

Objective and subjective socioeconomic status and cognitive impairment among older adults: a population-based study in a developing country

Abstract

Background:

We in this study aim to explore the late-life cognitive impairment as a function of older individuals' objective and subjective socio-economic status (SES).

Methods:

Data for this study was utilized from the Longitudinal Ageing Study in India (2017-18). The total sample size for the present study was 31,464 older adults aged 60 and above. Chi square test was used to evaluate the significance level of differences in cognitive impairment. Additionally, binary logistic regression analyses were performed to fulfil the objectives.

Results:

About 41.7 percent and 43.4 percent of older adults had low subjective and objective SES respectively. It was revealed that older adults with low subjective SES [AOR: 2.04; $p<0.05$] and objective SES [AOR: 1.32; $p<0.05$] had significantly higher odds of cognitive impairment in comparison to their counterparts with a stronger subjective SES-cognitive impairment association. It was observed that older adults with low subjective as well as objective SES were 2.45 times more likely to suffer from cognitive impairment compared to older adults from high subjective and objective SES [AOR: 2.45; $p<0.05$].

Conclusion:

The results suggest that more attention should be placed at subjective SES indicators when investigating socioeconomic influences on cognitive functioning among older adults in India.

Keywords: *Subjective; Objective; Socioeconomic status; Cognitive impairment; Older adult*

Background

Cognitive impairment, including dementia as an outcome of decline in cognitive ability, increases considerably with the rapidly growing population of older adults [1]. Worldwide, almost 80% of the general public are concerned about developing dementia at some point in time and 1 in 4 people think that they can do nothing to prevent such a cognitive decline [2].

Various indices of economic hardship, including lack of education, poor household economy, unemployment, and employment frustration, are linked with poor physical health conditions resulting in cognitive deficits [3–5]. Similarly, evidence suggests an aggregate or cumulative effect of socio-economic risk factors on cognitive impairment in later years of life [6–8]. Persons with higher cumulative socioeconomic status (SES) demonstrated an advantage in cognitive functioning [9]. A growing body of literature suggests that people who accumulated more wealth may be able to more easily translate it into better environmental circumstances or less stressful living conditions, further contributing to better cognitive health in later life [7, 10, 11]. Studies reported improvements in mental well-being for older people after the introduction of an income supplemental program [12, 13]. Measured by a test of processing speed, associations of educational attainment and current poverty index were found with late-life cognitive impairment in multiple studies [7, 14, 15]. Furthermore, a major contributing factor may include poor literacy resulting in an inability to benefit from strategies for early prevention of cognitive impairment [16].

Two Approaches to SES: Subjective and objective SES measures

Objective SES, which is commonly indicated by household wealth index and individual educational attainment [17]. Although these indicators are highly correlated [18], they reflect more of one's power or prestige [19]. In comparison, the subjective SES captures individuals' perceptions of their position in the social hierarchy, thus representing a psychological process [20].

In this regard, people make judgments of where they belong in the social hierarchy relative to others based on cognitive averaging of their economic status, education, occupation, and other objective indicators using different reference groups [17]. There is a growing body of research documenting that if people perceive themselves to be subordinate to others, they report lower self-esteem and greater stress, and they are likely to suffer from diseases more often than people who do not regard themselves to be of lower status [21]. Hence, subjective

SES as a rank-based judgment that is composed of an evaluative judgment of where the objective resources would place a person in rank within a specific context, which is derived mainly via the social comparison process.

Evidence for the association between poor socioeconomic indicators with worse mental health outcomes is abundant in the geriatric research. Many previous studies in India and other countries have reinforced that illiteracy and poor financial status were strongly associated with worse cognitive function at the individual level [1, 22, 23]. However, the difference in the role that subjective and objective socioeconomic factors play in contributing to declining in late life cognition is poorly understood in the context of developing countries. Therefore, we in this study aim to explore the late-life cognitive impairment as a function of older individuals' objective and subjective SES using a large representative survey information of older adults aged 60 and above in India.

Methods

Data

Data for this study was utilized from the recent release of Longitudinal Ageing Study in India (LASI) wave 1 [24]. LASI is a full-scale national survey of scientific investigation of the health, economic, and social determinants and consequences of population aging in India, conducted in 2017-18. The LASI is a nationally representative survey of over 72000 older adults aged 45 and above across all states and union territories of India [24]. The main objective of the survey is to study the health status and the social and economic well-being of older adults in India. LASI adopted a multistage stratified area probability cluster sampling design to arrive at the eventual units of observation: older adults age 45 and above and their spouses irrespective of age. The survey adopted a three-stage sampling design in rural areas and a four-stage sampling design in urban areas. In each state/UT, the first stage involved the selection of Primary Sampling Units (PSUs), that is, sub-districts (Tehsils/Talukas), and the second stage involved the selection of villages in rural areas and wards in urban areas in the selected PSUs [24]. In rural areas, households were selected from selected villages in the third stage. However, sampling in urban areas involved an additional stage. Specifically, in the third stage, one Census Enumeration Block (CEB) was randomly selected in each urban area [24]. In the fourth stage, households were selected from this CEB. The detailed methodology, with the complete information on the survey design and data collection, was published in the survey report [24]. The present study is conducted on eligible respondents

aged 60 years and above. The total sample size for the present study is 31,464 older adults aged 60 years and above.

Variable description

Outcome variable

Cognitive impairment was measured through five broad domains (memory, orientation, arithmetic function, executive function, and object naming). The cognitive impairment in our study is based on the different cognitive measures including: immediate (0–10 points) and delayed word recall (0–10 points); orientation related to time (0-4 points), and place (0-4 points); arithmetic ability based on serial 7s (0–5 points), computation (0-2) and backward counting from 20 (0–2 points); executive functioning based on paper folding (0-3) and pentagon drawing (0-1); and object naming (0-2). The overall score ranges between 0 and 43, and a higher score indicate better cognitive functioning. In our study, the respondents who received assistance during the cognition module were excluded from the analysis. The lowest 10th percentile is used as a proxy measure of poor cognitive functioning [24].

Control variables

The control variables were divided into four sections namely socio-economic status (SES), individual factors, health factors and household factors.

Socio-economic status

The main explanatory variables were subjective socio-economic status and objective socio-economic status among older adults.

1. The subjective socio-economic status was assessed using ladder technique and the question used to assess the variable was “Think of the ladder with 10 stairs as representing where people stand in our society. At the top of the ladder are the people who are the best off – those who have the most money, most education, and best jobs. At the bottom are the people who are the worst off – who have the least money, least education, and the worst jobs or no jobs. The higher up you are on this ladder, the closer you are to the people at the very top and the lower you are, the closer you are to the people at the very bottom of your society”. A score of 0-10 was hence generated using this technique and variable subjective socio-economic status was coded as 0-3 as “low”, 4-7 as “middle” and 8-10 as “high” [25].

2. The monthly per capita expenditure (MPCE) quintile was assessed using household consumption data. Sets of 11 and 29 questions on the expenditures on food and non-food items, respectively, were used to canvas the sample households. Food expenditure was collected based on a reference period of seven days, and non-food expenditure was collected based on reference periods of 30 days and 365 days. Food and non-food expenditures have been standardized to the 30-day reference period. The monthly per capita consumption expenditure (MPCE) is computed and used as the summary measure of consumption [24]. The variable was then divided into five quintiles i.e., from poorest to richest. The variable objective socio-economic status was coded as low which includes poorest and poorer, middle which includes middle and high which includes richer and richest [26].

Individual factors

Age was coded as young old (60-69 years), old-old (70-79 years), and oldest-old (80+ years). Sex was coded as male and female. Educational status was coded as no education/primary not completed, primary, secondary and higher. Working status was coded as currently working, retired, and not working [27]. Marital status was coded as currently married, widowed and others. Others included divorced/separated/never married. Living arrangement was coded as living alone, living with spouse, living with spouse and children and living with others [28]. Social participation was coded as no and yes. Social participation was measured through the question “Are you a member of any of the organizations, religious groups, clubs, or societies? The response was coded as no and yes. Physical activity status was coded as frequent (every day), rare (more than once a week, once a week, one to three times in a month), and never. The question through which physical activity was assessed was “How often do you take part in sports or vigorous activities, such as running or jogging, swimming, going to a health centre or gym, cycling, or digging with a spade or shovel, heavy lifting, chopping, farm work, fast bicycling, cycling with loads”? [24].

Health factors

The probable major depression among the older adults with symptoms of dysphoria, calculated using the CIDI-SF (Short Form Composite International Diagnostic Interview) score of 3 or more. This scale estimates a probable psychiatric diagnosis of major depression and has been validated in field settings and widely used in population-based health surveys [24]. The lowest 10th percentile is used as a proxy measure for major depression among older

adults. Self-rated health was coded as good which includes excellent, very good, and good whereas poor includes fair and poor [29]. Difficulty in ADL (Activities of Daily Living) was coded as no and yes. Activities of Daily Living (ADL) is a term used to refer to normal daily self-care activities (such as movement in bed, changing position from sitting to standing, feeding, bathing, dressing, grooming, personal hygiene, etc.) The ability or inability to perform ADLs is used to measure a person's functional status, especially in the case of people with disabilities and the ones in their older ages [27]. Difficulty in IADL (Instrumental Activities of Daily Living) was coded as no and yes. Activities of daily living that are not necessarily related to the fundamental functioning of a person, but they let an individual live independently in a community. These tasks are necessary for independent functioning in the community. Respondents were asked if they were having any difficulties that were expected to last more than three months, such as preparing a hot meal, shopping for groceries, making a telephone call, taking medications, doing work around the house or garden, managing money (such as paying bills and keeping track of expenses), and getting around or finding an address in unfamiliar places [30]. Morbidity was coded as no morbidity, 1 and 2+ [30].

Household factors

Religion was coded as Hindu, Muslim, Christian, and Others [31]. Caste was recoded as Scheduled Tribe, Scheduled Caste, Other Backward Class, and others [31]. The Scheduled Caste include "untouchables"; a group of the population that is socially segregated and financially/economically by their low status as per Hindu caste hierarchy. The Scheduled Tribes (STs) and Scheduled Castes (SCs) are among the most disadvantaged and discriminated socio-economic groups in India. The OBC is the group of people who were identified as "educationally, economically and socially backward". The OBC's are considered low in the traditional caste hierarchy but are not considered untouchables. The "other" caste category is identified as having higher social status [32]. Place of residence was coded as rural and urban. The regions of India were coded as North, Central, East, Northeast, West, and South [28].

Statistical analysis

Descriptive statistics along with cross-tabulation were presented in the present study. Chi square test was used to evaluate the significance level of differences in cognitive impairment for subjective and objective SES [33, 34]. Additionally, binary logistic regression analysis

[35] was used to establish the association between the outcome variable (cognitive impairment) and socio-economic status.

The binary logistic regression model is usually put into a more compact form as follows:

$$\text{Logit [P(Y = 1)]} = \beta_0 + \beta * X + \epsilon$$

The parameter β_0 estimates the log odds of cognitive impairment for the reference group, while β estimates the maximum likelihood, the differential log odds of cognitive impairment associated with a set of predictors X, as compared to the reference group, and ϵ represents the residual in the model. Variance inflation factor (VIF) was generated in STATA 14 [36] to check the multicollinearity and it was found that there was no evidence of multicollinearity in the variables used [37, 38].

Moreover, interaction effects [30, 39–42] were observed for subjective SES and objective SES with cognitive impairment among older adults in India.

Results

Table-1 represents socio-economic and demographic profile of older adults in India. It was found that about 41.7 per cent of older adults belong to low subjective SES and nearly seven per cent belong to higher subjective SES. Additionally, about 43.4 per cent of older adults belonged to low objective SES and about 35.6 percent belonged to higher objective SES.

About 26.4 per cent of older adults got retired and 30.8 per cent were currently working. Nearly 36.2 per cent of older adults were widowed. Almost 5.7 per cent of older adults were living alone and 68.3 per cent were living with their children and spouse. Only 4.5 per cent of older adults reported they socially participate. Nearly, 69.3 per cent of older adults were never involved in any physical activity. About 8.7 per cent of older adults suffered from major depression. Nearly, 48.6 per cent of older adults reported poor self-rated health. About 24.4 percent and 48.7 per cent of older adults reported difficulty in ADL and IADL.

[Insert table-1 here]

Figure-1 reveals percentage of older adults with cognitive impairment by their subjective and objective socio-economic status. It was found that lower the subjective (17.8 per cent) and objective SES (16.6 per cent) status of an older adults higher the percentage of cognitive impairment among them.

[Insert figure-1 here]

Figure-2 represents the plots for logistic regression estimates for cognitive impairment among older adults in India. In model-1 which is an unadjusted model it was found that the older adults who belonged to lower subjective SES had significantly higher odds for cognitive impairment [UOR: 3.83; $p < 0.05$] in reference to older adults who belonged to higher subjective SES. Moreover, older adults who belonged to lower objective SES had 50% significantly higher likelihood to suffer from cognitive impairment [UOR: 1.50; $P < 0.05$] in comparison to older adults who belonged to higher objective SES.

Similarly, in model-2 which is an adjusted model, it was revealed that the older adults who belonged to lower subjective SES had significantly higher odds for cognitive impairment [AOR: 2.04; $p < 0.05$] in reference to older adults who belonged to higher subjective SES. Moreover, older adults who belonged to lower objective SES had 32% significantly higher likelihood to suffer from cognitive impairment [AOR: 1.32; $p < 0.05$] in comparison to older adults who belonged to higher objective SES.

In model-3 which reveals the interaction results for cognitive impairment. It was found that older adults who belong to lower subjective as well as objective SES were 2.45 times significant more likely to suffer from cognitive impairment in reference to older adults from higher subjective as well as objective SES [AOR: 2.45; $p < 0.05$].

[Insert figure-2 here]

Discussion

This study using a large representative information on older population in India was in parallel to multiple earlier studies in India and other developing countries which found that older individuals with higher SES experience cognitive impairment compared with people with lower SES [1, 43–45]. This association has been identified in case of both objective and subjective measures of SES. Moreover, studies have amassed empirical evidence on the positive relationship between SES as measured by objective indices of material resources along with subjective measures and psychological well-being [46, 47]. Similarly, the interactive effect in our study found that older adults with lower levels of subjective and objective SES were at greater risk of cognitive impairment.

However, subjective SES was identified to have a much stronger association with cognitive impairment in the unadjusted and adjusted regression estimates in comparison to objective SES. With respect to this strong association, there can be some possible explanations. At first,

obviously, subjective SES was more meaningful than household wealth index. Higher economic status does not necessarily mean more available resources, if compared with higher individual circumstances, but positive social comparison does. In addition, people with greater household economic status may endure more pressures and mental stress, which in turn may affect their mental health status and cognitive ability [48]. This could be mainly due to the subjectivity character of subjective SES. This potential explanation can also be attributed to different perceptions towards wealth and social statuses among older population in India.

The finding underscores the need for further longitudinal investigation of subjective SES-related measurement strategies to obtain a better understanding of the SES-cognitive functioning link especially in poor resource settings. The effects of country affluence on population health have been demonstrated. Several cross-country comparisons have documented considerable variations in the strength of subjective SES-health relationship between affluent and low-income countries with a stronger association in the later ones [49, 50].

There are several limitations of the present study to be considered. The major limitation is the cross-sectional design of the study eliminating the drawing of causal inferences among variables. Indeed, it is important to consider that some individuals may become cognitively impaired because they are illiterate and could not respond to several measures with accuracy. Finally, there may also be floor or ceiling effects for SES because we have only three categories for both SES measures. Notwithstanding these limitations, there were several advantages in this study. At first, this may be the first study to identify the association between both objective and subjective SES indicators and cognitive impairment based on a comprehensive measure with a score of 0 to 43 among the older Indian population. The large sample of the present study that is free from selection bias includes all SES groups of Indian population that credits to the representativeness and generalizability of the findings. Further, the findings of the present study provide empirical support to the body of literature that highlights the vulnerability of older adults who have low subjective and objective socioeconomic status to the worse mental health outcomes.

Conclusion

In conclusion, the findings of the study highlight the importance of subjective SES measure in assessing mental health outcomes in developing countries. The results also suggest that

more attention should be placed on subjective SES indicators when investigating socioeconomic influences on cognitive functioning among older adults in India.

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Table-1. Socio-economic and demographic profile of older adults in India.

Background characteristics		Sample	Percentage
Socio-economic status			
Subjective SES			
	Low	13,127	41.7
	Medium	16,142	51.3
	High	2,195	7.0
Objective SES			
	Low	13,660	43.4
	Medium	6,590	21.0
	High	11,213	35.6
Individual characteristics			
Age			
	Young-old	18,410	58.5
	Old-old	9,501	30.2
	Oldest-old	3,553	11.3
Sex			
	Male	14,931	47.5
	Female	16,533	52.6
Education			
	Not educated/primary not completed	21,381	68.0
	Primary	3,520	11.2
	Secondary	4,371	13.9
	Higher	2,191	7.0
Working status			
	Working	9,680	30.8
	Retired	13,470	42.8
	Not working	8,314	26.4
Marital status			
	Currently married	19,391	61.6
	Widowed	11,389	36.2
	Others	684	2.2
Living arrangement			
	Living alone	1,787	5.7
	Living with spouse	6,397	20.3
	Living with children and spouse	21,475	68.3
	Living with others.	1,805	5.7
Social participation			
	No	30,053	95.5
	Yes	1,411	4.5
Physical activity			
	Frequent	5,651	18.0
	Rarely	4,023	12.8
	Never	21,790	69.3
Health factors			
Depression*			
	No	27,995	91.3
	Yes	2,657	8.7
Self-rated health*			
	Good	15,850	51.4

Difficulty in ADL	Poor	14,961	48.6
	No	23,802	75.7
Difficulty in IADL	Yes	7,662	24.4
	No	16,130	51.3
Morbidity	Yes	15,334	48.7
	No morbidity	14,773	47.0
	1	9,171	29.2
	2+	7,520	23.9
Household factors			
Religion			
	Hindu	25,871	82.2
	Muslim	3,548	11.3
	Christian	900	2.9
	Others	1,145	3.6
Caste			
	Scheduled Caste	5,949	18.9
	Scheduled Tribe	2,556	8.1
	Other Backward Class	14,231	45.2
	Others	8,729	27.7
Place of residence			
	Rural	22,196	70.6
	Urban	9,268	29.5
Region			
	North	3,960	12.6
	Central	6,593	21.0
	East	7,439	23.6
	Northeast	935	3.0
	West	5,401	17.2
	South	7,136	22.7
Total		31,464	100.0

**if Sample may be less due to missing cases.*

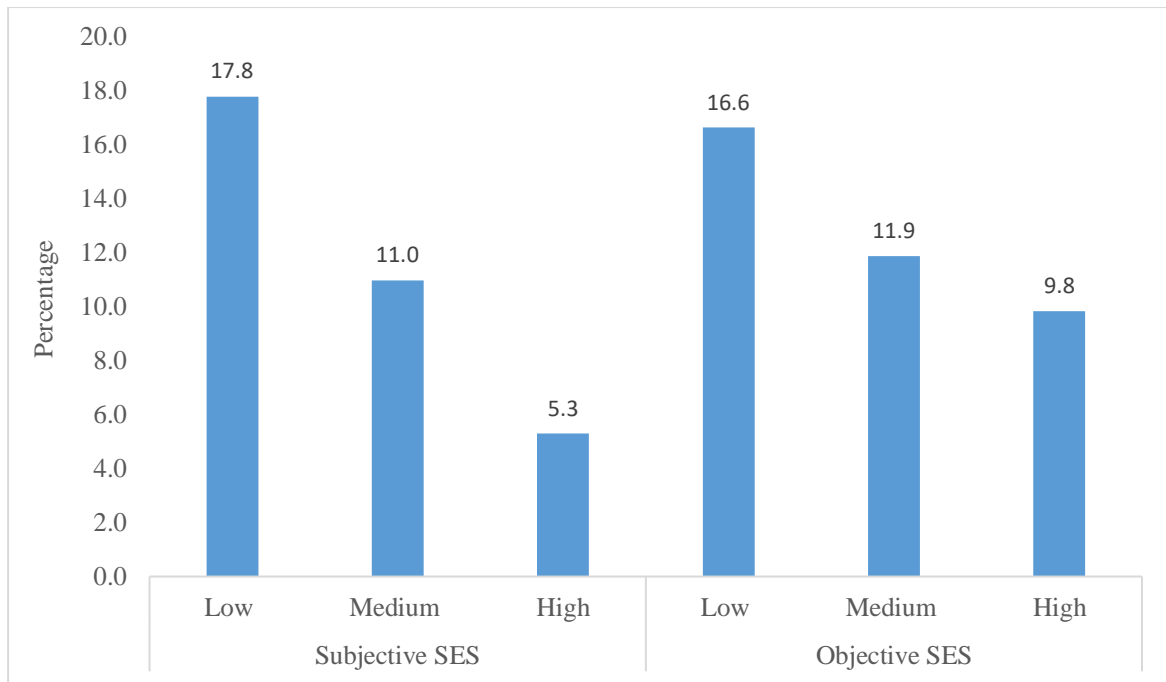
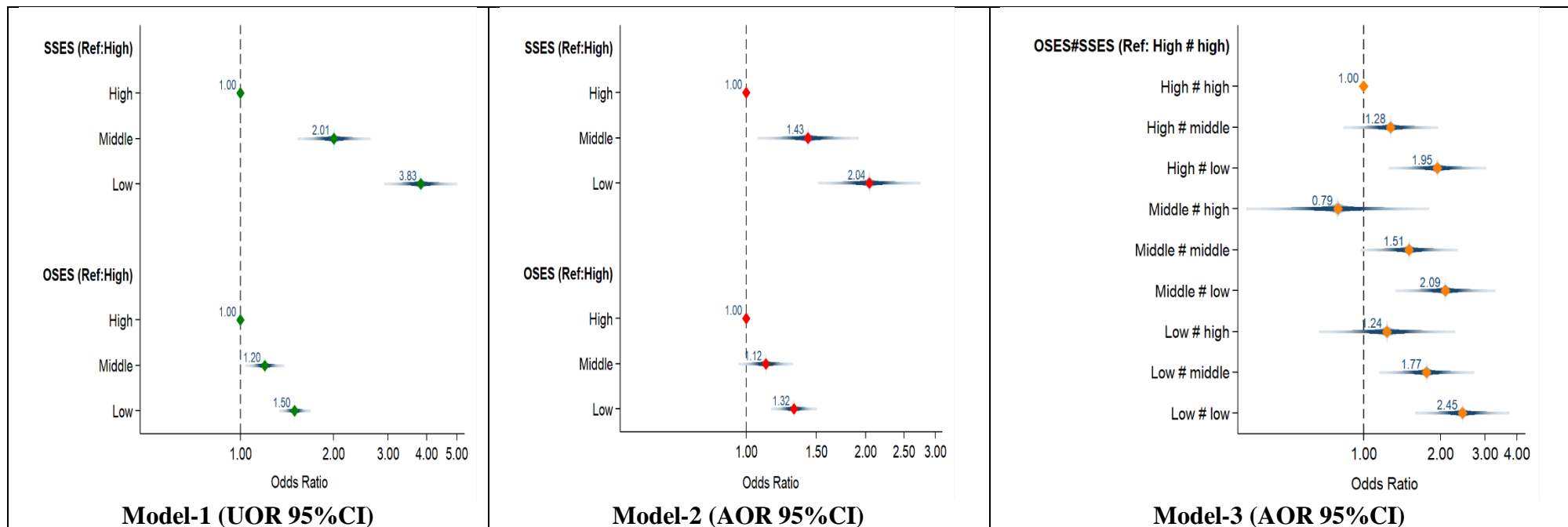


Figure-1. Percentage of older adults with cognitive impairment by their subjective and objective socio-economic status.



#: Interaction; Ref: Reference; UOR: Unadjusted Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval; SES: Socio-economic status; Model-2 and Model-3 were adjusted for Individual, Health and Household factors; SSES: Subjective socio-economic status; OSES: Objective socio-economic status

Figure-2. Plots for logistic regression estimates for cognitive impairment among older adults in India.

Supplementary material

Table-S1. Logistic regression estimates for cognitive impairment among older adults in India, 2017-18

Background characteristics	Model-1 UOR (95% CI)	Model-2 AOR (95% CI)	Model-3 AOR (95% CI)
Socio-economic status			
Subjective SES			
High	Ref. 2.01*(1.63,2.47)	Ref.	
Medium)	1.43*(1.14,1.79)	
Low)	2.04*(1.63,2.56)	
Objective SES			
High	Ref. 1.20*(1.07,1.34)	Ref.	
Medium)	1.12(0.99,1.26)	
Low)	1.32*(1.19,1.46)	
Subjective SES # Objective SES			
High # high			Ref.
High # middle			1.28(0.92,1.77)
High # low			1.95*(1.39,2.72)
Middle # high			0.79(0.42,1.48)
Middle # middle			1.51*(1.08,2.11)
Middle # low			2.09*(1.49,2.95)
Low # high			1.24(0.77,1.98)
Low # middle			1.77*(1.28,2.45)
Low # low			2.45*(1.77,3.39)
Individual characteristics			
Age			
Young-old		Ref.	Ref.
Old-old		1.61*(1.46,1.78)	1.61*(1.46,1.78)
Oldest-old		2.95*(2.58,3.37)	2.95*(2.58,3.37)
Sex			
Male		Ref.	Ref.
Female		2.1*(1.88,2.34)	2.1*(1.88,2.34)
Education			
Not educated/primary not completed		22.4*(10.58,47.41)	22.4*(10.58,47.41)
Primary		3.83*(1.75,8.36)	3.83*(1.75,8.36)
Secondary		1.94(0.86,4.38)	1.94(0.86,4.38)
Higher		Ref.	Ref.
Working status			
Working		Ref.	Ref.
Retired		1.17*(1.03,1.33)	1.17*(1.03,1.33)
Not working		1.34*(1.17,1.54)	1.34*(1.17,1.54)
Marital status			

Currently married	Ref.	Ref.
Widowed	1.37*(1.23,1.53)	1.37*(1.23,1.53)
Others	1.34*(1.01,1.79)	1.34*(1.01,1.79)
Living arrangement		
Living alone	Ref.	Ref.
Living with spouse	1.18(0.95,1.46)	1.18(0.95,1.46)
Living with children and spouse	1.04(0.87,1.24)	1.04(0.87,1.24)
Living with others.	1.29*(1.03,1.61)	1.29*(1.03,1.61)
Social participation		
No	1.65*(1.3,2.09)	1.65*(1.3,2.09)
Yes	Ref.	Ref.
Physical activity		
Frequent	Ref.	Ref.
Rarely	1.06(0.89,1.26)	1.06(0.89,1.26)
Never	1.35*(1.17,1.55)	1.35*(1.17,1.55)
Health factors		
Depression		
No	Ref.	Ref.
Yes	1.09(0.93,1.27)	1.09(0.93,1.27)
Self-rated health		
Good	Ref.	Ref.
Poor	1.27*(1.16,1.39)	1.27*(1.16,1.39)
Difficulty in ADL		
No	Ref.	Ref.
Yes	1.41*(1.26,1.56)	1.41*(1.26,1.56)
Difficulty in IADL		
No	Ref.	Ref.
Yes	1.37*(1.24,1.5)	1.37*(1.24,1.5)
Morbidity		
No morbidity	Ref.	Ref.
1	0.81*(0.74,0.9)	0.81*(0.74,0.9)
2+	0.73*(0.65,0.82)	0.73*(0.65,0.82)
Household factors		
Religion		
Hindu	Ref.	Ref.
Muslim	1.02(0.89,1.17)	1.02(0.89,1.17)
Christian	0.97(0.81,1.17)	0.97(0.81,1.17)
Others	0.83(0.68,1.02)	0.83(0.68,1.02)
Caste		
Scheduled Caste	Ref.	Ref.
Scheduled Tribe	1.48*(1.28,1.73)	1.48*(1.28,1.73)
Other Backward Class	0.81*(0.72,0.91)	0.81*(0.72,0.91)
Others	0.82*(0.72,0.94)	0.82*(0.72,0.94)
Place of residence		
Rural	Ref.	Ref.
Urban	0.54*(0.48,0.6)	0.54*(0.48,0.6)
Region		
North	Ref.	Ref.
Central	0.81*(0.7,0.95)	0.81*(0.7,0.95)
East	0.86*(0.75,1)	0.86*(0.75,1)

Northeast	1.07(0.89,1.28)	1.07(0.89,1.28)
West	1.26*(1.08,1.49)	1.26*(1.08,1.49)
South	0.87(0.75,1.01)	0.87(0.75,1.01)

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