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Strategies for Cognitive Impairment Prevention

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Abstract

With the ageing of the population, the prevention and treatment of cognitive impairment in the elderly have become increasingly important. This article reviews and evaluates the most recent research on therapies that may be useful in preventing cognitive impairment. Specifically, we address tactics that aim to address modifiable risk factors that may act prior to the onset of the disease. The cognitive reserve of healthy individuals can be enhanced, leading to a delay in the onset of neuropathological changes linked to dementia. Early preventative techniques include managing major depressive disorder (MDD), improving vascular risk factors including hypertension and diabetes mellitus, and changing lifestyle factors like diet, exercise, and stress reduction.

Keywords: Cognitive decline; Dementia; Cognitive impairment; Alzheimer's disease; Modifiable risk factors

1 Introduction

According to the Ministry of Statistics and Programme Implementation (2019), there will be a significant increase in the number of senior people in India by the end of the following ten years (2021–2031), with their share growing at a rate of around 40.5% compared to the growth of the general population (8.4%). The aforementioned data unequivocally demonstrate the need of maintaining the general health of the senior population in India as well as globally. It is assumed that all degenerative conditions start slowly and worsen with time. There may then be a chance for secondary prevention if partial symptomatology is identified in its early stages. Mild Cognitive Impairment (MCI) is a term used to describe this early stage of dementia. In this article, we review strategies that focus on modifiable risk factors that may manifest prior to the onset of the disease, the enhancement of the cognitive reserve in individuals who are healthy and the postponement of the onset of neuropathological changes that are typical of dementia.

2 Review criteria

The aim of this article is to draw attention to and evaluate research on dementia prevention measures that show promise. Using the following search terms in combination, Pubmed, Google Scholar, PsycINFO. I used the following search terms to find the studies: dementia,

cognitive impairment, cognitive decline, Alzheimer's disease, diet, nutrition, exercise, physical activity, vascular risk, hypertension, diabetes mellitus, cognitive training, stress reduction, MDD, immunomodulators, and antidepressants. While all historical periods were covered, high calibre research published in the previous ten years—including human observation.

2.1 Prevalence of Cognitive impairment

- Cognitive impairment is more prevalent in the elderly and increases as the age progresses[1,2].

Table 1. Prevelance of cognitive impairment

Cognitive impairment	Prevalence
As per the studies done in India and Taiwan[3], prevalence of Cognitive impairment was found be.	• 22.2% • 18%
Prevalence of MCI among different age groups[4].	a. 6.7% for ages 60 to 64 b. 8.4% for ages 65 to 69 c. 10.1% for ages 70 to 74 d. 14.7% for ages 75 to 79 e. 25.3% for ages 80 to 84
Expected prevalence of severe cognitive impairment[5,6].	• 82 million in 2030 • 152 million by 2050
Alzheimer's and related disorders society of India report[7] estimated.	In 2020, 5.3 million Indians over 60 will suffer from dementia. This translates to one in every 27 Indians over 60 having dementia.

2.2 Stages of cognitive impairment

Cognitive impairment is divided into three stages as given below:

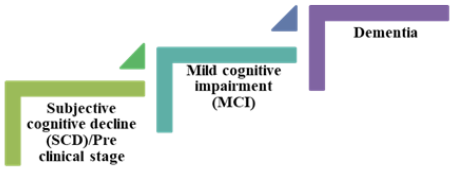

Fig 1. Stages of cognitive impairment

2.3 Causes of cognitive impairment

Numerous cross-sectional and longitudinal studies carried out in the western world have determined that aging is the main cause of cognitive impairment and decline[8,9]. Increasing age is the most important factor for cognitive impairment[10].

- **Causes of short-term or reversible cognitive impairment include**
  - **Infections e.g. UTI or pneumonia:** By impairing the brain's capacity to operate properly, infections can result in cognitive issues. Confusion, trouble focusing, or forgetfulness are typical cognitive symptoms brought on by illnesses.
  - **Dehydration:** Severe dehydration can result in death in extreme cases and confusion similar to dementia.
  - **Reactions to medications or anesthetics:** The most common drugs to cause cognitive problems are sedatives, hypnotics, antihypertensive medications, and arthritis medications. Once the issue with the medication is fixed, cognitive symptoms brought on by it go away[11].
- **Causes of long-term or permanent cognitive impairment include:**
  - **Psychiatric disorder such as major depressive disorder (MDD):** Numerous studies have discovered a link between a lifelong history of MDD and a higher likelihood of developing clinically diagnosed AD[12].
  - **Chronic substance abuse:** The risk of cognitive impairment is found to be significantly higher in older adults who smoke and drink[13]. Ever-smokers carry a 21% higher risk, compared to never-smokers[14].
  - **Head injury:** A history of traumatic brain injury has been found to positively correlated with an increased risk for developing cognitive impairment[15]. For example, After controlling for covariates, a 5-year follow-up study discovered that a traumatic brain injury could increase the risk of dementia by 1.7 times[16].
  - **Brain pathologies like Alzheimer disease (AD):** It is primary contributing factor for cognitive impairment in elderly is Alzheimer's disease i.e. 60-70% of cases[17,18]. Vascular cognitive impairment is present in varying degrees in up to two-thirds of stroke survivors in India (VCI), which includes milder forms of cognitive impairment brought on by cerebrovascular disease[19]. According to recent research, altering one's lifestyle and reducing vascular risk factors can cut the risk of dementia by up to 40%[20].
  - **Food intake:** A number of vitamins and micronutrient deficiencies also cause different forms of cognitive impairment, which frequently progresses to chronic illnesses like Alzheimer's[21]. According to a 2011–14 National Center for Health Statistics (USA) study, older adults' food insecurity is negatively correlated with their cognitive function, which increases their risk of cognitive impairment over time[8].

- **In childhood or adolescence:** autism, malnutrition, metabolic disorders, heavy metal poisoning, and side effects of cancer treatment[10].
- **Hypertension:** Numerous studies have shown that high blood pressure raises the risk of Alzheimer's disease, vascular dementia, and cognitive impairment[22].

2.4 Preventive Strategies for Cognitive Impairment

The prevention of dementia and cognitive deterioration is a significant public health concern. A multifaceted approach to dementia prevention is recommended by existing literature, including the World Alzheimer Report, due to the role that numerous risk factors play in the disease. A total of 48.4% of dementia cases can be attributed to a variety of modifiable lifestyle risk factors. Prevention of cognitive impairment can be encompassing under three levels.

2.4.1 ***Primary prevention***

The ability of individuals and populations to make healthier decisions can be enhanced by lowering their exposure to the modifiable risk factors (which can be started in childhood[23,24].

- **Prevention and early management of vascular disorders**

An increased risk of dementia in later life has been linked to midlife hypertension, hyperlipidemia, and diabetes. Changing one's lifestyle is the first step in treating hypertension. and the DASH diet, which stands for Dietary Approaches to Stop Hypertension, effectively treats hypertension with an impact size akin to that of medication monotherapy.

- **Prevention and early management of depression**

Depression is linked to noradrenergic alterations and white matter lesions. Depression also highlights underlying deficits by lowering motivation and bringing about its own cognitive deficits. Depression arises from awareness of impairment at an early stage of decline[25].

- **Promotion of cognitive stimulation activities**

In order to lower the risk of cognitive decline and/or dementia, the World Health Organization[26] conditionally suggests that older adults with normal cognition and mild cognitive impairment may be offered cognitive training. The Global Council on Brain Health (GCBH) has produced consensus recommendations that indicate formal or informal educational activities, as well as other cognitively stimulating activities throughout life, are beneficial to adult brain health[27].

- **Meditation:** According to the National Center for Complementary and Integrative Health, research shows that meditation can help the brain by slowing the aging process and increasing the speed of information processing.
- **Playing games:** According to a 2017 survey, a link between the decrease in the risk of games and the elderly's cognitive impairment was found[28].
- **Playing memory card games and practicing crossword puzzles:** Crosswords may delay the onset of memory decline in people with preclinical dementia.
- **Socializing:** According to a 2019 study, those who interact with others more frequently have lower rates of dementia and cognitive decline[29].
- **Learning new skills:** Learning a new skill uses your brain in different ways and improves its functioning.
- **Taking up engaging hobbies :** Engaging in activities that demand agility or precision will enhance an individual's motor abilities. Knitting, Embroidery, Dancing etc.
- **Eating balanced and nutritious diet**

According to WHO guidelines, a Mediterranean diet may help and is safe to follow in lowering the risk of dementia or cognitive decline. A variant known as the Mediterranean–DASH Intervention for Neurodegenerative Delay (MIND) integrates the DASH diet—Dietary Approaches to Stop Hypertension—which has demonstrated efficacy in reducing hypertension, a risk factor associated with Alzheimer's disease.

The anti-inflammatory and antioxidant qualities of certain nutrients that may be increased in the Mediterranean diet may shield the brain. Furthermore, better global cognition and episodic memory are linked to higher adherence among participants with normal cognitive abilities[30].

- **Maintaining adequate physical activity**

Enhancing fitness can improve cognitive functions, especially executive function, according to a meta-analysis of multiple aerobic exercise intervention studies[31].

For adults aged 18 to 64, the World Health Organization offers 150 minutes of moderate intensity or 75 minutes of energy intensity aerobic activity per week. Doubling the weekly duration of activity may also provide additional benefits. It is advised to engage in muscle-strengthening exercises two or more days per week.

- **Maintain adequate sleep**

According to studies, the brain's beta amyloid levels can rise after just one sleep-deprived night[32]. Another study also demonstrated an increase of tau in both sleep-deprived humans and rodents. Furthermore, ISF/CSF tau levels were regulated by the sleep-wake cycle[33].

- **Social engagement**

Participation in social activities is a significant indicator of lifelong well-being. On the other hand, it has been demonstrated that social disengagement increases the risk of dementia and cognitive impairment in older people[34]. A meta-analysis and systematic review of 51 longitudinal cohort studies examining social isolation and cognition comprised 102035 participants who were at least 50 years old at the beginning and followed up for a period of 2–21 years[35].

- **Prevention and early management of obesity**

It has been proposed that losing weight may improve a number of metabolic variables, such as glucose tolerance, that are connected to the aetiology of dementia and cognitive impairment, thus indirectly lowering the risk of dementia. Medication, behavioral interventions like exercise, food modification, and, if necessary, surgery, should all be part of the management plan.

- **Cessation of smoking**

Smoking doubles the risk of stroke in a dose-dependent manner, with a 12% increase in risk for every 5 extra cigarettes smoked each day. It affects the areas of the brain associated with memory, attention, and learning.

Even as you get older, quitting smoking lowers your risk. Among 50,000 men over 60, quitting smoking for more than four years, as opposed to continuing, significantly decreased the risk of dementia over the next eight years[36].

- **Cessation of excessive alcohol consumption**

Acetaldehyde, which is produced when alcohol is metabolized, directly causes neurotoxicity in the brain. Wernicke-Korsakoff syndrome can be brought on by thiamine deficiency brought on by prolonged alcohol consumption[37]. Severe consequence of alcoholism on cognitive functioning, referred to as "alcoholic Korsakoff's syndrome.

- **Attain high level of education**

A significant preventive factor against dementia and a crucial element of successful cognitive aging is educational attainment. In people with low or high educational attainment, more years of education were linked to a higher cognitive level and a slower rate of cognitive decline.

2.4.2 ***Secondary Prevention***

Preventing neurodegeneration, cognitive decline, and dementia is crucial because there are currently no treatments that modify the disease (or slow disease progression by targeting the underlying cause) for those with the condition.

There are four public health priorities for improving screening and diagnosis in secondary prevention[38]:

1. Information campaign on cognitive impairment and treatment methods, will make the general public sensitive to the advantages of early detection of population.
2. Teaching medical personnel the clinical characteristics of dementia in its early stages and the best approaches to interact with patients.
3. Healthcare professionals who do not specialize in dementia should act appropriately and promptly.
4. Creating a methodical procedure.

- **Early assessment and screening tools used for cognitive screening are [39]:**
- Mini-Mental State Examination (MMSE).
- Memory Impairment Screen
- General Practitioner Assessment of Cognition (GPCOG)
- Montreal Cognitive Assessment (MOCA)
- Mini-Cog
- Clock Drawing Test
- Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)
- AD8 (Aging and Dementia)
- **Neuropsychological assessment**

The goal of neuropsychological evaluations is to determine the degree and character of a patient's cognitive and behavioral deficits.

- **Laboratory test:** Lab tests are used to rule out causes of cognitive dysfunction that are reversible or treatable and to optimize levels of laboratory tests associated with cognitive health.
  - Blood levels of biomarkers connected to cognitive dysfunction causes that are treatable or reversible
  - Measurable micronutrient blood levels (e.g., Vitamin B12, Vitamin D, etc.)
- **Management includes**
  - **Pharmacological Treatment**
    - **Acetylcholinesterase inhibitors (AChEls):** donepezil, galantamine, rivastigmine: AChEls inhibit the breakdown of the neurotransmitter acetylcholine. Acetylcholine is a motor neurotransmitter that stimulates the muscles and helps with speed, short term memory and learning.
    - **N-methyl-D-aspartate (NMDA) antagonist:** Memantine functions as an NMDA receptor antagonist by inhibiting the activity of NMDA, a glutamate receptor and neurotransmitter responsible for controlling functions such as respiration, cognition, memory consolidation, and brain plasticity.

2.4.3 ***Tertiary Prevention***

Tertiary prevention strategies show the best results when initiated during the initial phases of Alzheimer's disease. Effective management of Alzheimer's disease necessitates clear communication among physicians, caregivers, and patients, as well as the use of behavioural techniques, caregiver assistance, and medication.

- **Various psychological therapies for the patient in rehabilitation phase includes**
  - **Cognitive stimulation therapy:** The basic tenet of CST is to provide enjoyable, patient-centered, and intellectually stimulating activities. The chosen exercises should have meaning for the patient and improve their language, logic, and memory. Both long-term care facilities and the community can use CST[40].
  - **Reminiscence therapy (RT):** It is also known as life review therapy. Reminiscence therapy uses tangible aids including pictures, sentimental objects from the past, music, and films to help patients remember former activities, experiences, and events.
  - **Validation therapy**: The fundamental idea of validation therapy is that people who are approaching the end of their lives may still be dealing with unresolved issues that influence their behavior and feelings. The goal of validation therapy is to assist the patient in addressing the feelings that underlie difficult behaviors.
  - **Music therapy:** It is used as a medicine to help dementia sufferers with their cognitive abilities. The intervention is built around singing and listening to music.
- **Caregiver support interventions**

Caregiver support interventions play a crucial role in tertiary prevention due to the rising rates of Alzheimer\'s morbidity and mortality, as well as the growing number of patients who pass away at home. This trend indicates an increasing number of Alzheimer's caregivers. It is essential to educate these caregivers on effective communication, maintaining emotional well-being, managing challenging behaviors, offering assistance with bathroom and bedroom tasks, and raising awareness among family members to prevent wandering behavior.

3 Conclusion

Alzheimer's disease and other forms of cognitive impairment pose a significant public health crisis, creating a substantial and rapidly expanding global, national, and regional burden that adversely affects patients, caregivers, families, the healthcare system, government, and society. Despite being historically viewed as issues related to aging or medical conditions, the prevalence of these conditions is expected to double by 2030 due to increased life expectancies and population aging. Collaboration between public health experts, healthcare professionals, policymakers, and non-governmental organizations is essential to implement a comprehensive approach encompassing primary, secondary, and tertiary prevention strategies to effectively tackle this public health emergency.

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