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Original Article

Community Section

Urban-rural Comparative Assessment of Cognitive Impairment and its Determinants among Elderly Residents of Southern India: A Cross-sectional Study

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ABSTRACT

Introduction: Cognitive impairment in older adults includes subjective memory complaints, Mild Cognitive Impairment (MCI) and major neurocognitive disorders. Cognitive impairment among older adults is an emerging public health challenge globally and in India.

Aim: To estimate the prevalence of cognitive impairment and identify its associated factors among elderly residents in rural and urban area.

Materials and Methods: A comparative community-based analytical cross-sectional study was done among elderly subjects (≥60 years) in Poolavari (rural) and Attayampatti (urban) field practice areas of the institution ensuring feasibility, accessibility and representativeness of typical rural and urban populations in the Salem district of Tamil Nadu, India from 1st November 2025 to 31st January 2026. Simple random sampling was used to select participants. A structured questionnaire was used to collect data. Cognition was evaluated using the Brief Interview for Mental Status (BIMS) and function was characterised with the KATZ Index of Activities of Daily Living (ADL). Data were analysed through Statistical Packages of Social Sciences (SPSS) version 22.0. A Chi-square test and a multivariable logistic regression were conducted.

Results: Mean age was 65±4.7 years, majority were females 231 (57.7%) and 169 (42.3%) were males. The majority 235 (58.7%) were from lower class. Forgetting things often 228 (57%) was the most common dementia-related symptom and as per KATZ ADL scale 52 (13%) were dependent. Nearly 82 (20.5%) had moderate cognitive impairment and 11% had severe cognitive impairment. Multivariable analysis showed independent predictors of cognitive impairment were residence in rural area (AOR: 1.67), dependence in KATZ ADL scale {Adjusted Odds Ratios (AOR): 1.55}, and presence of dementia-related symptoms (AOR: 1.87).

Conclusion: Cognitive impairment is highly prevalent in South India elderly population. Immediate steps for reducing the future burden of dementia include community-based screening, early detection and integration of geriatric cognitive care into primary healthcare services.

Keywords: Cognition, Dementia, Dependence, Mental status

INTRODUCTION

Cognitive impairment in older adults includes subjective memory complaints, MCI and major neurocognitive disorders which is a substantial and growing global public health challenge. Globally, systematic reviews and meta-analyses reported that the prevalence of MCI in community living adults aged 50 years or older was about 15.6% with amnestic-type MCI around 10% and non amnestic types approximately 9% [1,2]. Recent international reviews find that estimates of the prevalence of cognitive impairment range from 5.1% to 41% across studies and have a median estimate of about 19% among older people; the incidence rate for cognitive impairments is approximately 54 per 1000 person-years [3,4]. Evidence also supports age and education as correlates of MCI prevalence and cognitive impairment indicating that omnipresence and complexity of burden is experienced across populations [1,2,5]. With population ageing occurring rapidly around the world, these estimates underscore the importance of increased vigilance and action for cognitive health.

Age-related cognitive decline is now being considered as a significant public health problem in developing countries like India because of demographic transition and increasing life expectancy. National ageing statistics estimate 10.8% mild cognitive impairment in older adults, and lifestyle associates to cognition vary [6]. It is estimated that India has approximately 7.4% prevalence of dementia in population above the age 60 years, which is an equivalent of about 8.8 million people with a significant variation among states and sociodemographic groups [7]. Regional studies further indicate 18.6% MCI prevalence from rural Kerala [8] and >30% objective cognitive impairment and ~11.7% MCI found among elderly groups of South India [9,10]. These observations highlight a heavy burden of cognitive impairment and its long continuum among the elderly in India.

Studies from South India have consistently reported a substantial burden of cognitive impairment among the elderly. A recent community-based study conducted in urban Tamil Nadu, India reported a cognitive impairment prevalence of 36.67%, with significant associations observed with depression, gait disturbances and dependence in ADL [9]. Similarly a study conducted in an urban setting reported a prevalence of cognitive impairment as 35.06% and those subjects who led a solitary life, had less than 10 years of schooling, used kerosene as cooking fuel and consumed bore well water had significant association with cognitive impairment [11]. Another South Indian study recorded a cognitive impairment prevalence of 41.6% and multivariable logistic regression analysis revealed participants who were retired and not living with spouse were independently associated with cognitive impairment [12].

Although the literature has been increasing, there are still evident gaps especially in South Indian context. As the studies have used different assessment tools, varied definitions for cognitive impairment and do not compare well with respect to comparability

and community-level generalisability [10,13]. Furthermore, most studies have been conducted in either rural or urban settings independently with a paucity of comparative analyses across rural-urban populations within the same sociocultural context. While factors such as age, illiteracy, and depression have been explored, there is limited comprehensive evidence examining the combined influence of cognitive impairment with lifestyle behaviours, functional dependence in ADL, social engagement, and coexisting physical morbidities among community-dwelling elderly [6,8]. These gaps underscore the need for integrated, community-based research that captures both clinical and functional dimensions of ageing.

It is important to address these gaps given that India has ageing population rapidly. Earlier recognition of cognitive impairment and its determinants could reinforce screening by primary care, prompt interventions that prevent or delay the development of dementia and promote active ageing at place in communities [10,14]. With rapid population ageing and limited community-based data from South India, there is a need to estimate its burden and determinants. This study uniquely compares cognitive impairment between rural and urban elderly within the same setting. It also integrates cognitive, functional and socio-environmental factors in a single community-based analysis. The present study was conducted to estimate the prevalence of cognitive impairment and its determinants among elderly people living in the community in South India.

MATERIALS AND METHODS

A comparative community based analytical cross-sectional study was done among elderly subjects (≥60 years) in Poolavari (rural) and Attayampatti (urban) field practice areas of the institution ensuring feasibility, accessibility and representativeness of typical rural and urban populations in the Salem district of Tamil Nadu, India. Data were collected for three months between 1st November 2025 - 31st January 2026.

Inclusion and Exclusion criteria: Those aged 60 years or older who agreed to participate were the ones included in the present study. Subjects with profound hearing loss, severe speech or visual impairment, history of psychiatric disease known to affect cognitive status were excluded. Key confounders such as depression, medication use, and stroke history were not assessed due to feasibility and resource constraints in this community-based study. Their omission may have led to residual confounding and is acknowledged as a limitation.

Sample size calculation: The sample size was estimated according to the prevalence of cognitive impairment in a community-based study done by Diwakar R et al., in Tamil Nadu, India which recorded a magnitude of 36.67% [9]. Using $N=Z^2pq/L^2$ formula with Z=1.96 at 95% confidence level, p=36.67, q=63.33 and absolute precision (L)=5. The final sample size was rounded to 400 after considering a 10% expected non response rate. Of the total sample size of 400 elderly participants, 200 individuals each were selected from the urban and rural study areas to ensure equal representation of both settings. A complete list of eligible elderly residents in each area was prepared through a household enumeration. From these sampling frames, participants were selected using a simple random sampling technique with the aid of computer-generated random numbers. The study was approved by the Institutional Ethics Committee (Ref: VMKVMC&H/IEC/25/264). All the participants provided a written consent. Confidentiality and anonymity were observed at all times.

Study Procedure

The data were gathered through a pretested validated structured questionnaire. Demographic data, family history of dementia and co-morbidities were collected. Functional status was measured using the KATZ Index of Independence in ADL, where one point was awarded for independent activity and zero if help were needed. A composite score from 0 to 6 was calculated, 0 representing very dependence, six represent independent and in between scores indicate moderate dependency [15]. Cognitive impairment was measured using the BIMS which examines three domains namely attention, orientation and ability to register and recall. Score cut-off values for BIMS were categorised as intact cognition (13-15), moderate cognitive impairment (8-12) and severe cognitive impairment (≤7) [16]. BIMS was used due to its simplicity and suitability for field-based assessments, enabling rapid and standardised evaluation of cognition in a community setting. House to house visits were made and interviews were conducted in a private setting after obtaining written informed consent. Cognitive testing was conducted by the examiner after appropriate training.

STATISTICAL ANALYSIS

The data were gathered in Microsoft Excel with analysis of the data performed in SPSS version 22.0. Participant characteristics were summarised using descriptive statistics. Chi-square was done to test association between cognitive impairment and study variables. Covariates that were significant in univariate analysis were entered into multivariable logistic regression for independent determinants. A p-value <0.05 was considered as statistically significant.

RESULTS

Among 400 subjects 27% were more than 75 years, mean age was 65±4.7 years and majority were females 231 (57.7%). More than half (54%) of the study population had education < high school and 78.5% were unemployed at present. About, 55% had savings, 47.2% were covered by insurance schemes and 71.8% perceived their children to provide sufficient support [Table/Fig-1].

Variables	n (%)
Age (years)	
61 - 75	292 (73%)
> 75	108 (27%)
Gender	
Male	169 (42.3%)
Female	231 (57.7%)
Education	
< High school	216 (54%)
≥ High school	184 (46%)
Currently employed	
Yes	86 (21.5%)
No	314 (78.5%)
Socioeconomic status	
Upper and middle class	165 (41.3%)
Lower class	235 (58.7%)
Type of family	
Nuclear family	301 (75.2%)
Joint family/three generation family	99 (24.8%)
Body Mass Index (BMI)	
Underweight	34 (8.5%)
Normal	288 (72%)
Overweight/Obese	78 (19.5%)
Personal habits	
Tobacco user	43 (10.8%)
Alcohol user	58 (14.5%)
Walk/Exercise regularly	132 (33%)
Involve in recreational activities	158 (39.7%)
Financial Status*	
Savings	220 (55%)

Debts	115 (28.7%)
Assets	225 (56.3%)
Insurance schemes	189 (47.2%)
Pension	262 (65.5%)
Adequate children support	
Yes	287 (71.8%)
No	113 (28.2%)

[Table/Fig-1]: Baseline characteristics of the study participants (N=400).
*Multiple responses allowed

Forgetting things often 228 (57%) was the most common dementia-related symptom, followed by difficulty in making decisions 153 (38.2%) and as per KATZ ADL scale 52 (13%) were dependent. Cognitive status testing demonstrated that 274 (68.5%) of the sample had intact cognition, 82 (20.5%) had moderate cognitive impairment and 44 (11%) had severe cognitive impairment [Table/Fig-2].

Variables	Urban area n (%)	Rural area n (%)	Total N (%)
Family history of dementia			
Yes	68 (34%)	81 (40.5%)	149 (37.2%)
No	132 (66%)	119 (59.5%)	251 (62.8%)
Symptoms related to dementia*			
Forget things often	124 (62%)	104 (52%)	228 (57%)
Difficulty in conversing	66 (33%)	72 (36%)	138 (34.5%)
Forget important dates	31 (15.5%)	50 (25%)	81 (20.2%)
Difficulty in decision making	72 (36%)	81 (40.5%)	153 (38.2%)
Noticeable changes informed by others	59 (29.5%)	63 (31.5%)	122 (30.5%)
Difficulty in finding own bed/ room	13 (6.5%)	10 (5%)	23 (5.8%)
No symptoms of dementia	60 (30%)	69 (34.5%)	129 (32.2%)
KATZ ADL Scale			
Dependent	23 (11.5%)	29 (14.5%)	52 (13%)
Independent	177 (88.5%)	171 (85.5%)	348 (87%)
Cognitive impairment category			
Intact cognition	143 (71.5%)	131 (65.5%)	274 (68.5%)
Moderate cognitive impairment	36 (18%)	46 (23%)	82 (20.5%)
Severe cognitive impairment	21 (10.5%)	23 (11.5%)	44 (11%)
Co-morbidities*			
Arthritis	89 (44.5%)	78 (39%)	167 (41.8%)
Diabetes mellitus	90 (45%)	102 (51%)	192 (48%)
Hypertension	97 (48.5%)	92 (46%)	189 (47.2%)
Respiratory problems	51 (25.5%)	56 (28%)	107 (26.7%)
Dermatological problems	26 (13%)	20 (10%)	46 (11.5%)
Vision problems	112 (56%)	127 (63.5%)	239 (59.7%)
Cardiovascular disease	51 (25.5%)	35 (17.5%)	86 (21.5%)
Thyroid disorders	12 (6%)	5 (2.5%)	17 (4.2%)
Sleep disturbances	57 (28.5%)	61 (30.5%)	118 (29.5%)
Hearing problems	34 (17%)	43 (21.5%)	77 (19.2%)
Others	53 (26.5%)	65 (32.5%)	118 (29.5%)
No co-morbidity	110 (55%)	80 (40%)	190 (47.5%)

[Table/Fig-2]: Various characteristics of study participants (N=400).
*Multiple responses allowed

On bivariate analysis using Chi-square test [Table/Fig-3], cognitive impairment was significantly associated with female gender (p-value<0.0001, OR: 3.71), less than high school education (p-value - 0.005, OR: 1.85), rural type of residence (p-value - 0.0003, OR: 2.23), family history of dementia (p-value<0.001, OR: 3.97), KATZ ADL dependence (p-value<0.0001, OR: 4.32) and presence of dementia symptoms (p-value-0.0009, OR: 2.31).

Variables	Cognitive Impairment		p-value	Odds ratio (Confidence interval)
	Yes n=126	No n=274		
Age				
61 - 75 years	91	201	0.812	0.94 (0.58-1.51)
> 75 years	35	73		
Gender				
Female	98	133	<0.0001*	3.71 (2.29-6.01)
Male	28	141		
Education status				
< High school	81	135	0.005*	1.85 (1.20-2.86)
≥ High school	45	139		
Type of family				
Nuclear	91	210	0.341	0.79 (0.49-1.29)
Joint/Three generation	35	64		
Socioeconomic status				
Lower class	70	165	0.379	0.82 (0.53-1.26)
Upper and middle class	56	109		
Type of area				
Rural	80	120	0.0003*	2.23 (1.44-3.44)
Urban	46	154		
Body Mass Index				
Normal	90	198	0.863	0.95 (0.60-1.53)
Underweight/ Overweight/Obese	36	76		
Family history of dementia				
Yes	75	74	<0.0001*	3.97 (2.54-6.19)
No	51	200		
KATZ ADL Scale				
Dependent	32	20	<0.0001*	4.32 (2.35-7.93)
Independent	94	254		
Symptoms of dementia				
Yes	100	171	0.0009*	2.31 (1.42-3.80)
No	26	103		
Co-morbidities				
Yes	64	146	0.643	0.90 (0.59-1.38)
No	62	128		

[Table/Fig-3]: Association between cognitive impairment and selected study variables.
*p-value <0.05 was statistically significant

In the binomial logistic regression model, living in a rural area (AOR: 1.67), KATZ ADL dependence (AOR: 1.55) and presence of dementia symptoms (AOR: 1.87) were independent predictors for cognitive impairment respectively. Female sex, lower education and family history of dementia were no longer statistically significant once adjusted for in the model [Table/Fig-4].

Variables	Cognitive impairment		
	p-value	AOR	95% CI
Female gender	0.112	0.87	0.56-1.12
< High school education	0.135	0.79	0.49-1.37
Rural area	**0.003**	1.67	1.07-2.59
Family history of dementia	0.221	0.91	0.61-1.31
Dependence in KATZ ADL Scale	**0.010**	1.55	1.32-1.72
Presence of dementia symptoms	**0.001**	1.87	1.21-3.55

[Table/Fig-4]: Binomial logistic regression analysis findings.
Reference categories: Male gender, ≥ High school education, Urban area, Negative family history of dementia, Independence in KATZ Scale, Absence of dementia symptoms

DISCUSSION

In the present study, majority were females 231 (57.7%), more than half had education below high school and majority belonged to low

socioeconomic categories. The age-sex distribution is comparable to findings from Longitudinal Ageing Study in India (LASI) and Study on Global Ageing and Adult Health (SAGE) [17,18]. A similar female preponderance and age distribution have been reported in Indian community-based studies by Iype T et al., and Kumari R et al., [8,14]. Comparable findings regarding education levels, living arrangements and co-morbidities were documented by Patel RM et al., [19]. Additionally, rural-urban differences in cognitive profiles have been observed by Roy D et al., indicating environmental effects on ageing outcomes [10]. These observations suggested that the sociodemographic characteristics of present study represent typical group feature of any Indian geriatric population.

Forgetting things (57%) and difficulty in decision making (38.2%) were the most frequent symptoms of dementia in the present study. Subjective cognitive complaints are being recognised as the earliest symptoms of incipient cognitive decline. Nearly one third of the participants had the symptoms of cognitive impairment as comparable to the current study. In Venkatesh U et al., Iype T et al., (25.4%), Halder P et al., and Basu R thus, the percentage of individuals with cognitive symptoms in the present study closely aligns with existing Indian literature, indicating a consistently moderate burden [5,8,17,18]. Also, Roy D et al have described a strong link between subjective cognitive decline and objective definitions of MCI particularly in rural areas [10]. Petersen RC et al., characterised subjective memory impairment as part of the emerging clinical syndrome of MCI, a frequent precursor to objective decline [2]. In a meta-analysis by Bai W et al., revealed that incorporating symptom-based screening criteria increases the case detection rate across studies [1]. The present study findings support to the practical utility of symptom enquiry for use in community screening when it is difficult to perform advanced neuropsychological testing.

In the present study, prevalence of cognitive impairment was 31.5% (moderate and severe forms). Comparatively, the prevalence of cognitive impairment was similar to that of Indian studies by Dasgupta A et al., from rural West Bengal 48% Jeeje VK et al., from rural Kerala (27–30%) and Sujitha P et al., [13,15,20] among elderly in old-age homes (31%). Internationally, Waldron N et al., study from Jamaica was comparable with a prevalence of 34% [21]. Whereas the prevalence was higher than global pooled estimates as reported in studies by Bai W et al., (19%), Pais R et al., (20.8%) and Salari N et al., (22-23%) [1,3,4]. Like-wise studies conducted in urban Indian communities by Khanna AB and Metgud CS reported 8.4% and Gambhir IS et al., reported 42.9% as prevalence [22,23]. Meanwhile Kumari R et al., study from rural North India reported 36% and Patel RM et al., reported around 16% cognitive impairment prevalence [14,19].

Larger Indian studies like LASI and SAGE reported cognitive impairment prevalence of 16-20% and 18%, respectively which were comparatively low [17,18]. The difference in current study may be due to inclusion of moderate and severe impairment, higher proportion of participants aged >75 years (27%) and methodological difference in the tools used for assessment. In summary our results showed a considerable cognitive health burden typical to rural and urban elderly populations.

In present population, 13% of subjects were dependent according to the KATZ ADL scale; functional dependence was independently related to cognitive impairment and this relationship persisted even after adjustment. This correlation has been found to be robust in Indian studies. Dasgupta A et al., revealed the elderly with restricted ADL did have significantly increased risk of cognitive impairment and Gambhir IS et al., also found a strong correlation between decreased MMSE scores and loss of independence in ADL [20,23]. In rural Kerala, Jeeje VK et al., noted significant functional limitation with cognitive impairment. International study conducted by Saliba D et al., have reinforced the relevance of combining cognitive assessment with structured functional evaluation [13,16]. The independence of ADL dependence as a predictor in the present study reiterates the fact that cognition and functional autonomy are inter-related with each other among the elderly.

Rural area, KATZ ADL dependence and the presence of dementia symptoms were independent predictors of cognitive impairment in the present study in multivariable analysis. Similar results to present study were observed in Sujitha P et al., study conducted in old age homes in Tamil Nadu, India [15]. Roy D et al., showed that rural populations have significantly increased prevalence of subjective cognitive decline and MCI due to restricted medical facility accessibility and lower level of education respectively [10]. Iype T et al., Kumari R et al., and Patel RM et al., also found female sex and low education to be strong predictors in unadjusted analysis [8,14,19]. Dasgupta A et al., similarly noted the more powerful contribution of functional status [20]. At the global level, low education and SES was determined by Bai W et al., and Salari N et al., as predominantly impacting heterogeneity of MCI prevalence [1,4]. The present findings indicate that demographic factors are associated with vulnerability, but contextual determinants such as rural residence and functional status exert a more enduring influence on cognitive outcomes.

Limitation(s)

The present study has certain limitations. Its cross-sectional design limits causal inference, and the study was conducted in selected field practice areas, which may limit generalisability. Reliance on self-reported data may have introduced recall bias. Additionally, the absence of detailed neuropsychological assessment and longitudinal follow-up restricts deeper understanding of cognitive trajectories.

CONCLUSION(S)

The present study has shown that cognitive impairment remains a public health challenge in South India, even beyond several pooled national and global estimates. These results emphasise the importance of rural-specific cognitive screening, early detection of functional deterioration, and delivery of geriatric mental health care integrated with primary health care programs in South India. It is essential for health services and government policy to focus on increasing awareness of geriatric health services, promoting active ageing strategies and improving access to healthcare in rural areas.

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