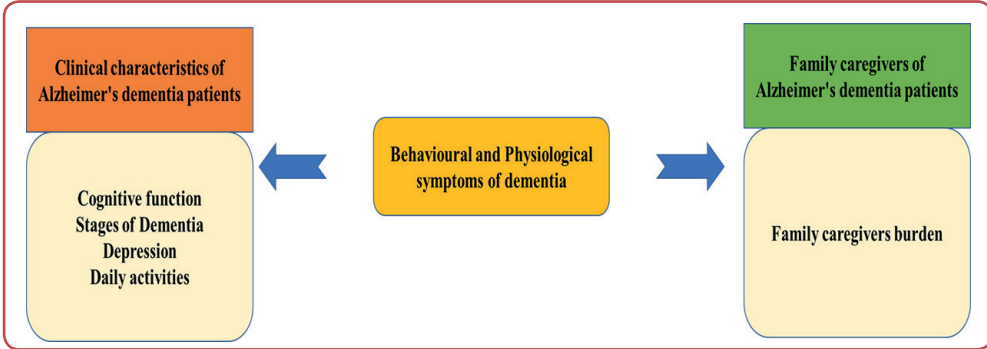


Figure 2: Evaluation of the patient's individual qualities and characteristics

Table 2: Personal evaluations regarding to dementia

Personal evaluations about dementia
The impact was primarily felt in the cognitive domains are relatively untouched
Possibility of having direct interaction with the patient cooperation about the implementation of therapeutic measures
Impairment of the senses (hearing and vision)
Complications of existing medical conditions that may impede the effectiveness of treatment (unstable angina, severe bronchial asthma, etc)

and significant activities in younger years should be the primary focus of the assessment as represented in Table 2.^{33,34}

The need for assessments and evaluations of treatment plans in dementia

Patients suffering from dementia require extensive evaluations and assessments in order to facilitate appropriate management. The Clinical Practice Guidelines for Dementia, 2018 from the Indian Psychiatric Society provides thorough protocols for evaluating patients with a dementia diagnosis.¹⁷ In brief, the purpose of evaluation and assessment is to confirm the diagnosis of dementia, identify any potentially treatable causes and determine the extent of impairment in cognitive function, behaviour and activities of daily

living. Comorbidities that need to be treated in terms of both medical and mental health should also be identified during the assessment. It is necessary to conduct an evaluation of the requirements of the patient as given in Table 3.³⁵

Role of exercise and motor rehabilitation in vascular dementia and AD

A healthy lifestyle has been shown to decrease the danger of developing CVD, osteoporosis, DM and depression, according to an increasing body of research. Multiple prospective cohort studies have found that regular exercise improves cognitive function, reduces risk of AD, dementia and slows the progression of these diseases in their participants.³⁶ A recent research conducted at the Mayo Clinic on 280 patients with mild cognitive

Table 3: Preparatory evaluations

Preparatory evaluations for cognitive therapy in patients diagnosed with dementia
Information crucial to the patient's profile is included in this section
The preferences of the patient, both positive and negative
Personal interests and unique abilities
Information regarding significant occurrences and experiences throughout the patient's life
Compilation of materials that will prove helpful in the development of individualised therapeutic interventions (relevant photographs, videos, etc)
Willingness and the ability to carry out an intervention as a group
Access to computers and other technology-assisted interventions, as well as a familiarity and comfort level with using those technologies
Observations and reactions to previous instances of similar interventions

impairment found that physical activity of a moderate intensity during midlife was markedly linked to a lower risk of having an occurrence of dementia and delay in the progression of AD.^{37, 38} It has been hypothesised that regular exercise can progress vascular well-being by lowering BP, arterial stiffness, oxidative stress and inflammation throughout the body, as well as by enhancing endothelial dysfunction.³⁹⁻⁴¹ All of these factors are related with improved cerebral perfusion. In addition to protecting neurons, regular exercise has been shown to boost neurogenesis, synaptogenesis and neuronal plasticity by following the brain-derived neurotrophic factor or neurotrophins depicted in Figure 3.⁴²

Cognitive therapy

Since cognitive decline is defining the characteristic of dementia, treatments that aim to improve and sustain cognitive function are regarded as an integral part in the management of dementia.^{43, 44} The effectiveness of cognitive interventions in enhancing patients' existing cognitive abilities when treating dementia has been the subject of a wide range of randomised controlled trials displayed in Figure 4.⁴⁵ Patients who participated in these studies might have noteworthy differences in the phase of dementia they were experiencing, the associated comorbidities they were dealing with and the background characteristics of their lives.^{46, 47} Unlike developed countries, only a very

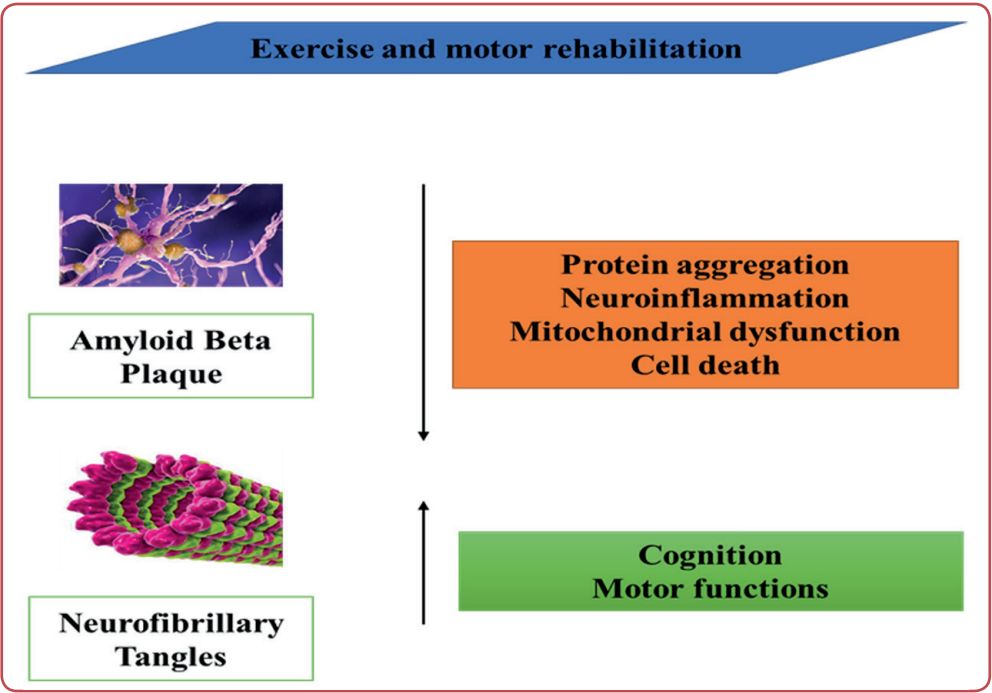


Figure 3: Role of exercise in enhancing motor functions

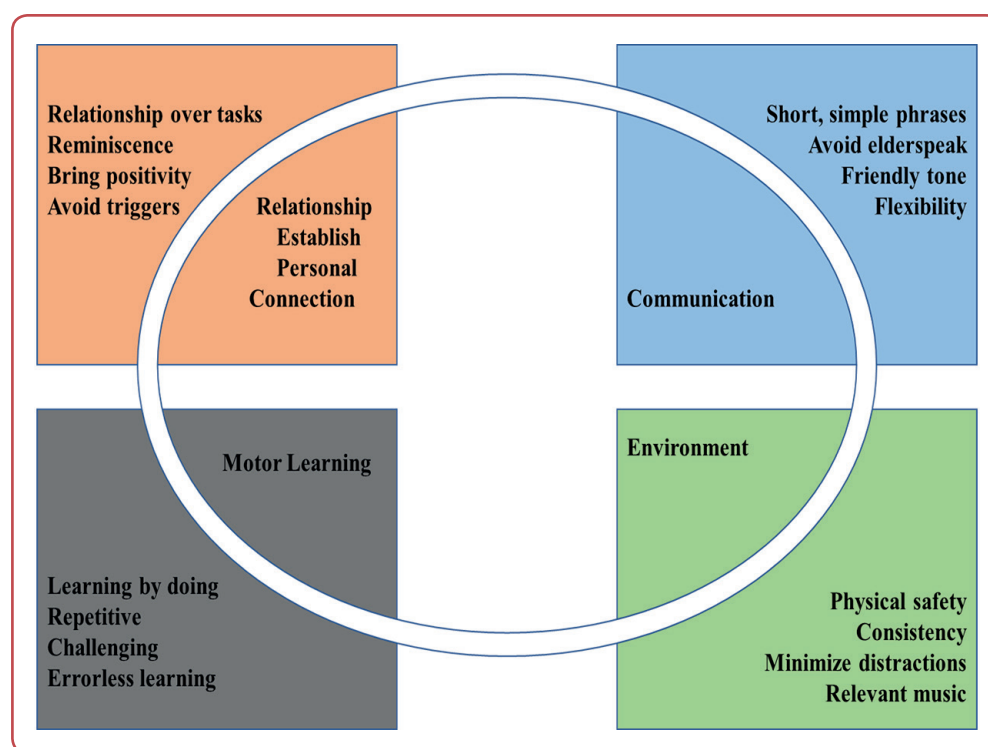


Figure 4: Cognitive therapy

small proportion of dementia patients in India have access to institutional care facilities.⁴⁸ On the other hand, the current body of evidence supporting efficacy of these interventions when used individually as therapy is extremely scant.⁴⁹ It is recommended to carry out preparatory assessments which are mentioned in Table 3 in order to make it easier to put cognitive therapy into practice effectively with patients who have dementia.

Cognitive intervention

Cognitive interventions are presently non-invasive psychological techniques (NPTs) that are successfully investigated in dementia and AD. It describes the most acceptable alternative to

pharmacological treatment or works in conjunction with it and is the NPT that has received the most attention in recent years. Typical sub-types of cognitive intervention include cognitive stimulation (CS), cognitive rehabilitation (CR) and cognitive training (CT).⁵⁰ The term cognitive stimulation (CS) indicates a wide variety of activities that are designed to improve an individual's general cognitive and social functioning. The literature on cognitive interventions is a little confusing, even though the differences between CT, CS and CR are crystal clear.^{51, 52} However, preliminary findings suggest that CS can improve the standard of living and overall well-being of people with AD and dementia given in Table 4.

Table 4: Cognitive intervention studies

SN	Therapy	Session	Results	Ref.
1	Cognitive skills remediation.	30-40-minute sessions; 3 times a week for 6 weeks	Recall of digits is improved.	[53]
2	Computerised memory, perceptual and motor skill training.	48: Weekly; 60-minute sessions	Brain and cognitive activation improved.	[54]
3	Therapist visits once a week along with caregiver-assisted cognitive training focusing on memory, problem-solving and conversational fluency.	72: Weekly; 60-minute activities	Cognitive decline and behavioural scores were maintained.	[55]
4	Language, executive and memory training.	12 weeks of 24-45-minute sessions	Cognitive and non-cognitive results improved.	[56]

5	Cognitive training for memory, problem-solving and conversational proficiency by the caregiver with therapist assistance.	40 sessions of 60 minutes; for 8 weeks	Improved composite cognition scores (delayed memory and verbal fluency). Patients' caregivers reported decreased depression symptoms.	[57]
6	Face recognition and name recall training.	5x60-minute sessions	Enhanced training tasks.	[58]
7	The course material covered techniques like spaced retrieval, face-name recall, verbal elaboration, concentration/overt repetition, the use of memory aides and coping techniques.	5–6 60-minute sessions	Trends favoured.	[59]
8	Cognitive training for word-list recall and recognition.	6 weeks of 45-minute sessions	Retained cognitive function.	[60]
9	Brain exercises for learning to recognise people, following directions, paying attention in class, remembering phone numbers and managing finances.	12-16-year-olds: 24 45-minute sessions	Enhanced performance of cognitive function.	[61]
10	Cognitive domain-specific computerised training.	12x60-minute sessions, 3x/week	Constant cognitive function.	[62]
11	Cognitive training for everyday mnemonic and vocational performance.	8x60-minute sessions	No changes between individual cognitive training groups.	[63]
12	Patient-driven cognitive rehabilitation.	8x60-minute sessions	Increased brain activation and improved goal performance and pleasure.	[64]

Non-pharmacological methods for the management of behavioural and psychological indications of dementia or AD BPSD are the leading cause of hospitalisation and prescription of medications for dementia management. These symptoms also contribute to higher healthcare costs, reduced quality of life

and greater disability for patients.⁶⁵ The setting in which interventions are delivered is an important consideration, as it can influence both the treatment objectives and the outcomes.^{53, 54} Some of the non-pharmacological therapies for dementia and AD are given in the Figure 5 and Table 5.

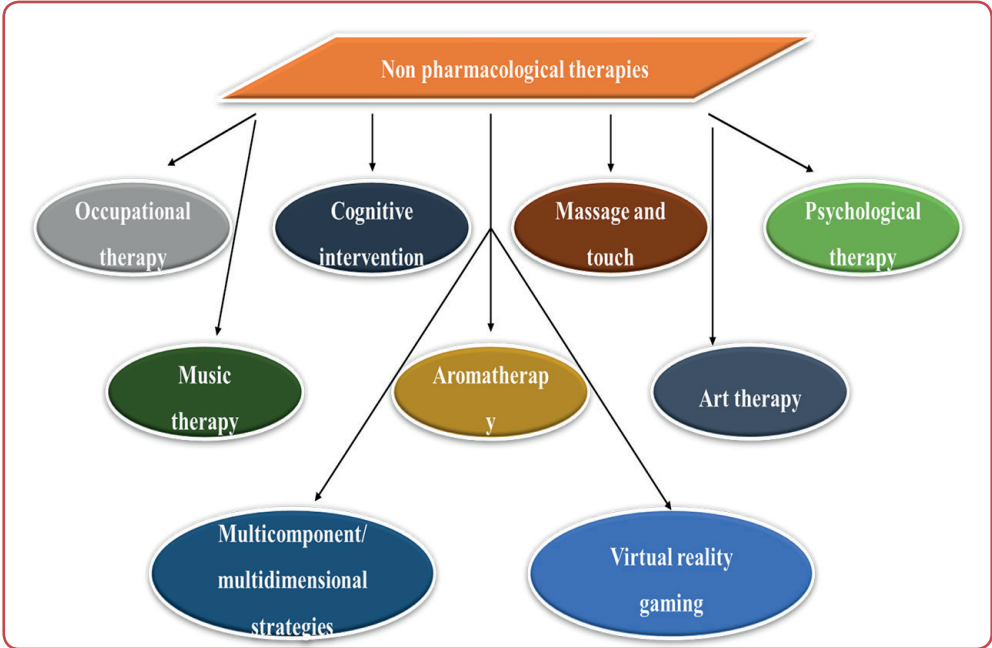


Figure 5: Non-pharmacological therapies

Table 5: Scientific proofs of non-pharmacological studies

Therapies	Subclass	Scientific	Major beneficial	Restrictions	Ref.
Physical therapy through movement and exercise		Moderate	Reduced incidence of BPSD, enhanced performance in ADL.	Scant evidence for learning and memory, QoL, distress, morbidity and caregiver burden. Few qualitative studies examine the best exercise intervention. Few comparison studies on exercise interventions.	[66]
	CS	Moderate	Improved overall cognitive abilities. Minimal impact on patient and caregiver attitude and QoL.	Uncertain long-term cognition impact, Variability of results.	[67]
	CT	Minor	Improvement in trained and comparable activities.	Insufficient daily function applicability, Low-quality research.	[68]
Cognitive intervention	CS+CT	Minor	Cognitive enhancement.	Treatment and dementia degree heterogeneity, Limited high-quality RCTs.	[69]
	CST	Moderate	Developments in overall cognitive performance and specific cognitive areas, Low impact on QoL, Enhancement of caring relationship, small effect on caregiver depressed indicators and QoL.	BPSD and ADL unclear effect.	[70]
Occupational therapy		Minor	ADL, social involvement. BPSD, depression reduction. Caregiver relief.	Uncertain optimum period, long-term influence Combinations. Insufficient high-quality RCTs.	[71]
Psychological therapy		Minor	Reduce depression, anxiety and apathy. Improve patient well-being.	No psychological Therapy comparisons few high-quality RCTs.	[72]
Multicomponent/multidimensional strategies		Minor	Reduced BPSD, improved cognition, delayed institutionalisation and caregiver burden.	Persistence, generalisation to daily life, limited implementation and diffusion and very few high-quality RCTs.	[73]
Aromatherapy		Minor	Reduced BPSD and sleep disruptions; Improved motivation.	Poor methodology; Few good RCTs.	[74]
Music therapy		Minor	Depression reduction, Improved communication and social engagement, relations and cognition.	Small sample size, low-quality research.	[75]
Art therapy		Very small	Reduced BPSD, improved concentration, social behaviour and self-esteem.	No RCTs, uncertain long-term effect.	[76]
Massage and touch		Very small	Reduce BPSD, affect mood, relaxation, hunger.	Small number of participants. Poor research.	[77, 78]
Virtual reality gaming			Improve both physical and cognitive function Improve balance, memory, attention, visuospatial abilities.	Small sample size.	[79]

BPSD: Behavioural and psychological symptoms of dementia; ADL: activities of daily living therapy; RCT: randomised controlled trial; CST: cognitive stimulation therapy;

Occupational therapy

Patients with dementia experience a decline in their ability to participate in occupations as the disease progresses. These occupations primarily include ADL, IADL, leisure and social activities. This decline has a negative influence on both the patients' quality of life.^{80, 81} According to the findings of a review that included seven randomised

controlled trials (RCTs), occupational therapy (OT) interventions may be able to maintain physical function and ADL in community-dwelling individuals with dementia.⁸² Multiple dementia management guidelines include occupational therapy among their recommended strategies.⁸³ These guidelines and principles were built on the most recent and highest-quality evidence available.⁸⁴

Psychological therapy

According to the WHO, the primary psychotherapeutic strategies that have supportive counselling and proof of efficacy in preventing depression and anxiety in adults are cognitive behavioural therapy and psychological therapy (also known as Rogersian person-centred therapy). Recent research on the efficacy of psychological interventions for depression in dementia or MCI found that adding psychological therapy to standard care for people with AD or mild cognitive impairment improved the symptoms of depression and anxiety.⁸⁵ Methods from a wide range of fields of study were used to inform the many psychological strategies offered.⁸⁶ In addition, patients with dementia who were in their early stages were the focus of the majority of studies.⁸⁷

Strategies with multiple components and different dimensions

The multidimensional protocols of treatment that have been proposed combine various methods of treatment and may be the most effective intervention to progress a variety of outcomes in AD.^{88, 89} A recent study using functional magnetic resonance imaging (fMRI) provided evidence that the positive effects of MST are caused by a mechanism that involves the restoration of neural functioning.⁷³

Similarly, Meeting Centres Support Program (MCSP) was implemented in the Netherlands. This program is intended for dementia patients with mild to moderate symptoms. The MCSP is

grounded on an amalgamation of psychomotor therapy and recreational events for patients, psychoeducational and support groups, social activities for patients and regular centre meetings.^{90, 91}

Complementary and alternative medicine

Here, research on the most popularly used complementary and alternative medicine (CAM) practices, such as aromatherapy, massage, music therapy, touch therapy and virtual reality-based interventions is reviewed. These non-invasive psychological techniques (NPTs) are considered to be a subset of the broader category of sensorial stimulation techniques, which aim to activate and engage the patients' sensory experiences.⁹²

New technologies

Several studies have been conducted in recent years that investigate the role emerging technologies play in dementia as a consequence of their accessibility, their widespread adoption and, for some of them, their relatively low cost. In this section, a concise summary of evidence concerning use of virtual reality and telemedicine, information and communication technologies (ICTs) and assistive devices in monitoring and treatment of patients who have dementias is shown (Figure 6).

ICT, assistive devices and domotics

ICT advancements in robotics, computing, miniaturisation of sensors, technologies and cost reduction have accelerated the development of environments with embedded technology and intelligent devices to improve the normal lives of

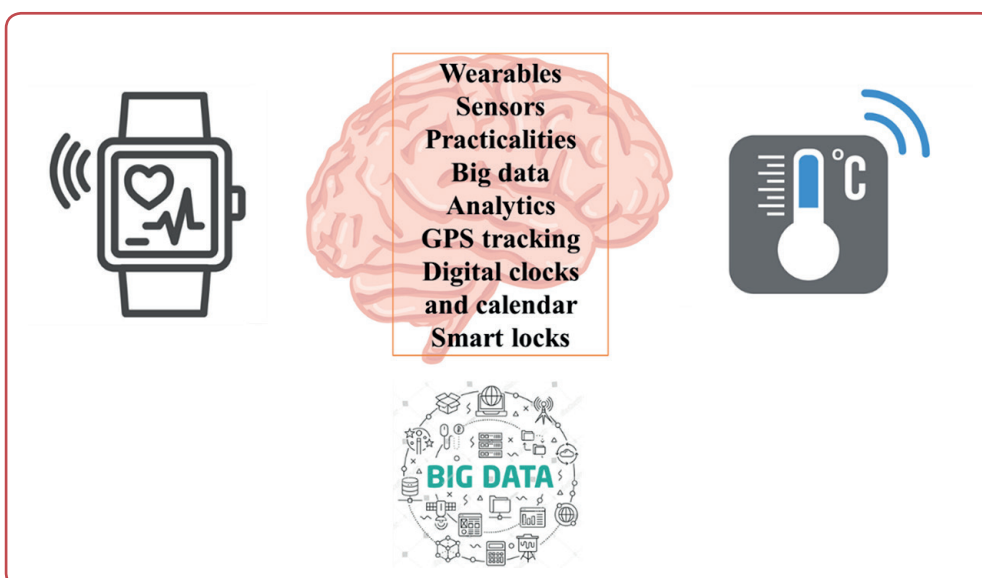


Figure 6: New technologies in cognitive therapy

patients and protectors as well as to assess the severity and course of the disease.⁹³ In particular, ICT allows for constant monitoring of patients' activities, responses in real-time and natural environments.⁹⁴ It is considered as a significant ADL achievement to be able to move freely outside, as this is connected with the ability to sustain independence and participate.⁹⁵ Therefore, the most successfully processed ICT research in dementia as in tracking technologies.^{96, 97} In addition to cameras and microphones, floor sensors and motion sensors, have been used in non-wearable systems to achieve this goal.⁹⁸ Similarly, a shole insole that emits vibrations may lower the risk of falling while improve both gait and balance.^{99, 100} Domotics is another interesting aspect of research because approximately 3/4 of people are be interested for in the comfort of their homes and creates a link between surroundings of the home and consequences related to disability.^{101, 102}

One of primary enabling features of a smart home is capability to track individuals' ADLs, ensure their security and spot variations in their daily routines. All of these sensors work together to analyse the data they collect to conclude the home's state and the habits of its inhabitants.^{103, 104} However, partial absence of clinical validation and a lack of attention to patient needs are two structural barriers to successful adoption.¹⁰⁵

Telemedicine

The availability and quality of healthcare are two areas where technological progress has opened up new avenues for involvement. Dementia is a chronic disorder with challenges connected to continued long-term care and limited access to medical services; therefore, telemedicine may be an efficient technique to deliver diagnosis and therapy to dementia patients in the comfort of their own homes.¹⁰⁶ This is because dementia is a disease that affects the brain. This can also improve their clinical outcomes, safety and reduce access to healthcare services.¹⁰⁷ However, because the data are still in their infancy, there is no general agreement on the procedures that should be followed when conducting neuropsychological evaluations via tele-medicine as depicted in Figure 7.^{108, 109}

Due to the limited efficacy of pharmaceutical medicines and their potentially fatal side effects, the proper management of people with AD and

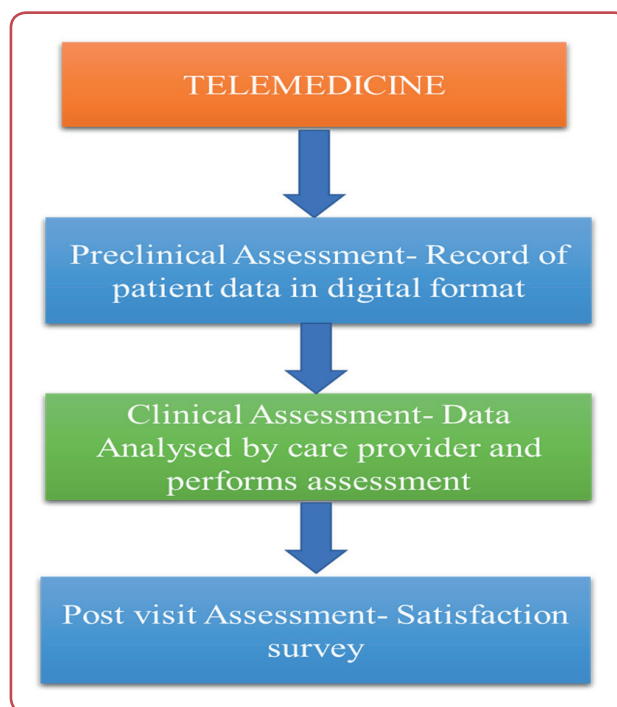


Figure 7: Role of telemedicine in assessment of early neurodegeneration

dementia is a critical public health concern. Development of an NPT that is helpful for these situations is of the utmost importance and many potential interventions have been proposed. The interventions that were researched for this article present varying degrees of evidence of their effectiveness on a variety of outcomes, which are summarised in Table 5. Few of these are plagued by methodological issues that are typical of non-pharmacological investigations, which are focused on practice. These issues are shared by all of the studies. There are certain difficulties when applying the standard pharmaceutical RCT methodology to the contexts of rehabilitation and NPT, thus, it would be beneficial to design unique studies for these conditions. In addition, investigations on the cost-effectiveness of NPT treatment for dementia and AD are required in order to better understand its role in these conditions.

Because vascular impairments can play a role at specific stages in progression of disease but before that, it is essential to study the conditions of the BBB permeability as well as its vascular pathology. Cognitive impairment that may be associated with AD and other forms of dementia have been related to BBB disintegration, as have problems with synapses and neurons (AD).

Conclusion

In conclusion, cognitive remediation for AD needs to take into account all aspects of neuropsychological deficiencies in context of behaviour and social functioning. It is especially challenging to get patients with AD to participate in cognitive enhancement therapies due to progressive nature of disease. Lack of insight, depression, hopelessness and beliefs of defeat are some of the specific obstacles that must be overcome before treatment can be successful. The future of AD cognitive remediation lies not only in the development of effective training paradigms based on neuroscience but also in the investigation of how such treatments can be implemented within context of the enormous psychological toll that dementia diagnosis imposes. Future of CR therapies appears bright, but the therapy needs to be made more widely available to individuals who would benefit from it. Treatment adherence is impacted by AD and it appears that the effectiveness of CR is tied to the creation of novel means of treatment engagement. This stands true despite the intervention might result in some functioning improvement. There is reason for optimism regarding CR treatments; however, the therapy must become more accessible to those who need it. The success of CR appears to be intertwined with the development of new methods of treatment engagement as well as strategies to target the distinctive challenges posed by AD, which affect adherence. These strategies are derived from those that have been discussed in this article and have shown initial efficacy. As a result, more studies have to be explored to show which psychological interventions may result in improved outcomes and to pinpoint common elements among various strategies that can improve the well-being of dementia patients.

Ethics

This study was a secondary analysis based on currently existing data and did not directly involve with human participants or experimental animals. Therefore, the ethics approval was not required in this paper.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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Data access

The data that support the findings of this study are available from the corresponding author upon reasonable individual request.

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