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COGNITIVE FUNCTIONING AMONG OLDER PEOPLE IN

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ABSTRACT:

Cognitive processes involve various parts of the brain working together. These processes can be influenced by factors such as genetics, environment, education, and health. Cognitive impairment is a condition where a person's ability to think, remember, learn, or make decisions is significantly affected. However, the changes can progress at different rates, with many individuals suffering from cognitive decline severe enough to interfere with their ability to perform activities of daily living. The dramatic aging of the Indian population will inevitably result in significantly amplified numbers of older individuals suffering from cognitive impairment. There is a need to strengthen geriatric care services in the existing public health system so that the increasing care demands of the elderly can be met. The present study aims to Explore the cognitive capabilities of older adults across a range of demographic characteristics. Sixty-two participants aged 65 and above were taken as subjects for the study by taking an informed consent form. The Addenbrooke's Cognitive Examination – ACE-R was administered to assess cognition. Statistical Package for Social Sciences (SPSS) software version 26.0 was used to analyse the data. Results show that among the participants, 16.1% have moderate to severe impairment on MMSE, and 25.8% have mild impairment. The majority of the participants (56.5%) had cognitive impairment on ACE-R. There is a significant correlation between educational status, ACE-R, and MMSE scores. The majority were women (60.0%), belonging to urban domicile (57.8%), and were from joint families (68.4%). Results suggest that understanding the cognitive profiles of elderly individuals and the factors that influence cognitive function is essential for developing effective interventions aimed at promoting healthy aging and preventing cognitive decline. Targeted interventions addressing modifiable lifestyle factors and promoting cognitive resilience may help optimize cognitive health outcomes in the elderly population. Further longitudinal research is warranted to explore the trajectories of cognitive function over time and identify early markers of cognitive decline.

Key Words: Cognition, Cognitive impairment, Addenbrooke's Cognitive Examination

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Introduction:
Cognition is a combination of skills that include attention, learning, memory, language, visuospatialskills, and executive function, such as decision-making, goal setting, planning, and judgment. The administration and scoring of the ACE-R usually require 12 to 20 minutes in a clinical setting, averaging around 16 minutes. This tool assesses five cognitive domains: attention/orientation (18 points), memory (26 points), fluency (14 points), language (26 points), and visuospatial (16 points). The maximum achievable score on the ACE-R is 100, calculated by combining scores from all domains, with a higher score reflecting better cognitive function (Shuba, 2012).

Olderadults are the population most at risk for cognitive impairment (Sharma & Parashar 2013). The Government of India adopted the National Policy on Older Persons in 1999, which defines a 'senior citizen'or 'elderly'as a person 60 years or above." It has been estimated that in India, the population of those agedover 60 years will have increased from its level of 7.7% in2001 to 12.30% by 2025, and there will be nearly 150 millionelderly individuals (Sengupta et al., 2014). The ACE-R serves as a concise cognitive screening battery that evaluates five neuropsychological domains: orientation and attention (ACE-R OA), memory (ACE-R M), verbal fluency (ACE-R F), language (ACE-R L), and visuospatial abilities (ACE-R VA). While incorporating elements from the widely used MMSE, it offers a more comprehensive assessment of cognitive function (Berankova et al., 2015).

Research on cognitive function among older adults across various nations has primarily pinpointed socio demographic and health traits as significant risk factors (Ren et al., 2018). The link between aging and cognitive impairment is a biological fact and is an important health indicator pointing to jeopardized quality of life among the elderly (Lodha & De Sousa 2018).

The scope of geriatric mental health differs from other areas of mental health as geriatric populations have unique needs, thereby fostering many challenges. Cognitive impairment, a condition linked to aging, is frequently regarded as a precursor to more severe illnesses like depression, dementia, or Alzheimer's disease (Sengupta et al., 2014). Agüero-Torres et al., (2001) studied that cognitive impairment stands out as a primary factor leading to institutionalization among the elderly, irrespective of their socio-demographic status, social network, or functional abilities.

The normal function of brain systems is responsible for the individual's proper cognitive function. Cognitive impairment ranges from mild to severe. Mild cognitive impairment (MCI) is the term used to describe the condition of individuals whose cognition lies between the cognitive changes of aging and early dementia (Rajesh et al., 2020). Thus cognitive disorders occur in proportion to increasing age and deterioration of the elements involved in these systems. Cognitive disorders are closely associated with a decline in cognitive abilities including attention, memory, language, orientation, performance, judgment, and problem-solving skills. Studies have shown that about 5% of the elderly have a

severe cognitive disorder, 47.5% have a moderate disorder, 30% have a mild cognitive disorder and only 5.17% have no disorder (Aajami et al., 2020).

However, the changes can progress at different rates, with many individuals suffering from cognitive decline severe enough to interfere with their ability to perform activities of daily living, later diagnosed as dementia (Chodosh et al., 2004). Studies on cognitive function in older adults across different countries have largely identified sociodemographic and health characteristics as significant risk factors (Setiyani, 2022).Wisniowska-Szurlej and Wilmowska-Pietruszynska (2018) conducted a study analyzing the factors related to disability in ADL and IADL among elderly inhabitants of ruralsouth-eastern Poland. Results indicate that the subjects reported problems with IADL (43.19%) more often than with ADL (36.85%). Safak et al. (2019) aimed to describe the relationship between activities of daily living and cognitive function in community-dwelling elderly, revealing a prevalence of ADL dependency at 0.6% with no significant sex difference. Makino et al. (2020) examined the relationship between the performance of instrumental activities of daily living (IADL) and the future incidence of mild cognitive impairment (MCI) among community-dwelling older adults in Japan. Of all participants, 922 (57.8%) had a limitation in at least one IADL at baseline, and during the follow-up period, 179 (11.2%) transitioned from normal cognitive function to MCI. Participants who had not engaged in activities such as "going out using buses/trains" or "using maps to travel to unfamiliar places" at baseline showed a significantly higher risk of developing MCI compared to those who had engaged in such activities. Edwards et al. (2020) assessed the activities of daily living among older adults with cognitive impairment in the U.S. Their findings highlight the need for targeted efforts to support older adults living alone with cognitive impairment.

Identifying cognitive impairment, largely in its earlier stages, is more and more important because recognition of cognitive impairment allows provision of early awareness to patients and caregivers, greater communication about symptoms and treatment decisions, and identification of proxy decision-makers. The scope of geriatric mental health differs from other areas of mental health as geriatric populations have unique needs, thereby fostering many challenges. Very few people receive proper assessment and care due to reasons like lack of trained professionals, scarce geriatric mental health infrastructure, and a dearth of financial resources for geriatric mental health are some of the challenges that our nation faces. These challenges are seen at every level of care and treatment, from acceptance of a mental health problem to seeking help and remaining compliant in treatment (Aajami et al., 2020).

Geriatric mental health problems can be accurately diagnosed and effectively treated if help is sought early, but it is erroneously assumed that they are part of “normal aging.” The unprecedented pace of demographic aging makes geriatric mental health a huge public health challenge for India (Setiyani&Iskandar, 2022).Completing a thorough evaluation of all six cognitive domains (attention, executive function, learning and memory, language, and perceptual-motor and social cognition) is often difficult within the time constraints of a primary care setting. Moreover, patients with cognitive decline commonly present with

multiple comorbidities and face challenges in communication due to issues like hearing, vision, and comprehension. To overcome these obstacles, various clinical assessment tools have been devised to assist in evaluating cognitive function in conjunction with other clinical markers (Ranjit et al,. 2020).

Maintaining cognitive health is one of the key areas of successful ageing. Researchers have to concentrate on this kind of important issues related to older rather than neglect them. A periodical review on research towards improving functional competence or at least towards the management of functional autonomy is identified as one of the thrust areas of research in Gerontology in India. Improvement in cognitive health helps to maintain good mental health. Because of the growing elderly population and their cognitive impairment, there is a dearth of research on the impact of cognitive impairment among older adults. Indian society is ageing despite following traditional lifestyle.

Many studies reported that mental health may have a significant effect on learning and memory. It is evident that elderly exhibit higher levels of anxiety than young adults in testing and exhibit poor performance in memory tasks (Lalitha & Jamuna, 2004a, 2004b, 2006). Among the psychological variables in association with different facets of memory, the highly correlating variables were self-rated memory, self-esteem and locus of control with the exception of logical information and the free word association. The moderately (and negatively) correlating variables were psychological health and physical health with an exception of free-word association. The low correlating variables were social supports and lastly life stress with an exception of letter span. A general observation in this regard is that the one facet of memory viz., free word association was least correlating with psychological variables (Lalitha, 2000). Many studies reported that mental health may have a significant effect on learning and memory. It is evident that elderly exhibit higher levels of anxiety than young adults in testing and exhibit poor performance in memory tasks (Lalitha & Jamuna, 2000, 2015). Lalitha (2015) study carried out small intervention on everyday memory self-efficacy found that the subjects those who are with good self-efficacy are maintain good memory compared to others. Results related to intervention are effective. It indirectly improves quality of life of older men and women. Initially, studies were carried out on a specific cognitive domain, later MMSE and MOCA tests were entered into the assessment majority of studies used them for a comprehensive understanding of the cognitive functioning in Indian older people. The majority studies showed that the MoCA was superior in both sensitivity and specificity to the MMSE, although not all MoCA tasks were of equal predictive value. Performance on MoCA subtests was compared at these MMSE cutoffs to determine profiles of early cognitive difficulties. Initially studies carried out to assess the role of demographic variables impact on the cognitive status.. In few studies researchers carried out interventions with the Mini-Mental State Examination, the Montreal Cognitive Assessment, the Wechsler Adult Intelligence Scale, the Wechsler Memory Scale, the Wisconsin Card Sorting Test, the Trail Making Tests, the Stroop Color and Word Test. Few studies carried out comparing MMSE and MOCA with Everyday Cognition (ECog) scale, Cognitive Failures Questionnaire (Lalitha, 2015; 2020; Lalitha & Aswartha Redy, 2022).

There is dearth of studies on Cognitive research in India particularly on community living older people. The dramatic aging of the Indian population will inevitably result in significantly amplified numbers of older individuals suffering from cognitive impairment. Cognitive functioning in older adults can be improved or maintained through cognitive interventions, regardless of their educational background, socio-economic status, or cognitively stimulating occupations. These interventions, which are a type of psychological treatment or counseling technique, aim to reduce deficits in memory, reasoning, learning, and thinking. Targeted cognitive interventions, particularly memory training, have been widely used to achieve these benefits (Lalitha et al., 2022). There is a need to strengthen geriatric care services in the existing public health system so that the increasing care demands of the elderly can be met. With this background, a community-based descriptive cross-sectional study was conducted among older persons aged 60 years and above.

Objectives:

- To assess the levels of cognitive functioning among older men and women.
- To examine the relationship between socio demographic variables among the elderly with cognitive impairment
- To study the role of socio demographic variables on different cognitive domains.

Sample, Tools and Method:

Sample details:

The total sample (Table I) comprised 62 participants aged above 60, of which 46.8% were between the ages of 70 to 79. The majority of the sample were men (51.6%) and women were (48.4%). The sample from urban areas (72.6%) and rural areas was (27.4%). Subjects belonging to nuclear families were (69.4%) and subjects belonging to joint families were (30.6%). Of the total sample, 27.4% had no formal education, 11.3% had primary education, 21.0% had high school education, and 40.3% had a college education. The majority of the participants belong to middle socioeconomic status (59.7%), and 25.8% and 14.5% belong to low and high socioeconomic status, respectively. Of the participants, 30.6% had no health issues, while 22.6% had hypertension, 14.5% of them have diabetes and 32.3% had other comorbidities. A paternal family history of cognitive impairment was present for 16.1%, and a maternal family history of cognitive impairment was present in 12.9% of the sample where as 71.0% had no family history of cognitive impairment.

Table I: Socio-demographic details of the sample

S.NO	SUBGROUP	N	%
1	**AGE**		
	60-69	28	45.2%
	70-79	29	46.8%
	80 and Above	5	8.1%
2	**GENDER**		
	Men	32	51.6%
	Women	30	48.4%
3	**DOMICILE**		
	Urban	45	72.6%
	Rural	17	27.4%
4	**EDUCATIONAL STATUS**		
	No formal education	17	27.4%
	Primary education	7	11.3%
	High school education	13	21.0%
	College education	25	40.3%
5	**FAMILY STATUS**		
	Nuclear	43	69.4%
	Joint	19	30.6%
6	**SOCIO-ECONOMIC STATUS**		
	Low	16	25.8%
	Middle	37	59.7%
	Upper	9	14.5%
7	**HEALTH STATUS**		
	No health issues	19	30.6%
	Hyper Tension	14	22.6%
	Diabetic	9	14.5%
	Other Comorbidities	20	32.3%
8	**FAMILY HISTORY**		
	Paternal History	10	16.1%
	Maternal History	8	12.9%
	Nil Significant	44	71.0%

Tools used:

Detailed socio-demographic data was obtained including name, age, gender, domicile, educational qualification, family status, and socioeconomic status. Information regarding comorbid medical conditions was also recorded from the patients. Addenbrook's Cognitive Examination-ACE-R was administered to assess the cognitive status. ACE-R, which incorporates the MMSE, consists of five domains, each representing a specific cognitive

function: (I) attention and orientation (18 points), (II) memory (26 points), (III) fluency (14 points),(IV) language (26 points), and (V) visuospatial ability (16 points). The total score of ACE-R is100 points, which includes the MMSE score (30 points). Two cut-offs are recommended, 88 for screening, and 82 for research purposes. As per test norms, those who score less than 82 were considered to have cognitive impairment.

Method of testing: The present study was a cross-sectional observational study. All the subjects who approached various psychiatrists with complaints of memory problems and behavioral changes, and subsequently referred to a clinical psychologist for psychometric evaluation were sampled. Data was collected over 6 months between 01-03-2023 to 01-08-2023. The nature and purpose of the study were explained to the subjects before obtaining consent from each subject. Confidentiality and personal data protection are guaranteed, assuring them of the voluntary nature of research participation. Older people aged 60 years and above and willing to give informed consent were included. Data was collected by using purposive sampling method. All those with diagnosed psychiatric illnesses and serious medical/neurological comorbidities were excluded. Individuals identified with cognitive impairments were then advised to follow up for both pharmacological and non-pharmacological treatments as deemed necessary. Data was entered in Microsoft Excel and analysed with Statistical Package for Social Sciences (SPSS) software version 26.0 using appropriate statistical tests. The mean and standard deviation of the quantitative variables were measured. P value ≤ 0.05 was taken as statistically significant.

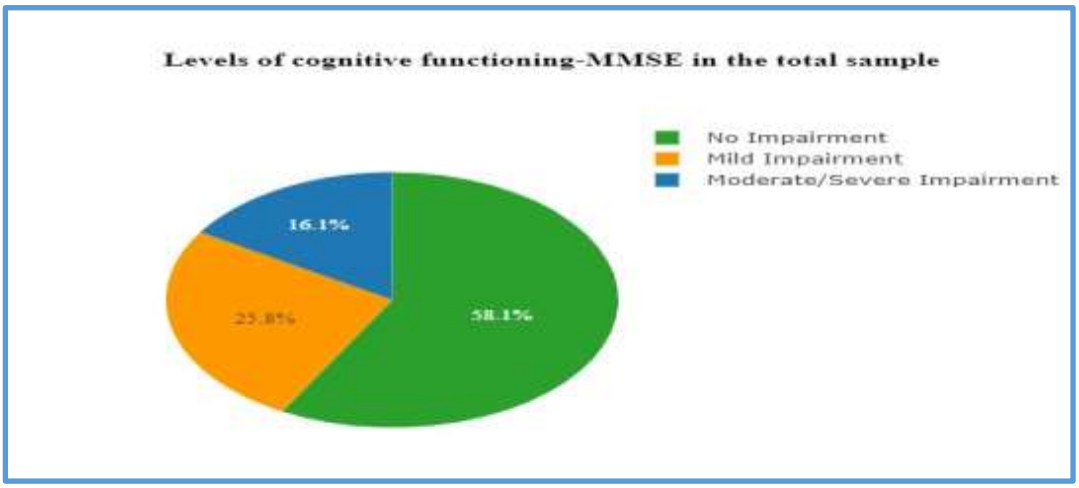
Results:

The obtained data was analysed to meet the objectives of the study. From the Table II, it's clear that 58.1 % percent of the sample found with no impairment, 25.8 with mild impairment and 16.1% have moderate to severe impairment, and 25.8% have mild impairment. The data states that 48 percent reported to mild to moderate impairment indicates the poor cognitive functioning which is going to impact their day today life.

Table II: Levels of cognitive functioning-MMSE in the total sample

Sl. No.	Level of Cognitive functioning	N	%
1.	Moderate/Severe impairment	10	16.1
2.	Mild impairment	16	25.8
3.	No impairment	36	58.1
Total		**62**	**100.0**

Figure 1



In the total sample (Figure 1), 16.1%of individuals exhibited moderate to severe impairment in cognitive functioning as assessed by the MMSE. Additionally, 25.8% showed mild impairment, while the majority, comprising 58.1%, displayed no impairment on the MMSE.

Most of those with mild impairment on MMSE (Table III) were in the 60 to 69 age group (35.7%) and (17.2%) in the age group of 70 to 79 and 20.0% from the age group were with mild impairment respectively. Of those with moderate impairment most of them were in 80+ age group (60.0%) and 13.8% in the age group of 70 to 79 and 10.7% in the age group of 60 to 69% were with moderate impairment respectively. The age-related nature of cognitive decline, with mild impairment primarily affecting individuals in their 60s and 70s, while moderate impairment becomes more prevalent among those aged 80 and above

On the MMSE, 21.9% of men exhibit mild cognitive impairment, while 12.5% show moderate cognitive impairment. Among women, 30.0% have mild cognitive impairment, and 20.0% have moderate cognitive impairment. These findings suggest a notable gender difference in the prevalence of cognitive impairment, with a higher proportion of women exhibiting both mild and moderate cognitive impairment compared to men.

Among those residing in urban areas, 26.7% exhibited mild cognitive impairment, while 13.3% showed moderate cognitive impairment. In contrast, in rural areas, the prevalence of mild cognitive impairment was 23.5%, with an equal percentage also displaying moderate cognitive impairment. This suggests that while the overall prevalence of cognitive impairment may vary between urban and rural settings, both environments experience significant rates of cognitive decline.

Table III: Levels of cognitive functioning-MMSE in different Socio-demographic variables

S.NO	SUB-GROUPS	Level of Cognitive Impairment – MMSE		
		NORMAL(f)	MILD(f)	MODERATE(f)
1	**AGE**			
	60-69	15(53.6%)	10(35.7%)	3(10.7%)
	70-79	20(69.0%)	5(17.2%)	4(13.8%)
	80 +	1(20.0%)	1(20.0%)	3(60.0%)
2	**GENDER**			
	Men	21 (65.6%)	7(21.9%)	4(12.5%)
	Women	15 (50.0%)	9(30.0%)	6(20.0%)
3	**DOMICILE**			
	Urban	27(60.0%)	12(26.7%)	6(13.3%)
	Rural	9(52.9%)	4(23.5%)	4(23.5%)
4	**EDUCATION**			
	No Formal Edn.	5(29.4%)	8(47.1%)	4(23.5%)
	Primary Education	4(57.1%)	2(28.6%)	1(14.3%)
	High School Edn.	10(76.9%)	2(15.4%)	1(7.7%)
	College Education	17(68.0%)	4(16.0%)	4(16.0%)
5	**FAMILY STATUS**			
	Nuclear	27(62.8%)	10(23.3%)	6(14.0%)
	Joint	9(47.4%)	6(31.6%)	4(21.1%)
6	**SOCIO-ECONOMIC STATUS**			
	Low	9(56.2%)	5(31.2%)	2(12.5%)
	Middle	23(62.2%)	8(21.6%)	6(16.2%)
	Upper	4(44.4%)	3(33.3%)	2(22.2%)
7	**HEALTH STATUS**			
	No health issues	10(52.6%)	5(26.3%)	4(21.1%)
	Hyper Tension	12(85.7%)	1(7.1%)	1(7.1%)
	Diabetic	3(33.3%)	4(44.4%)	2(22.2%)
	Other Comorbidities	11(68.8%)	6(93.8%)	3(37.0%)
8	**FAMILY HISTORY**			
	Paternal History	4(40.0%)	3(30.0%)	3(30.0%)
	Maternal History	5(62.5%)	2(25.0%)	1(12.5%)
	Nil Significant	27(61.4%)	11(25.0%)	6(13.6%)

The prevalence of cognitive impairment varies significantly across different levels of education. Among individuals with no formal education, 47.1% exhibit mild cognitive impairment, with 23.5% showing moderate impairment. For those with primary education, 28.6% display mild cognitive impairment, while 14.3% present with moderate impairment.

Those with a high school education have lower rates of cognitive impairment: 15.4% have a mild impairment, and 7.7% have moderate impairment. Of those with a college education, 16.0% have mild cognitive impairment, and the same percentage, 16.0%, have moderate impairment. These findings suggest a complex relationship between education level and cognitive impairment, highlighting the potential protective effect of higher education against cognitive decline.

In nuclear families, 23.3% of individuals show mild cognitive impairment, while 14.0% exhibit moderate impairment. However, in joint families, these rates are notably higher, with 31.6% experiencing mild cognitive impairment and 21.1%. This suggests that family dynamics may play a role in cognitive health.

The prevalence of cognitive impairment varies significantly across different socio-economic statuses. Among individuals with low socio-economic status, 31.2% exhibit mild cognitive impairment, while 12.5% show moderate impairment. In the middle socio-economic status group, 21.6% experience mild cognitive impairment, and 16.2% demonstrate moderate impairment. But, those in the upper socio-economic status category show the highest impairment with 33.3% experiencing mild cognitive impairment and 22.2% showing moderate impairment.

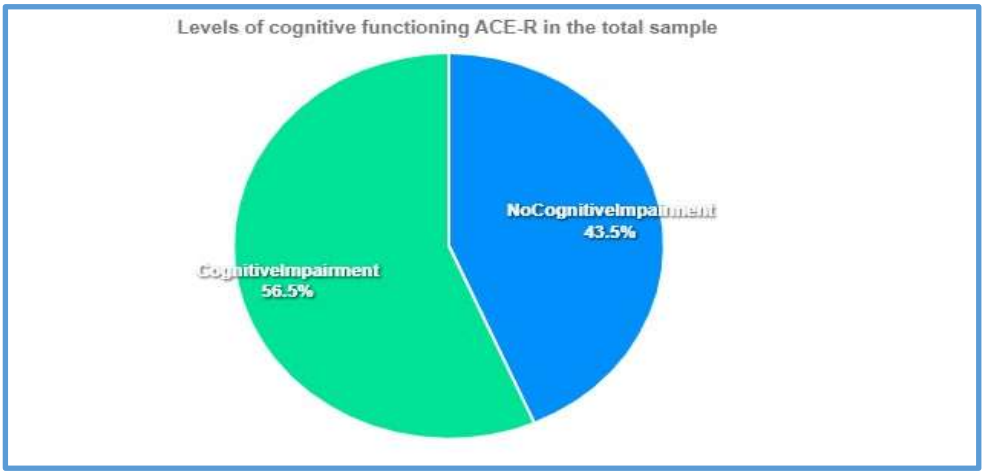
When we observe the MMSE results and health status, among individuals with hypertension, both mild cognitive impairment and moderate cognitive impairment were observed at 7.1%. In contrast, among those with diabetes, a higher prevalence of cognitive impairment was evident, with 44.4% experiencing mild cognitive impairment and 22.2% demonstrating moderate cognitive impairment. Individuals with other comorbidities showed the highest prevalence of cognitive impairment, with 93.8% experiencing mild cognitive impairment and 37.0% demonstrating moderate cognitive impairment.

Individuals with a paternal history of cognitive impairment displayed a prevalence of 30.0% for both mild and moderate cognitive impairment on MMSE performance. Conversely, those with a maternal history of cognitive impairment exhibited a prevalence of 25.0% for mild impairment and 12.5% for moderate impairment.

Table IV: Levels of cognitive functioning ACE-R in the total sample

Sl. No.	**Level of Cognitive functioning**	**N**	**%**
1.	Normal	27	43.5
2.	With impairment	35	56.5
Total		**62**	**100.0**

Figure.2



The majority of the participants (56.5%) (Table IV) had cognitive impairment on ACE-R. Of the total participant, 43.5% (Figure 2) showed no cognitive impairment and 56.5% showed impairment in cognitive functioning.

Table V: Levels of cognitive functioning-ACE-R in different Socio-demographic variables

S.NO	SUB-GROUPS	Level of Cognitive Impairment – ACE-R	
		NORMAL(f)	IMPAIRED(f)
1	**AGE**		
	60-69	13(46.4%)	15(53.6%)
	70-79	14(48.3%)	15(51.7%)
	80 and above	0(00.0%)	5(100.0%)
2	**GENDER**		
	Men	15(46.9%)	17(53.1%)
	Women	12(40.0%)	18(60.0%)
3	**DOMICILE**		
	Urban	19(42.2%)	26(57.8%)
	Rural	8(47.1%)	9(52.9%)
4	**EDUCATION**		
	No Formal Edn.	4(29.4%)	13(47.1%)
	Primary Education	2(57.1%)	5(28.6%)
	High School Edn.	8(76.9%)	5(15.4%)
	College Education	13(68.0%)	12(16.0%)
5	**FAMILY STATUS**		
	Nuclear	21(48.8%)	22(51.2%)
	Joint	6(31.6%)	13(68.4%)

6	**SOCIO-ECONOMIC STATUS**		
	Low	7(43.8%)	9(56.2%)
	Middle	15(40.5%)	22(59.5%)
	Upper	5 (55.6%)	4(44.4%)
7	**HEALTH STATUS**		
	No health issues	6(31.6%)	13(68.4%)
	Hyper Tension	10(71.4%)	4(28.6%)
	Diabetic	1(11.1%)	8(88.9%)
	OtherComorbidities	10(62.5%)	4(100.0%)
8	**FAMILY HISTORY**		
	Paternal History	2(20.0%)	8(80.0%)
	Maternal History	4(50.0%)	4(50.0%)
	Nil Significant	21(47.7%)	23(52.3%)

On the ACE-R test (Table V), 53.6% of individuals belonging to the age group 60 to 69 showed cognitive impairment, while 51.7% and100% of those in the age groups 70 to 79 and 80 and above, respectively, exhibited cognitive impairment. A significant proportion of the older population is affected by age-related cognitive decline (ARCD), which is independent of dementia and occurs at a rate 70% higher than that of dementia alone(Juan &Adlard, 2019).

Additionally, in the sample, 53.1% of men and 60.0% of women exhibited cognitive impairment on the ACE-R test. Moreover, cognitive impairment rates varied among educational backgrounds, with 47.1% of the subjects with no formal education have cognitive impairment, 28.6% of those with primary education, 15.4% individuals with high school education, and 16.0% of those with college education were found to have cognitive impairment. Differences were also observed between urban and rural populations, where 52.9% of the urban population showed cognitive impairment, while 57.8% of the rural population exhibited cognitive impairment. Of the total sample, 51.2% of individuals from nuclear families had cognitive impairment, while 68.4% of those from joint families experienced cognitive impairment.

The ACE-R results for subjects from different socio-economic statuses indicate that 86.2% of those from low SES, 59.5% from middle SES, and 44.4% from upper SES showed cognitive impairment. The prevalence of cognitive impairment related to health status is 28.6% among those with hypertension, 88.9% among diabetics, 100.0% among individuals with other comorbidities, and 68.4% among those with no health issues showed cognitive impairment on ACE-R. In the sample, 80.0% of those with a paternal family history of cognitive impairment, 50.0% of those with a maternal family history, and 52.3% of those with no family history showed cognitive impairment. This is in contrast with a recent study by Qin et al. (2020) who concluded that the MCI progression outcomes were associated with sex, age,

education degrees, occupations types, income level, children number, height, and weight, emphasizing the multifaceted nature of cognitive impairment across different populations.

Table VI: Means, S. D's &'t' values related to Cognitive status- ACE-R in Different Sub-Groups

S.NO	SUB-GROUP	N	M (σ)	't'
1	**AGE**			
	60-65	28	73.82(17.63)	0.36@
	66-70	29	72.21(15.66)	2.56**
	71-75	5	52.20(19.14)	
2	**GENDER**			
	Men	32	71.94(16.68)	0.28@
	Women	30	70.67(18.66)	
3	**DOMICILE**			
	Urban	45	71.49(17.55)	0.12@
	Rural	17	70.88(18.00)	
4	**EDUCATION**			
	No Formal Education	17	63.47(16.03)	0.86@
	Primary Education	7	69.43(13.04)	0.93@
	High School Education	13	76.69(18.02)	0.36@
	College Education	25	74.40(18.29)	
5	**FAMILY STATUS**			
	Nuclear	43	73.51(17.69)	1.49@
	Joint	19	66.37(16.56)	
6	**SOCIO-ECONOMIC STATUS**			
	Low	16	69.25(18.06)	0.63@
	Middle	37	72.57(17.29)	0.40@
	Upper	9	69.89(19.17)	
7	**HEALTH STATUS**			
	No health issues	19	67.58(19.88)	2.09*
	Hyper Tension	14	80.21(12.21)	2.40**
	Diabetic	9	66.67(14.61)	0.97@
	Other health issues	4	58.50(12.06)	1.54@
	Comorbidities	16	73.81(18.66)	
8	**FAMILY HISTORY**			
	Paternal History	10	68.19(13.65)	0.19@
	Maternal History	8	70.75(20.47)	
	Nil Significant	44	72.16(18.04)	
**Significant at 0.01level, @not significant				

The analysis of cognitive status (Table VI) using the Addenbrooke's Cognitive Examination Revised (ACE-R) across different socio-demographic sub-groups reveals several interesting patterns. For age groups, the scores show a significant decline with increasing age, particularly between the 66-70 and 71-75 age groups ($t = 2.56$, $p < 0.01$), with mean scores of 72.21 ($\sigma = 15.66$) and 52.20 ($\sigma = 19.14$), respectively. This significant decline suggests that cognitive function deteriorates more noticeably in the older age group. Gender differences in cognitive scores are not significant, with men scoring 71.94 ($\sigma = 16.68$) and women scoring 70.67 ($\sigma = 18.66$), indicating similar cognitive performance across genders ($t = 0.28$).

Domicile also shows no significant differences in cognitive scores, with urban participants scoring 71.49 ($\sigma = 17.55$) and rural participants scoring 70.88 ($\sigma = 18.00$), suggesting that living environment does not significantly impact cognitive performance ($t = 0.12$). Educational status shows higher cognitive scores with increasing education levels, though none of the differences reach statistical significance. Participants with no formal education score 63.47 ($\sigma = 16.03$), those with primary education score 69.43 ($\sigma = 13.04$), high school education score 76.69 ($\sigma = 18.02$), and college education score 74.40 ($\sigma = 18.29$). Despite the trend, the differences are not statistically significant, indicating that while education may have a positive impact, the sample size might be too small to detect a significant effect (t-values: 0.86, 0.93, 0.36).

Family status also does not show significant differences, with nuclear family participants scoring 73.51 ($\sigma = 17.69$) and joint family participants scoring 66.37 ($\sigma = 16.56$), indicating no substantial impact of family structure on cognitive function ($t = 1.49$). Socio-economic status similarly shows no significant differences, with low SES participants scoring 69.25 ($\sigma = 18.06$), middle SES scoring 72.57 ($\sigma = 17.29$), and upper SES scoring 69.89 ($\sigma = 19.17$) (t-values: 0.63, 0.40).

Health status shows significant differences, particularly between participants with no health issues scoring 67.58 ($\sigma = 19.88$) and those with hypertension scoring 80.21 ($\sigma = 12.21$) ($t = 2.40$, $p < 0.01$). Participants with comorbidities score 73.81 ($\sigma = 18.66$) compared to other health issues scoring 58.50 ($\sigma = 12.06$), showing significant cognitive impacts from health conditions ($t = 2.09$, $p < 0.05$). Diabetic participants score 66.67 ($\sigma = 14.61$) with no significant difference ($t = 0.97$), indicating specific health conditions like hypertension and comorbidities have a more pronounced effect on cognitive function.

Lastly, family history of cognitive impairment does not show significant differences, with participants having paternal history scoring 68.19 ($\sigma = 13.65$), maternal history scoring 70.75 ($\sigma = 20.47$), and no significant family history scoring 72.16 ($\sigma = 18.04$) ($t = 0.19$). Overall, these findings highlight significant cognitive declines associated with aging and health conditions, while other socio-demographic factors like gender, domicile, family status, socio-economic status, and family history show no significant impact in this sample. The positive influence of educational status is noted but not statistically significant, suggesting further research with larger sample sizes could provide more definitive insights. Fletcher et al. (2021) noted that education's impact on cognition is influenced by family background factors (~40%) and genetics (<10%). Even after adjusting for these factors, we consistently observe significant effects of education. Notably, college graduates exhibit cognition scores approximately 0.75 SD higher than individuals without credentials, which corroborates our findings.

Table VII: Correlation Matrix related to Mini-mental status examination (MMSE), ACE-R among Socio-Demographic Variables.

SL. NO.	Socio-demographic variables	Mini-mental status examination (MMSE)	ACE-R
1	Age	0.217@	0.244@
2	Gender	0.126@	0.037@
3	Domicile	0.083@	0.016@
4	Educational status	0.264*	0.266*
5	Family status	0.132@	0.189@
6	Socio-economic status	0.066@	0.030@
7	Health status	0.043@	0.027@
8	Family history	0.061@	0.085@
** Significant at 0.01 level; * Significant at 0.05 level; @ Not significant			

The results in (Table VII) measured using the Mini-Mental Status Examination (MMSE) as a component of the Addenbrooke's Cognitive Examination Revised (ACE-R). The results revealed that age had a positive but not significant correlation with MMSE (r = 0.217) and ACE-R (r = 0.244) scores, suggesting that age alone is not a strong predictor of cognitive status in this sample. Gender also showed no significant correlation with MMSE (r = 0.126) and ACE-R (r = 0.037) scores, indicating that cognitive performance is similar between men and women in this study.

Domicile (urban vs. rural) was not significantly correlated with MMSE (r = 0.083) or ACE-R (r = 0.016) scores, suggesting that living environment does not substantially impact cognitive function. However, educational status was significantly correlated with both MMSE (r = 0.264, $p < 0.05$) and ACE-R (r = 0.266, $p < 0.05$) scores, highlighting that higher educational attainment is associated with better cognitive performance.

Family status (nuclear vs. joint) showed no significant correlation with MMSE (r = 0.132) and ACE-R (r = 0.189) scores, implying that family structure does not strongly influence cognitive function. Socio-economic status also did not significantly correlate with MMSE (r = 0.066) or ACE-R (r = 0.030) scores, indicating that socio-economic factors might not have a direct impact on cognitive status in this sample.

Similarly, health status showed no significant correlation with MMSE (r = 0.043) or ACE-R (r = 0.027) scores, possibly due to the variability in individual health conditions and compensatory mechanisms. Lastly, family history of cognitive impairment was not significantly correlated with MMSE (r = 0.061) or ACE-R (r = 0.085) scores, suggesting that family history does not have a strong direct impact on current cognitive function. Overall, the findings indicate that educational status is a significant predictor of cognitive performance, while other socio-demographic factors such as age, gender, domicile, family status, socio-

economic status, health status, and family history do not show strong correlations. This is in contrast with a recent study by Qin et al. (2020) who concluded that the MCI progression outcomes were associated with sex, age, education degrees, occupations types, income level, children number, height, and weight, emphasizing the multifaceted nature of cognitive impairment across different populations. The inclusion of MMSE as part of ACE-R reinforces the importance of comprehensive cognitive assessment, while also highlighting the robustness of educational attainment as a key factor in cognitive health.

Table VIII: Correlation Matrix related to Sub-domains of ACE-R among Socio-Demographic Variables.

SL. NO	Socio-demographic variables	Attention/ Orientation	Memory	Fluency	Language	Visuospatial
1	Age	0.202@	0.376**	0.276*	0.061@	0.019@
2	Gender	0.226@	0.111@	0.027@	0.034@	0.191@
3	Domicile	0.089@	0.065@	0.020@	0.024@	0.079@
4	Educational status	0.279*	0.177@	0.122@	0.288*	0.254*
5	Family status	0.182@	0.102@	0.058@	0.242@	0,250*
6	Socio-economic status	0.006@	0.056@	0.043@	0.067@	0.193@
7	Health status	0.023@	0.048@	0.003@	0.056@	0.165@
8	Family history	0.045@	0.015@	0.230@	0.082@	0.019@
** Significant at 0.01 level; * Significant at 0.05 level; @ Not significant						

The correlation matrix (Table VIII) related to the sub-domains of the Addenbrooke's Cognitive Examination Revised (ACE-R) among various socio-demographic variables provides insights into how these factors are associated with specific cognitive abilities. Age shows a significant correlation with the Memory sub-domain ($r = 0.376$, $p < 0.01$) and Fluency sub-domain ($r = 0.276$, $p < 0.05$), indicating that as age increases, there is a notable impact on memory and fluency abilities. However, the correlations with Attention/Orientation ($r = 0.202$), Language ($r = 0.061$), and Visuospatial ($r = 0.019$) are not significant, suggesting these cognitive functions are less affected by age in this sample.

Gender does not significantly correlate with any sub-domains, with correlations ranging from r = 0.027 for Fluency to r = 0.226 for Attention/Orientation, indicating that cognitive performance across these domains is similar between men and women. Domicile (urban vs. rural) also shows no significant correlations with any cognitive sub-domains, with values like r = 0.089 for Attention/Orientation and r = 0.020 for Fluency, suggesting that living environment does not strongly influence cognitive abilities.

Educational status, however, shows significant positive correlations with Attention/Orientation ($r = 0.279$, $p < 0.05$), Language ($r = 0.288$, $p < 0.05$), and Visuospatial ($r = 0.254$, $p < 0.05$) sub-domains, indicating that higher educational attainment is associated with better performance in these areas. The correlations with Memory ($r = 0.177$) and Fluency ($r = 0.122$) are not significant but still positive, suggesting a beneficial impact of education on overall cognitive function.

Family status shows a significant positive correlation with the Visuospatial sub-domain ($r = 0.250$, $p < 0.05$), implying that individuals in different family structures may experience variations in visuospatial abilities. Other correlations, such as with Attention/Orientation ($r = 0.182$) and Language ($r = 0.242$), are not significant, suggesting limited influence of family status on these cognitive areas.

Socio-economic status does not significantly correlate with any sub-domains, with correlations like r = 0.006 for Attention/Orientation and r = 0.193 for Visuospatial, indicating that socio-economic factors might not have a direct impact on cognitive performance in this sample. Health status also shows no significant correlations, with values like r = 0.048 for Memory and r = 0.165 for Visuospatial, suggesting that overall health may not strongly influence specific cognitive abilities.

Finally, family history of cognitive impairment does not show significant correlations with any sub-domains, with values such as r = 0.045 for Attention/Orientation and r = 0.230 for Fluency, indicating that family history may not directly affect specific cognitive functions in the individuals assessed. Overall, the findings highlight the significant impact of educational status on cognitive performance and suggest that other socio-demographic factors have varied and often non-significant influences on different cognitive abilities.

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Discussion: The findings from our study provide valuable insights into the demographic and clinical characteristics associated with different levels of cognitive impairment, as measured by the ACE-R. Understanding these patterns can inform targeted interventions and support strategies for individuals with varying degrees of cognitive impairment, as well as guide future research efforts aimed at elucidating the underlying mechanisms and risk factors.

The current study identified most of the 60 to 69 age group having MCI, followed by women and individuals from urban domiciles. This pattern suggests that middle-aged and older adults, particularly females residing in urban areas, may be more vulnerable to mild cognitive impairment. Similar findings were noted regarding sex differences by Snyder et al. (2016) that dementia development typically points to the longer life expectancy generally experienced by women as the rationale for a higher occurrence in women. Furthermore, a

study by Andersen et al. (1999) found that 65-year-old women had a cumulative risk of developing dementia that was twice as high as that of men

The empty-nest elderly, particularly those living alone, experienced more severe cognitive impairment progression compared to non-empty-nest elderly individuals (Duan et al., 2017). The phenomenon of empty nest syndrome could contribute to this high impairment levels among individuals in higher socio-economic groups. Empty nest syndrome refers to the feelings of loneliness, grief, or loss experienced by parents when their children leave home to live independently. This transition often occurs during mid to later life stages, coinciding with the age range where cognitive decline becomes more prevalent.

Notably, a significant proportion of individuals with mild cognitive impairment (MCI) had a paternal family history of cognitive impairment. This suggests a potential genetic predisposition to cognitive decline, with familial factors playing a role in the development of MCI. A positive family history is a reliable predictor of future AD. We found that those with a positive family history reported a greater amount of subjectively experienced memory and language decline (Robertson et al., 2021).

Individuals with moderate cognitive impairment were predominantly aged 80 and above, with a notable proportion being women. Women were younger than men at onset of subjective cognitive decline (Williamson et al., 2022). The different effect of education between women and men is a challenging issue and may be explained by a multifactorial approach. Social factors should be taken into account (Giacomucci et al., 2022).

At baseline, rural residents exhibited significantly better cognitive function compared with urban residents when accounting for socioeconomic factors. A longitudinal study on the elderly population in China showed similar results. “However, the results also showed that the initially higher MMSE scores among rural and rural-to-urban migrants decline at a significantly faster rate with age compared with long-term urban residents” (Xu et al., 2017) Present study shows high cognitive impairment in those living in a joint family type. These findings are consistent with the study by Konda et al.(2018). Research on cognition of older adults has gained momentum only in the last two decades. Studies in the Indian context indicate a significant lack of systematic research in this area. Early efforts focused primarily on developing a few assessment scales and evaluating certain aspects of memory, with minimal attention given to memory interventions. There remains a pressing need to develop indigenous assessment tools, and no comprehensive theory has been proposed in this field. This underscores that cognitive research among older adults in India is still in its infancy, and much work is needed to explore indigenous practices that can help maintain good memory in the Indian population (Lalitha & Dheeraj , 2021).

Conclusion: Our study revealed a diverse range of cognitive profiles among the elderly population, with varying levels of cognitive functioning observed across different individuals. This highlights the importance of recognizing the heterogeneity in cognitive abilities among older adults and tailoring interventions accordingly. We found that demographic factors such

as age, education level, and socioeconomic status were significant predictors of cognitive function. Older age and lower levels of education were associated with poorer cognitive performance, highlighting the importance of considering these factors in assessing cognitive health in elderly individuals.

Health-related factors, such as the presence of comorbid conditions were also found to influence cognitive function among the elderly. Poorer physical health was associated with lower cognitive functioning, emphasizing the interconnectedness of physical and cognitive well-being in older adults.

Understanding the cognitive profiles of elderly individuals and the factors that influence cognitive function is essential for developing effective interventions aimed at promoting healthy aging and preventing cognitive decline. Targeted interventions addressing modifiable lifestyle factors and promoting cognitive resilience may help optimize cognitive health outcomes in the elderly population. Further longitudinal research is warranted to explore the trajectories of cognitive function over time and identify early markers of cognitive decline. Additionally, investigating the efficacy of interventions targeting modifiable risk factors for cognitive impairment could provide valuable insights into strategies for maintaining cognitive health in aging populations.

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