Review Article

Lifestyle and mild cognitive impairment in aged people: Inhibitory effect of modifiable lifestyle in the progression of impairment

Suramya Srivastava[1], Dhananjay Kumar[2]

[1]Research Scholar, Department of Psychology, Deen Dayal Upadhyay Gorakhpur University, Gorakhpur, U.P., India.
[2]Professor, Department of Psychology, Deen Dayal Upadhyay Gorakhpur University, Gorakhpur, U.P., India.
Corresponding author: Suramya Srivastava
Email – srivastava.suramya021@gmail.com

ABSTRACT

The process of aging usually accompanied with deterioration of physical and mental abilities resulting in gradual decline in cognitive function and increased risk of cognitive impairment. People experience age related dysfunctions, which is termed as Mild Cognitive Impairment. The values and attitudes exhibited as an impact of social, cultural, economic and environmental conditions and a set of health pertinent behaviour are collectively termed as Lifestyle. Modifiable lifestyle factors are those factors, which inhibit the progression of cognitive decline and can act as an aid to stabilize cognitive health and improve cognitive functioning. The present paper intends to review the inhibitory effect of modifiable lifestyle in cognitive impairment in aged people. An integrated review of literature of about 30 papers ranging from 2004 to 2020 performed from different sources namely Publish or Perish 7, Academia, Research Gate, PubMed, NIH-PA, Science Direct, PloS Medicine etc. Findings of the present review suggest that modifiable lifestyle factors, level of education, leisure activity, and appropriate sleep duration are some important factors that influence cognitive health in later life and reduces the risk of cognitive decline. Further, social isolation, depression, alcohol consumption, and smoking are some factors that act as risk factors and may enhance the progression of MCI. Professionals can intervene with elderly individuals or in a geriatric community by implementing some modifications in lifestyle that in turn may inhibit or delay the progression of cognitive decline. Geriatric health policy can be developed by policy makers considering the modifiable risk factors to manage the problem of cognitive impairment.

Keywords: Lifestyle, Modifiable Lifestyle, Mild Cognitive Impairment, Cognitive Health, Aging, Aged People.

(Paper received – 22nd May 2022, Peer review completed – 15th July 2022, Accepted – 28th July 2022)

INTRODUCTION

Aging is a gradual ongoing biological alteration in a living being that results in feebleness or senescence. It may lead to a deterioration of physiological functioning of the organism and decrease his capability to accommodate with the metabolic processes [1]. Aging, defined as a set of changes that occurs in a living being with the increase in time span and may result in a series of diseases and death [2].

In humans, aging is inexorable. As the age of an individual increases, his physiological capacity decreases progressively and his ability to respond towards environmental stresses reduces. As a result, he becomes more susceptible and vulnerable to disease. With the advancing age and as an effect of the above listed causes fatality increases at an exponential rate [3]. Growth in the number of elderly, decline in the number of youth, and accompanying economic and social costs as the population is ageing rapidly [4]. Aging is an

unavoidable, undesirable and problem indulged phase of life, which usually appear after the age of 65 years [5].

Mild Cognitive Impairment (MCI)

It is a well-known fact that aging accompanies gradual decline in cognitive function and increased risk of cognitive impairment. In almost every individual, the speed of intellectual and physical activities decreases with the increase in age. People experience age related dysfunctions which was termed as Mild Cognitive Impairment (MCI) by Peterson in 1997 [6]. According to cognitive continuum, MCI is an intervening phase between normal aging and an early onset of dementia, where people experience a great amount of cognitive decline [7]. Few signs of cognitive impairment are memory loss, not recognizing familiar people and places, having trouble in making judgment, difficulty in planning and executing tasks. It also includes frequently repeating the same story or question several times in a short span of duration (Repetition Compulsion). Collectively, these signs are termed as Challenging Behaviours [8]. While working on MCI Winblad suggested three criteria to identify individuals facing MCI. These are: (1) the individual is neither normal nor demented; (2) there is evidence of cognitive deterioration, shown by either objectively measured decline over time or subjective report of decline by self or informant in conjunction with objective cognitive deficits; and (3) daily life impaired activities are preserved and complex instrumental functions are either intact or minimally impaired [9].

Cognitive impairment is a crucial health problem due to its adverse effect on both elderly people's independent living [10]. Cognitive functions of the elderly have predominantly focused on detecting cognitive impairment and assessing cognitive decline in those with dementia [11].

MCI classified into two subtypes: amnestic and non-amnestic [12]. An individual suffering from amnestic MCI have the problem of progressive forgetting. Here, the patient as well as the caregiver are well aware of the symptoms. Although, some other cognitive abilities such as use of language, planning and execution of tasks and visuospatial skills remain conserved and functional activities remain unimpaired. Despite, it is clinically significant memory impairment but it does not meet the criteria for dementia. On the other hand, non-amnestic MCI, characterized by a subtle decline in the functions not related to memory, affecting attention, use of language, or visuospatial skills [13].

Lifestyle

A particular set of habits, choices and customs practiced by individuals all through their life is termed as Lifestyle [14]. The values and attitudes delineated as an impact of social, cultural, economic and environmental conditions and a set of health pertinent behaviour are collectively termed as Lifestyle [15]. Conceptually, lifestyle consists of two components: 'life conduct', expressed in personal choices, and 'life chances', the opportunities available to realize these choices [16]. Lifestyle may include physical activity, cognitive activity and social engagement. Physical activity differentiated in three dimension from mild to severe comprises of gardening and lawn mowing, housework, home repairs, cleaning the car, walking at a moderate pace, dancing, floor or stretching exercises, jogging, swimming, cycling, aerobics or gym, sports etc. It also comprises of dietary intakes, habits of smoking and alcohol consumption. Cognitive activities included listening to the radio, reading a newspaper, magazine or book, playing games such as cards or chess, doing crosswords, and doing puzzles. Moreover, social engagement comprises of talking to family member, friends, neighbours and relatives, visiting them, attending community meetings or meetings of any social group [17].

Modifiable Lifestyle

Modifiable lifestyle factors are those factors that inhibit the progression of cognitive decline and can act as an aid to stabilize cognitive health and improve cognitive functioning [18]. For preserving cognitive health of aged people, it is important to get aware about how these lifestyle factors influence cognitive health. Smoking and alcohol consumption, found to be significant in increasing MCI whereas healthy diet and physical exercise are identified as significant factors for delaying MCI. Engagement in cognitive and social activity found to be highly associated with cognitive health [17].

METHODOLOGY

A review of literature of about 30 papers made by the present researcher ranging from 2004 to 2020. The literatures gathered from various sources namely Publish or Perish 7, Academia, Research Gate, PubMed, NIH-PA, Science Direct, PloS Medicine, BMJ Open, Medknow and Oxford Journals. The keywords searched by the researcher were *"Aging", "Aged People", "Mild Cognitive Impairment", "Cognitive Impairment", "Cognitive Decline", "Lifestyle"* and *"Modifiable Lifestyle".*

Author(s)	**Year**	**Title**	**Method and Sample**	**Lifestyle Component Evaluated In the Study**
Katayama et al.	2020	Modifiable Risk Factor Possession Patterns of Dementia in Elderly with MCI: A 4-Year Repeated Measures Study	Longitudinal method Mean age, 72.0±5.4 years	Health behaviour, education, smoking
Kimura et al.	2019	Modifiable Lifestyle Factors and Cognitive Function in Older People: A Cross-Sectional Observational Study.	Cross-sectional method and Observational method. Mean Age- 73.8 years.	Walking steps, conversation time, total sleep time (TST), sleep efficiency, time awake after sleep onset, awakening count, napping time, and heart rate
Wajman et al.	2018	Lifestyle Patterns as a Modifiable Risk Factor for Late-life Cognitive Decline: A Narrative Review Regarding Dementia Prevention	Narrative Review	Social, cultural and intellectual lifelong activities
Yuan et al.	2018	Associations between modifiable lifestyle factors and multidimensional cognitive health among community-dwelling old adults: stratified by educational level	Cross-sectional method. Mean age of 69.05 ± 7.07 years	Education level, leisure activities, exercise, smoking
Livingston et al.	2017	Dementia prevention, intervention, and care	Review Paper	Smoking, obesity, hearing loss, depression, diabetes, physical inactivity, hypertension, social isolation and education
Clare et al.	2017	Potentially modifiable lifestyle factors, cognitive reserve, and cognitive function in later life: A cross-sectional Study.	Cross-sectional method Age 65 years and above	Healthy diet, physical exercise, cognitive and social activity, smoking and alcohol consumption.
Ngandu et al.	2015	A 2 year multi-domain intervention of diet, exercise, cognitive training, and vascular risk monitoring versus control to prevent cognitive decline in at-risk elderly people	Longitudinal method Age- 60-77 years _	Dietary factors, exercise, cognitive training. _

da Silva RA	2015	Sleep disturbances and mild cognitive impairment: a review	Review Paper	Sleep disturbances
Benito-León et al.	2014	Long sleep duration in elders without dementia increases risk of dementia mortality	Cohort study Age- 65 years and above	Sleep duration
Anstey et al.	2013	Development of a new method for assessing global risk of Alzheimer's disease for use in population health approaches to prevention. Prevention Science	Review Paper	Physical activity, cognitive activity, social engagement, diet, alcohol consumption, and smoking
Lautenschlager et al.	2008	Effect of physical activity on cognitive function in older adults at risk for Alzheimer disease: a randomized trial	Longitudinal method. Age- 50 years and above	Regular physical activity and higher levels of cognitive function

DISCUSSION

Aging and Cognitive Health

Cognition is an integral part of human thinking and experiences. It refers to the process of recognizing, selecting, understanding, accumulating, and using relevant information in a meaningful way and interact with the physical and social world, to perform their day-to-day life activities, and to plan and execute the course of one's personal and professional life [19]. Centre for Disease Control and Prevention (2016) states that "a healthy brain is one that can perform all the mental processes that are collectively known as cognition, including the ability to learn new things, intuition, judgment, language and remembering" [20]. Securing the quality of life and independence of aged people is a major criterion achieved by focussing on their cognitive health [17]. Cognitive health particularly refers to the advancement and maintenance of the multidimensional cognitive structure that permits aged people to assert social connectivity, function independently, effective revival from illness or injury, and to cope with residual functional deficits [21]. The influence of some major factors like early life experiences, gender, genetic composition, socio-economic status, any clinical history on cognitive health cannot be directly modified [22-23]. Moreover, the health behaviour such as smoking, obesity, hearing loss, depression, diabetes, physical inactivity, and hypertension accounted for 23.9% and educational factor accounted for 18.5% of the total participants having impaired cognitive functioning [24]. A study suggest that low educational level is associated with impaired cognitive function and dementia [25].

Aging and Mild Cognitive Impairment (MCI)

India Aging Report 2015 entitled "Caring for our Elders: Elderly Responses" published by UNFPA states that globally, the elderly population constitutes about 11.5% of the total population [26]. By 2050, this proportion is expected to increase to about 22%. Degradation in memory processes usually seen in the elderly people. Older people frequently forget minor details like facts and names. Most common experiences include losing keys, misplacing a wallet, or forgetting someone's name but for people nearing or over the age 60, such memory lapses are frightening [27].

Studies from several countries have reported varied percentage of cognitive impairment among elderly. Canadian Study of Health and Aging suggest that approximately 7.5% aged people suffer from cognitive impairment [28]. Recently, a study mentioned that the prevalence of MCI in the older Chinese population was 14.71% [29]. Another study analysed eleven studies from USA, Europe, Asia and Australia and found that the prevalence of Mild Cognitive Impairment varies from 5.0% to 36.7% [30].

American Academy of Neurology (AAN), updated its guideline on mild cognitive impairment in 2017, mentioned that 6.7% individuals between ages 60–64, 8.4% individuals between ages 65–69, 10.1% individuals between ages 70–74, 14.8% individuals between ages 75-79 and 25.2% individuals between the ages 80–84 suffer from Mild Cognitive Impairment [31]. In their COSMIC collaboration, a study suggested

that the occurrence of MCI was 13% in Turkish, 10.1% in Moroccan–Arabic, 9.4% in Moroccan–Berber and 11.9% in Surinamese–Hindustani participants [32].
Studies in India reported that approximately 22.2% elderly have MCI. Moreover, the overall occurrence of MCI in Indian population estimated to be approximately 25% [33-34]. Another study reported that 26.06% -aged people in Kerala are facing MCI [6]. A study conducted on the South Indian elders noted that the prevalence of MCI was approximately 3.36% [35]. A study conducted on individuals of Ludhiana, Punjab aged 60 and above found that about 8.8% elders suffer from MCI [36]. A report released by UNFPA and HelpAge India (2015) says that the prevalence of cognitive impairment in India is to be around 4.6% [26]. Prevalence of cognitive impairment among elderly population in India found to be 10% [19].

Factors contributing to Mild Cognitive Impairment:

Physiological Factors contributing to Mild Cognitive Impairment
Prevalence of MCI increases with age, and male population is more vulnerable than female [37-38]. Additional risk factors identified in some studies include lower educational level, vascular risk factors (e.g., diabetes and hypertension), Apolipoprotein E (APOE) e4 genotype, Vitamin D deficiency, improper sleep, disordered breathing [39], and prior critical illness (e.g. sepsis) [40]. MCI may occur due to other conditions like depression, medication effects, thyroid disease, and B12 or folate deficiency [41]. Moreover, he elaborated that depression is associated with cognitive impairment in older adults, and the relationship is likely to be bi-directional.

Social Factors and Mild Cognitive Impairment
A study conducted on community-dwelling elders with MCI showed different patterns of modifiable risk factors [42]. Amongst 25.9% participants, psychosocial factors such as depression and social isolation found strongly related to late life cognitive health [24]. This depression and social isolation result in cognitive decline and dementia [43-45]. Furthermore, studies revealed that social isolation is associated with cognitive function in later life [46]. Differences in cognitive function due to socioeconomic inequalities partially attributed to differences in modifiable health and lifestyle factors. Thus, promoting health and lifestyle changes in individuals with low SES could contribute to attenuate socioeconomic inequalities in cognitive function, potentially benefiting dementia prevention [47].

Lifestyle and Mild Cognitive Impairment
Lifestyle activities are necessary for successful aging. Cognitive functioning in old age facilitated by an active lifestyle. In aged people, mild cognitive impairment is the result of cognitive styles including attitudinal and motor-cognitive flexibility as well as specific lifestyle variables particularly lifestyle or a breakdown of family ties and social interaction [48]. In a report entitled Access Economics Pty Limited for Alzheimer's Australia (2009) Keeping Dementia Front of Mind: Incidence and prevalence 2009–2050 it was mentioned that individuals with greater intensity of physical activity performed well in cognitive activities like speed of processing, memory and mental flexibility [49]. Two different studies found that cognitive lifestyle including education, occupational complexity and late life engagement lowered dementia incidents. Both studies reported a link between active cognitive lifestyle and decreased cognitive decline [25]. People who regularly and actively participate in different lifelong activities (social, cultural and intellectual), have different lifestyle factors, ranging from leisure activities and nutritional habits, social interaction and toxic exposure do tend to perform better on formal cognitive tests, experience fewer cognitive complaints, and are less likely to develop neurodegenerative disorders [50].

Leisure activities and cognition
Cognition is multidimensional, encompassing processes such as attention, memory, executive functioning, logic, and language function. A survey suggested that leisure activity was associated with multi-domain cognition, while substance abuse showed only a limited association. Further, for elders with a low education level, leisure activities such as TV watching, reading, and smartphone use effectively contributed to better cognition, while reading and exercise were beneficial to cognition for old adults with a moderate and high

education, respectively. The study also indicated that smoking was not associated with cognition [51]. Reports suggest that numerous age-related changes in cognition are highly relevant to daily activities and have considerable importance to the public [52].

Sleep and Mild Cognitive Impairment

Aged people face a common problem of disturbance in sleep, which is also seen patients with mild cognitive impairment and dementia [53-54]. Moreover, for MCI longer sleep duration observed as an important risk factor [55-56]. Further, an appropriate duration of sleep delays the progression of cognitive impairment, whereas sleeping for longer duration may enhance cognitive impairment in aged people and is a major risk factor for MCI [57].

The major highlights of the above review suggested that, aged male individuals are more susceptible to mild cognitive impairment. Apart from educational level, several physiological factors are major risk factors for the advancement of MCI. Further, social isolation and socio-economic inequalities are associated with cognitive functioning. Moreover, social, cultural and intellectual lifestyle as well as leisure activities affect the cognitive health of aged people. Duration of sleep and nutritional habits are also major factors that play a crucial role in progression and inhibition of MCI.

Modifiable Lifestyle and Cognitive Function: Protective Factors and Risk Factors

Studies suggested that, physical activity, cognitive activity, social engagement, diet, alcohol consumption, and smoking are some major potentially modifiable lifestyle factors that act as risk factors and may accelerate the progression of MCI [58]. Interventions in multi-domain lifestyles, such as dietary factors, exercise, cognitive training, monitoring vascular risk factor and counselling can improve cognitive functions [59-60]. Factors associated with recovery from MCI to normal cognition include lifestyle activities, cognitive function, genetic data, personality, and demographics [61-64].

Findings of another study highlighted that among community dwelling older people physical activity, conversation and proper sleep play an important role in preventing cognitive impairment. Further, for delaying cognitive impairment among older people, physical activity other than exercise like moving in the house and moving restlessly are also important. Lifestyle factors that function as protective factors and result in better cognitive function among older people are physical activity, sleep, social activity, number of walking steps, conversation time [57]. Total sleep time (TST) and physical inactivity, lower levels of education, midlife hypertension, late-life depression as well as social isolation, midlife obesity, diabetes mellitus, smoking, and hearing loss are some potentially modifiable risk factors for dementia [24].

A cross-sectional study had reported that lifestyle factors influence cognitive health and cognitive function in later life. Positive modifications in lifestyle reduces the risk of cognitive decline and dementia [17]. Another longitudinal study performed at an interval of 18 months found that individuals involved in regular physical activity have higher levels of cognitive function and decreased risk of cognitive decline [65].

CONCLUSION

Mild cognitive impairment also known as cognitive impairment no dementia (CIND), often accompanied with aging. With the advancement in age, the lifestyle of individual changes gradually which may lead to MCI. As reported from the previous findings, apart from the physiological factors, factors like social isolation, behavioural measures (smoking, obesity, hearing loss, depression, diabetes, physical inactivity, hypertension and education), leisure activities, socio-economic inequalities, sleep and lifestyle factors (physical activity, cognitive activity and social engagement) also affect the aged individuals and can lead to the progression of MCI. Depression and social isolation found to be strongly associated with cognitive function and cognitive health in later life. Both the factors result in cognitive decline and dementia. Education, occupational complexity and late life engagement lowers dementia. Elderly with low education with involvement in leisure activities (watching TV, reading and smartphone use) and elderly with moderate or high education involved in reading and exercise showed better cognitive activities. Individuals with greater intensity of physical activity performed well in cognitive activities like speed of processing, memory and mental flexibility. Active cognitive lifestyle result in delayed cognitive decline. Mild cognitive

impairment is found to be associated with breakdown of family ties and social interaction. Individuals regularly and actively participating in different lifelong activities (social, cultural and intellectual), have different lifestyle factors, ranging from leisure activities and nutritional habits, tend to perform better on formal cognitive tests, experience fewer cognitive complaints, and are less likely to develop neurodegenerative disorders. Moreover, some modifiable lifestyle factors like physical activity, cognitive activity, social engagement, diet, alcohol consumption, and smoking may act as risk factors and may enhance the progression of MCI. Individuals involving themselves in regular physical and cognitive activity, social engagement, taking a healthy diet, minimizing alcohol consumption, smoking, and taking proper sleep may inhibit the progression of MCI.

Implications

The findings are important for public health. Health professionals, counsellors, caregivers and family can intervene with the older people and encourage them to make changes in their diet, exercise more, and engage in more socially oriented and mentally stimulating activities which may inhibit or delay late life cognitive impairment. Health intervention program would be helpful in screening the risk factors and motivate the vulnerable individuals to modify their lifestyle at an early stage, so that it would delay the onset of cognitive impairment . Along with physical activity and general lifestyle changes, effective therapies need to be developed that would be helpful in delaying cognitive impairment, even in the presence of APOE4. Further, public awareness campaigns or advocacy programs can be organised by the health care professionals to promote modifiable lifestyle factors in the early stage of life. Social policies can be developed by the policy makers, which can support and directly benefit vulnerable individuals in our society that can promote cognitive enrichment and delay cognitive impairment.

REFERENCES

1. Rogers K, Guarente, Leonard P, Simic, P. aging. Encyclopedia Britannica; 2020, January 3). https://www.britannica.com/science/aging-life-process
2. Harman D. The aging process. Proc Natl Acad Sci;1981;78(11):7124-28.
3. Troen BR. The biology of aging. Mount Sinai J Med 2003;70(1):3-22.
4. Sanderson WC, Scherbov S. Remeasuring aging. Science 2010;329:1287-88.
5. Prasad, R. Problems of senior citizens in India. Int J Humanties Soc Sci 2017;3(1):35-37.
6. Mohan D, Iype T, Varghese S, Usha A, Mohan M. A cross-sectional study to assess prevalence and factors associated with mild cognitive impairment among older adults in an urban area of Kerala, South India. BMJ Open 2018;9(3).
7. Petersen R. Mild cognitive impairment as a diagnostic entity. J Intern Med 2004;256:183–94.
8. Mouriz R, Caamano Ponte J, García Tunas L, Dosil C, Facal D. Dementia and challenging behaviors in gerontological centers: A Case Report. Geriatrics (Basel, Switzerland) 2019;4(1):15.
9. Winblad B, Palmer K, Kivipelto M, Jelic V, Fratiglioni L, Wahlund LO. et al. Mild cognitive impairment--beyond controversies, towards a consensus: report of the international working group on mild cognitive impairment. J Intern Med 2004;256(3):240–6.
10. Cheng ST. Dementia caregiver burden: A research update and critical analysis. Curr Psychiatry Rep 2017;19: 64-8.
11. Whitlock EL, Ramirez LG, Glymour MM, Boscardin WJ, Covinsky KE, Smith AK. Association between persistent pain and memory decline and dementia in a longitudinal cohort of elders. JAMA Intern Med 2017;177:1146–53.
12. Petersen R. Mild cognitive impairment as a diagnostic entity. J Intern Med 2004;256:183–94.
13. Petersen RC. Clinical practice. Mild cognitive impairment. N Engl J Med 2011;364:2227–34.
14. Ferreira LK, Meireles JF, & Ferreira MEC. Evaluation of lifestyle and quality of life in the elderly: a literature review. Revista Brasileira de Geriatria e Gerontologia 2018;21(5):616–27.
15. Cockerham WC, Abel T, Lu¨schen G. Max Weber, formal rationality, and health lifestyles. Sociol Quart 1993;34:413–25.
16. Cockerham WC, Ru¨tten A, Abel T. Conceptualizing contemporary health lifestyles: moving beyond Weber. Sociol Quart 1997;38:321–42.
17. Clare L, Wu YT, Teale JC, MacLeod C, Matthews F, Brayne C, et al. Potentially modifiable lifestyle factors, cognitive reserve and cognitive function in later life: A cross-sectional study. PLoS Med 2017;14(3).
18. Rovio S, Kåreholt I, Helkala E-L, Viitanen M, Winblad B, Tuomilehto J, et al. Leisure-time physical activity at midlife and the risk of dementia and Alzheimer's disease. Lancet Neurol 2005;4(11):705-11.
19. Konda PR, Sharma PK, Gandhi AR, Ganguly E. Correlates of cognitive impairment among Indian urban elders. J Gerontol Geriatr Res 2018;7(6):489.

20. Centers for Disease Control and Prevention. Healthy Aging. Available at: https://www.cdc.gov/aging/pdf perceptions_of_cog_hlth_factsheet.pdf. Accessed September 9, 2016
21. Hendrie HC, Albert MS, Butters MA, Gao S, Knopman DS, Launer LJ et al. The NIH cognitive and emotional health project: report of the critical evaluation study committee. Alzheim Dement 2006;2(1):12-32.
22. Polidori MC, Nelles G, Pientka L. Prevention of dementia: focus on lifestyle. Int J Alzheim Dis 2010.
23. Scazufca M, Almeida OP, Menezes PR. The role of literacy, occupation and income in dementia prevention: the São Paulo ageing & health study (SPAH). Int Psychogeriatr 2010;22(08):1209-15.
24. Livingston G, Sommerlad A, Orgeta V, Costafreda SG, Huntley J, Ames D et al. Dementia prevention, intervention, and care. Lancet 2017;390:2673–734.
25. Valenzuela MJ, Sachdev P. Brain reserve and dementia: A systematic review. Psychol Med 2006;36;441–54.
26. India Aging Report. Caring for our elders: Elderly responses. UNFPA;2015.
27. Elizabeth Vierck. APA Office on Aging and Committee on Aging.
28. Canadian study of health and ageing: Study methods and prevalence of dementia. CMAJ 1994;150,899-913.
29. Xue J, Li J, Liang J, Chen S. The Prevalence of mild cognitive impairment in China: A systematic review. Aging Dis 2018;9(4):706–15.
30. Parlevliet JL, Uysal-Bozkir Ö, Goudsmit M, van Campen JP, Kok RM, Ter Riet G, et al. Prevalence of mild cognitive impairment and dementia in older non-western immigrants in the Netherlands: a cross-sectional study. Int J Geriatr Psychiatry 2016;31(9):1040–9.
31. Petersen RC, Lopez O, Armstrong MJ, Getchius T, Ganguli M, Gloss D, et al. Practice guideline update summary: mild cognitive impairment: Report of the guideline development, dissemination, and implementation subcommittee of the American Academy of Neurology. Neurology 2018;90(3):126–35
32. Sachdev PS, Lipnicki DM, Kochan NA, Crawford JD, Thalamuthu A, Andrews G, et al The prevalence of mild cognitive impairment in diverse geographical and ethno cultural regions: the COSMIC collaboration. PloS One 2015;10(11).
33. Patel RM, Singh US. Prevalence Study of Cognitive Impairment and its associated sociodemographic variables using Mini-Mental Status Examination among elderly population residing in field practice areas of a medical college. Indian J Commun Med 2018;43(2):113–6.
34. Goswami A, Reddaiah VP, Kapoor SK, Singh B, Dey AB, Dwivedi S N, et al. Prevalence and determinants of cognitive impairment in rural elderly population in India. HelpAge India Res Dev J 2006;12:8-15.
35. Shaji S, Bose S, Verghese A. Prevalence of dementia in an urban population in Kerala, India. Br J Psychiatry 2005;186:136-40.
36. Sengupta P, Benjamin AI, Singh Y, Grover A. Prevalence and correlates of cognitive impairment in a North Indian elderly population. WHO South-East Asia J Pub Health 2014;3(2):135–43.
37. Plassman BL, Langa KM, Fisher GG, et al. Prevalence of cognitive impairment without dementia in the United States. Ann Intern Med 2008;148(6):427–34.
38. Petersen RC, Roberts RO, Knopman DS, et al. Prevalence of mild cognitive impairment is higher in men. The Mayo Clinic Study of Aging. Neurology 2010;75(10):889–97.
39. Barnes DE, Yaffe K. The projected effect of risk factor reduction on Alzheimer's disease prevalence. Lancet Neurol 2011;10(9):819-28.
40. Iwashyna TJ, Ely EW, Smith DM, Langa KM. Long-term cognitive impairment and functional disability among survivors of severe sepsis. JAMA 2010;304(16):1787–94.
41. Langa KM, Levine DA. The diagnosis and management of mild cognitive impairment: a clinical review. JAMA 2014;312(23):2551–61.
42. Katayama O, Lee S, Bae S, Makino K, Shinkai Y, Chiba I, et al. Modifiable Risk Factor Possession Patterns of Dementia in Elderly with MCI: A 4-Year Repeated Measures Study. J Clin Med 2020;9(4):1076.
43. Dotson VM, Beydoun MA, Zonderman AB. Recurrent depressive symptoms and the incidence of dementia and mild cognitive impairment. Neurology 2010;75:27–34.
44. Kuiper JS, Zuidersma M, Oude Voshaar RC, Zuidema SU, van den Heuvel ER, Stolk RP, et al. Social relationships and risk of dementia: A systematic review and meta-analysis of longitudinal cohort studies. Ageing Res Rev 2015;22:39–57.
45. Chan JYC, Yiu KKL, Kwok TCY, Wong SYS, Tsoi KKF. Depression and antidepressants as potential risk factors in dementia: A systematic review and meta-analysis of 18 longitudinal studies. J Am Med Dir Assoc 2019;20:279–86.
46. Evans IEM, Martyr A, Collins R, Brayne C, Clare L. Social isolation and cognitive function in later life: A systematic review and meta-analysis. J Alzheimers Dis 2019;70:S119–44.
47. Roehr S, Pabst A, Witte AV, Schroeter ML, Loeffler M, Villringer A, et al. Socioeconomic inequalities in cognitive function in midlife and early late-life are partially attributable to modifiable health and lifestyle factors. Alzheim Dement 2020;16(S10).
48. Stevens FCJ, Kaplan CD, Ponds RW, Diederiks JP, Jolles J. How ageing and social factors affect memory. Age Ageing 1999;28(4):379-84.
49. Access economics Pty limited for Alzheimer's Australia (2009). Keeping dementia front of mind: Incidence and prevalence 2009–2050.
50. Wajman JR, Mansur Leticia L, Yassuda Monica S. Lifestyle patterns as a modifiable risk factor for late-life cognitive decline: A narrative review regarding dementia prevention. Curr Aging Sci 2018;11(2):90-9.

51. Yuan M, Chen J, Han Y, Wei X, Ye Z, Zhang L, et al. (2018). Associations between modifiable lifestyle factors and multidimensional cognitive health among community dwelling old adults: stratified by educational level. Int Psychogeriatr 2018;1:1–12.
52. IOM. Cognitive aging: Progress in understanding and opportunities for action. National Academies Press: Washington, DC;2015.
53. Benito-León J, Bermejo-Pareja F, Vega S, Louis ED. Total daily sleep duration and the risk of dementia: a prospective population-based study. Eur J Neurol 2009;16:990–7.
54. da Silva RA. Sleep disturbances and mild cognitive impairment: A review. Sleep Sci 2015;8:36–41.
55. Benito-León J, Louis ED, Villarejo-Galende A, Romero JP, Bermejo- Pareja F. Long sleep duration in elders without dementia increases risk of dementia mortality (NEDICES). Neurology 2014;83:1530–7.
56. Spira AP, Stone KL, Redline S, Ensrud KE, Ancoli-Israel S, Cauley JA, et al. Actigraphic sleep duration and fragmentation in older women: associations with performance across cognitive domains. Sleep 2017;40.
57. Kimura N, Aso Y, Yabuuchi K, Ishibashi M, Hori D, Sasaki Y, et al. Modifiable lifestyle factors and cognitive function in older people: A cross-sectional observational study. Front Neurol 2019;10:401.
58. Anstey KJ, Cherbuin N, Herath PM. Development of a new method for assessing global risk of Alzheimer's disease for use in population health approaches to prevention. Prev Sci 2013;14(4):411-21.
59. Kivipelto M, Solomon A, Ahtiluoto S, Ngandu T, Lehtisalo J, Antikainen R, et al. The Finnish Geriatric Intervention study to prevent cognitive impairment and disability (FINGER): Study design and progress. Alzheimers Dement 2013;9:657–65.
60. Ngandu T, Lehtisalo J, Solomon A, Levalahti E, Ahtiluoto S, Antikainen R, et al. A 2 year multidomain intervention of diet, exercise, cognitive training, and vascular risk monitoring versus control to prevent cognitive decline in at-risk elderly people (FINGER): A randomised controlled trial. Lancet 2015;385:2255–63.
61. Ganguli M, Jia Y, Hughes TF, Snitz BE, Chang CH, Berman SB, et al. Mild cognitive impairment that does not progress to dementia: A population-based study. J Am Geriatr Soc 2019;67:232–8.
62. Park MH, Han C. Is there an MCI reversion to cognitively normal? Analysis of Alzheimer's disease biomarkers profiles. Int Psychogeriatr 2014;27:429–37.
63. Pandya SY, Lacritz LH, Weiner MF, Deschner M, Woon FL. Predictors of reversion from mild cognitive impairment to normal cognition. Dement Geriatr Cogn Disord 2017;43:204–14.
64. Shimada H, Doi T, Lee S, Makizako H. Reversible predictors of reversion from mild cognitive impairment to normal cognition: A 4-year longitudinal study. Alzheimers Res Ther 2019;11:24.
65. Lautenschlager NT, Cox KL, Flicker L, Foster JK, van Bockxmeer FM, et al. Effect of physical activity on cognitive function in older adults at risk for Alzheimer disease: a randomized trial. JAMA 2008;300(9):1027–37.

****

Acknowledgements – Nil
Conflict of Interest – Nil
Funding – Nil