

Socio-economic inequality in functional disability and impairments with focus on Instrumental Activity of Daily Living: A Study on Older Adults in India

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Abstract

Background

Studies have examined functional disability among older adults by combining Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL). This study adds another dimension to ADL and IADL by combining various impairments such as hearing, vision, walking, chewing, speaking, and memory loss among older adults. This study examines functional disability among older adults in India as measured by ADL, IADL, along with various impairments.

Methods

This study utilized data from Building a Knowledge Base on Population Aging in India (BKPAI), a national-level survey and conducted across seven states of India. The study utilized three outcome variables, namely, ADL, IADL, and Impairments. Descriptive and bivariate analyses were used along with multivariate analysis to fulfill the objectives of the study. The concentration index was calculated for ADL, IADL, and impairments, and further, decomposition analysis was carried out for IADL.

Results

The results observed that nearly 7.5 percent of older adults reported ADL, more than half (56.8%) reported IADL, and nearly three-fourths (72.6%) reported impairments. Overall, ADL, IADL, and impairments were higher among older adults aged 80 + years, older adults with poor self-rated health, and those suffering from chronic diseases. Educational status and wealth explained most of the socio-economic inequality in the prevalence of IADL among older adults.

Conclusion

It is recommended that the government advise older adults to adopt health-promoting approaches, which may be useful. Further, there is a pressing need to deliver quality care to older adults suffering from chronic conditions.

Background:

Dialogues that took place during the World Assembly on Ageing, which was held in Vienna in 1982, have pushed the focus on ageing around the world [1]. It has been more than 35 years since then, ageing has risen significantly on the policy discourse across the countries [2]. However, the pace at which focus was given on ageing was not similar across the countries, much linked to the countries' current status of demographic transition [3]. Developed countries have raced ahead of developing countries in providing a healthy and quality life to their older adults [4]. This prompted us to examine functional disability status

among older adults in one of the developing countries, i.e., India. Improving life expectancy and declining fertility has played a significant role in raising the share of older adults in India. Currently, older adults share around 8 percent of India's total population, which is expected to rise to 19 percent by 1950 [5]. The higher share of older adults implies a higher burden of disease and functional disability among older adults [5].

This study intends to examine functional disability among older adults in India. Three different indicators of functional disability were examined in this study: Activity of Daily Living (ADL), Instrumental Activity of Daily Living (IADL), and impairments related to bodily functions like hearing, vision, walking, chewing, speaking, and memory. ADL and IADL have been studied widely to measure functional disability across various settings [6]. However, a limited scholarship is available in examining impairments related to bodily functions along with ADL and IADL [7]. Activities of Daily Living have been categorised into two groups: Basic activities and Instrumental activities [8]. Both ADL and IADL depict functional disability; however, these two are different. Basic ADLs are generally linked to motor functions, whereas Instrumental ADLs are more linked to cognitive functions [9]. In this study, Basic ADL includes bathing, dressing, toilet, mobility, continence, and feeding. Instrumental ADLs encompass activities that are a set of complex voluntary behaviour directed to achieve a goal, such as managing finances, housekeeping, problem-solving, and so on [10]. In this study, IADL includes eight functional limitations: the ability to use a phone, shopping, food preparation, housekeeping, laundry, transportation, medication, and finances.

Activities of Daily Living assume greater relevance in the Indian context as the elderly population is rising in India [11]. First proposed by Katz et al. (1963), ADL as an original measure included six activities of daily living, namely, difficulty with bathing, dressing, toileting, transferring, continence, and feeding [12]. This study has the same six activities of ADL, as was proposed by Katz et al. in 1963. The activities included as a measure of ADL in this study have been concordant with the previous studies in the Indian context [13]. Previously available literature in the Indian context noticed that ADL among older adults differs by various socio-economic characteristics [6,14]. Lawton and Brody (1969) proposed the eight activities as a measure of IADL, namely, using the telephone, managing money, handling medications, preparing meals, doing housework, laundry, transportation, and shopping [15]. This study used the same eight activities to measure the IADL as proposed by Lawton and Brody (1969). Various studies have measured functional performance among older adults by self-reported activities of daily living and instrumental activities of daily living; however, these tools do not provide enough data on actual functional capacity among older adults [16]. Therefore, in this study, we have added another dimension and examined various impairments among older adults in India. This study includes six types of impairments: hearing, vision, walking, chewing, speaking, and memory. ADL and IADL precisely measure functional disability; however, impairments measure an actual level of disability among older adults [17].

Extensive research is available on ageing in developed countries; there is a dearth of research on ageing among developing countries like India. There is a lack of epidemiological data from India, and the issue of functional disability along with impairments is one of the issues that has not been given sufficient attention. Therefore, this study aimed to examine the correlates of ADL, IADL, and Impairments among

older adults in India. Further, this study examined economic inequality in ADL, IADL, and Impairments among older adults with the concentration curve's help. Finally, the current study proposes to decompose the socio-economic factors of ADL, IADL, and Impairments.

Methods:

Data

The present research used data from Building a Knowledge Base on Population Aging in India (BKPAI), a national-level survey conducted in 2011 across seven states of India. The survey was sponsored by the Institute for Social and Economic Change (ISEC), Tata Institute for Social Sciences (TISS), Institute for Economic Growth (IEG), and United Nations Population Fund (UNFPA), New Delhi. The survey gathered information on various socio-economic and health aspects of ageing among those aged 60 years and above. Seven major regionally representative states were selected for the survey with the highest 60+ years population than the national average. This survey was carried out on a representative sample in India's northern, western, eastern, and southern parts following a random sampling process.

The Primary Sampling Unit (PSU) was villages for rural areas and urban wards in urban areas. The sample of 1280 elderly households was fixed for each state. Further details on the sampling procedure, the sample size is available in national and state reports of BKPAI, 2011 (BKPAI, 2012) [18]. For the current study, the effective sample size was 9541 older adults residing in seven states aged 60+ years were selected.

Outcome variables

This study utilized three outcome variables, namely ADL (Activity of Daily Living), IADL (Instrumental Activity of Daily Living), and Impairments. ADL was dichotomized from six questions asked to the older adults, given in the supplementary file 1. Activities of daily living (ADL) were categorized on a scale of 0 to 6, wherein a higher score represents higher independence. A detailed methodology on how we formed ADL is given in the supplementary file 1.

Instrumental activities of daily living were categorized into a scale of 0 to 8, wherein a higher score represents higher independence (For detail, see supplementary file 1). A score of 6+ was categorized as 0, representing high IADL, and a score of 5 and less was recoded as 1 representing low IADL [19]. At last, impairment was coded as 0 means "no impairment," and 1 means "having an impairment" (For detail, see supplementary file 1).

Predictor variables

The predictor variables included age (60-69, 70-79 and 80+ years), gender (men and women), education (no education, below five years, 6-10 years and 11+ years), marital status (not in a union and currently in a union), living arrangement (alone, with spouse, with children and others), economic independence (independent, pension and dependent), working status (no, yes and retired), having children (yes and no),

self-rated health (good and poor), chronic disease (no and yes), substance use (no and yes), wealth (poorest, poorer, middle, richer, and richest), religion (Hindu, Muslim, Sikh, and others), Caste (Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Class (OBC) and others), residence (rural and urban) and states (Himachal Pradesh, Punjab, West Bengal, Orrisa, Maharashtra, Kerala, and Tamil Nadu).

Statistical analysis.

Descriptive statistics and bivariate analysis were used to find the preliminary results. Further, multivariate analysis (binary logistic) has been done to fulfill the objectives of the study. The results were presented in an odds ratio (OR) with a 95% confidence interval (CI).

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

$$\ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 x_1 + \cdots + \beta_M x_{m-1},$$

Where β_0, \dots, β_M are the regression coefficient indicating the relative effect of a particular explanatory variable on the outcome. These coefficients change as per the context in the analysis in the study.

Moreover, the wealth quintile was the critical variable to measure the economic status of the household. A household wealth index was calculated in the survey by combining household amenities, assets, and durables and characterizing households in a range varying from the poorest to the richest, corresponding to wealth quintiles ranging from the lowest to the highest.

The study used wealth score (continuous variable) for decomposition analysis. For calculating the Concentration Index (CI), the study used the wealth quintile, divided into five equal sizes of the population.

Concentration index

The concentration index was calculated for ADL, IADL, and impairments. Concentration index represents the magnitude of inequality by measuring the area between the concentration curve and line of equality and is calculated as twice the weighted covariance between the outcome and fractional rank in the wealth distribution divided by the variable mean.

The concentration index can be written as follows:

$$C = \frac{2}{\mu} \text{cov}(y_i, R_i)$$

Where C is the concentration index; Y_i is the outcome variable index; R is the fractional rank of individual i in the distribution of socio-economic position; μ is the mean of the outcome variable of the sample, cov denotes the covariance. The index value lies between -1 to +1.

Further, the study decomposes the concentration index to understand the relative contribution of various socio-economic factors to IADL among older adults. We only decomposed factors for IADL and not for ADL and impairments as the concentration index result for ADL and impairments did not show any observed socio-economic inequality. For decomposing the socio-economic factors, the study used a regression-based decomposition technique proposed by Wagstaff et al. [20].

Results:

The socio-demographic profile of older adults was presented in *table 1*. Only 7% of older adults had a high score for ADL, whereas about 57% and 73% of older adults had high IADL and impairment, respectively.

Table-1 Socio-economic profile of older adults in India

Variable	Sample	Percentage
ADL		
Low	8,800	92.5
High	712	7.5
IADL		
Low	4,112	43.2
High	5,400	56.8
Disability		
No	2,611	27.5
Yes	6,901	72.6
Age (years)		
60-69	5,875	61.8
70-79	2,606	27.4
80+	1,031	10.8
Gender		
Men	4,517	47.5
Women	4,995	52.5
Educational Status		
No Education	4,857	51.1
Below 5 years	1,948	20.5
6 to 10 Years	2,129	22.4
11+ years	578	6.1
Marital Status		
Not in Union	3,745	39.4
Currently in Union	5,767	60.6
Living Arrangement		
Alone	558	5.9
With Spouse	1,518	16.0

With children	6,696	70.4
Others	740	7.8
Working Status		
No	6,396	67.3
Yes	2,307	24.3
Retired	809	8.5
Having children		
Yes	9,107	95.7
No	405	4.3
Self-rated health		
Good	4,254	44.7
Poor	5,258	55.3
Chronic diseases		
No	3,356	35.3
Yes	6,156	64.7
Substance use		
No	6,196	65.1
Yes	3,316	34.9
Wealth quintile		
Poorest	2,243	23.6
Poorer	2,107	22.2
Middle	1,963	20.7
Richer	1,766	18.6
Richest	1,429	15.0
Religion		
Hindu	7,549	79.4
Muslim	668	7.0
Sikh	897	9.4
Others	398	4.2

Caste		
Scheduled Caste	1,976	20.8
Scheduled Tribe	531	5.6
Other Backward Class	3,491	36.7
Others	3,513	36.9
Place of residence		
Rural	7,026	73.9
Urban	2,486	26.1
State		
Himachal Pradesh	1,469	15.4
Punjab	1,349	14.2
West Bengal	1,126	11.8
Orissa	1,452	15.3
Maharashtra	1,368	14.4
Kerala	1,348	14.2
Tamil Nadu	1,400	14.7
Total	9,512	100.0

The percentage distribution of ADL, IADL, and impairment among older adults by background characteristics was presented in *Table 2*. One-fourth (25.7%) of older adults aged 80+ years reported ADL problems, whereas about 85% and 91% of older adults aged 80+ years suffered from IADL and impairments, respectively. Around nine percent of women and six percent of men reported ADL related problems, while 74% of women and 71% of men older adults had an impairment. The education of older adults had a negative association with ADL, IADL, and impairment. Interestingly, only three percent of older adults reported ADL problems; however, about one-third and two-thirds of older adults living alone suffered from IADL and impairment. The prevalence of any impairment was higher among not working older adults than those who worked. Older adults had poor self-rated health and suffered from chronic diseases reported more ADL (11.4% & 9.9%), IADL (64.3% & 58.4%), and impairment (83.2% & 82.6%), respectively than their counterparts. About 68% of the poorest older adults reported the IADL problem, whereas 77% richest suffered from an impairment. ADL and IADL were more prevalent among lower caste groups (SC/ST) though impairment was higher in other caste groups. Older adults in rural areas reported functional disability and impairment (ADL-7.7%, IADL-59.6%, and impairment-74%) than their counterparts.

Table-2 Percentage of ADL, IADL, and Impairments among older adults by background characteristics in India

Background characteristics	ADL		IADL		Impairments	
	%	p<0.05	%	p<0.05	%	p<0.05
Age (years)	*		*		*	
60-69	3.4		47.4		65.6	
70-79	9.6		66.5		81.0	
80+	25.7		85.5		90.8	
Gender	*		*		*	
Men	5.8		56.3		70.7	
Women	9.0		57.2		74.2	
Educational Status	*		*		*	
No Education	9.2		69.7		75.4	
Below 5 years	7.6		51.2		77.0	
6 to 10 Years	4.5		40.5		62.0	
11+ years	3.9		26.3		72.5	
Marital Status	*		*		*	
Not in Union	10.9		63.0		77.4	
Currently in Union	5.3		52.7		69.4	
Living Arrangement	*		*		*	
Alone	3.4		36.4		66.5	
With Spouse	3.6		48.2		62.8	
With children	8.4		60.0		74.4	
Others	10.1		60.4		80.5	
Working Status	*		*		*	
No	10.4		63.3		76.2	
Yes	1.1		43.3		67.3	
Retired	2.6		43.4		58.9	
Having children	*		*		*	
Yes	7.7		57.0		72.7	

No	3.8	52.0	69.8	
Self-rated health	*	*	*	*
Good	2.6	47.5	59.4	
Poor	11.4	64.3	83.2	
Chronic diseases	*	*		
No	3.1	53.9	54.1	*
Yes	9.9	58.4	82.6	
Substance use				*
No	7.6	56.2	67.9	
Yes	7.3	57.8	81.2	
Wealth quintile		*		*
Poorest	7.9	67.6	76.5	
Poorer	7.4	59.2	70.6	
Middle	8.2	55.3	70.0	
Richer	6.7	51.4	69.1	
Richest	7.1	45.0	77.2	
Religion	*	*		*
Hindu	7.3	57.4	71.6	
Muslim	11.7	58.1	79.1	
Sikh	6.1	61.3	71.1	
Others	6.4	32.1	83.8	
Caste	*	*		
Scheduled Caste	8.0	62.9	74.2	
Scheduled Tribe	5.5	63.4	74.4	
Other Backward Class	7.6	53.4	65.7	
Others	7.4	55.7	78.2	
Place of residence	*	*		*
Rural	7.7	59.6	74.1	
Urban	6.8	48.7	68.1	

State	*	*	*
Himachal Pradesh	7.8	60.2	67.9
Punjab	5.8	60.6	73.3
West Bengal	11.2	69.3	88.0
Orissa	8.5	71.1	82.9
Maharashtra	3.9	49.3	72.9
Kerala	9.7	34.5	82.2
Tamil Nadu	6.0	53.3	44.0
Total	7.5	56.8	72.6

*p<0.05; ADL: Activities of daily living; IADL: Instrumental activities of daily living

Results from logistic regression estimates for ADL, IADL, and impairment by background characteristics were presented in *Table 3*. The likelihood of ADL (OR, 6.42; CI: 5.1-8.08), IADL (OR, 5.08; CI: 4.16-6.21), and impairment (OR, 3.50; CI: 2.73-4.48) were significantly higher among older adults aged 80+ years compared to 60-69 years. Older adults with 6-10 years of schooling had lower IADL and impairment odds than older adults who were not educated. Older adults living with children were more likely to report ADL (OR, 2.40; CI: 1.51-3.83) and IADL (OR, 2.65; CI: 1.57-4.46), related problem respectively, compared to older adults living alone. Working older adults had lower odds of ADL, IADL, and impairment than those who were not working. Older adults who had poor self-rated health and suffered from chronic diseases were more likely to report ADL (OR, 2.95; CI: 2.37-3.67 and OR, 2.70; CI: 2.13-3.43), IADL (OR, 1.74; CI: 1.57-1.92 and OR, 1.15; CI: 1.04-1.15), and impairment (OR, 2.36; CI: 2.11-2.63 and OR, 2.95; CI: 2.65-3.30), respectively compared to their counterparts.

Table-3 Logistic regression estimates for ADL, IADL, and Impairments by background characteristics among older adults in India

Background characteristics	ADL	IADL	Impairments
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (years)			
60-69			
70-79	2.33*(1.9,2.86)	1.85*(1.66,2.07)	1.86*(1.63,2.11)
80+	6.42*(5.1,8.08)	5.08*(4.16,6.21)	3.50*(2.73,4.48)
Gender			
Men			
Women	1.02(0.83,1.27)	0.57*(0.51,0.65)	1.03(0.9,1.18)
Educational Status			
No Education			
Below 5 years	1.00(0.8,1.27)	0.57*(0.5,0.65)	1.06(0.92,1.24)
6 to 10 Years	0.98(0.74,1.29)	0.44*(0.38,0.5)	0.79*(0.68,0.92)
11+ years	1.48(0.95,2.31)	0.21*(0.16,0.26)	1.18(0.93,1.5)
Marital Status			
Not in Union			
Currently in Union	1.01(0.81,1.24)	0.81*(0.72,0.91)	0.86*(0.75,0.98)
Living Arrangement			
Alone			
With Spouse	1.5(0.87,2.57)	2.79*(2.17,3.59)	0.78(0.6,1.02)
With children	2.40*(1.51,3.83)	4.13*(3.3,5.18)	0.91(0.72,1.16)
Others	2.65*(1.57,4.46)	3.98*(3.04,5.2)	0.97(0.72,1.3)
Working Status			
No			
Yes	0.16*(0.1,0.26)	0.47*(0.41,0.53)	0.85*(0.74,0.97)
Retired	0.41*(0.26,0.63)	0.81*(0.67,0.97)	0.83(0.68,1.01)
Having children			
Yes			

No	0.83(0.5,1.37)	1.03(0.8,1.32)	0.86(0.66,1.12)
Self-rated health			
Good			
Poor	2.95*(2.37,3.67)	1.74*(1.57,1.92)	2.36*(2.11,2.63)
Chronic diseases			
No			
Yes	2.70*(2.13,3.43)	1.15*(1.04,1.27)	2.95*(2.65,3.3)
Substance use			
No			
Yes	0.92(0.76,1.12)	0.92(0.83,1.03)	1.65*(1.45,1.87)
Wealth quintile			
Poorest			
Poorer	0.96(0.73,1.26)	0.88(0.75,1.03)	0.9(0.76,1.08)
Middle	0.87(0.65,1.17)	0.85(0.72,1.01)	0.86(0.71,1.04)
Richer	0.67*(0.48,0.92)	0.74*(0.61,0.89)	0.98(0.8,1.21)
Richest	0.72(0.51,1.03)	0.72*(0.58,0.88)	1.20(0.94,1.51)
Religion			
Hindu			
Muslim	1.41*(1.03,1.94)	1.51*(1.23,1.84)	0.91(0.72,1.14)
Sikh	1.24(0.79,1.93)	1.06(0.84,1.34)	0.78*(0.6,1)
Others	0.85(0.54,1.35)	0.85(0.66,1.09)	1.25(0.93,1.69)
Caste			
Scheduled Caste	1.08(0.85,1.38)	1.06(0.93,1.22)	0.92(0.78,1.07)
Scheduled Tribe	0.86(0.53,1.38)	0.95(0.75,1.2)	0.8(0.61,1.04)
Other Backward Class	1.05(0.83,1.34)	1.06(0.93,1.21)	0.83*(0.72,0.96)
Others			
Place of residence			
Rural			
Urban	1(0.83,1.21)	0.85*(0.77,0.95)	1.06(0.94,1.19)

State			
Himachal Pradesh			
Punjab	0.52*(0.35,0.79)	1.05(0.85,1.31)	1.02(0.81,1.28)
West Bengal	1.19(0.86,1.64)	1.74*(1.44,2.11)	2.51*(1.98,3.17)
Orissa	1.34(0.96,1.87)	2.21*(1.83,2.67)	2.62*(2.11,3.24)
Maharashtra	0.49*(0.33,0.71)	0.77*(0.65,0.93)	1.14(0.94,1.38)
Kerala	0.91(0.64,1.28)	0.35*(0.29,0.43)	1.38*(1.1,1.72)
Tamil Nadu	1.31(0.91,1.89)	1.25*(1.02,1.52)	0.51*(0.42,0.63)

*p<0.05; ADL: Activities of daily living; IADL: Instrumental activities of daily living; OR: odds ratio; CI: confidence interval

Results for Concentration Curve and Decomposition analysis:

Concentration curves for ADL, IADL, and impairments among older adults in India were displayed in figures 1, 2, and 3, respectively. If the curve is formed below the line of equality, inequality is concentrated towards the rich and vice-versa. Moreover, the more the area between the line of equality and curve, the higher is the inequality. The result noticed inequality of -0.001 (figure-1), -0.59 (figure-2) and -0.0004 (figure-3), respectively. The result noticed that inequality was significantly higher for IADL (-0.59) than ADL (-0.001) and impairment (-0.0004). The results noticed negligible inequality for ADL and impairment, and that is why this study could not decompose the factors for these two variables.

[Insert figure 1,2, & 3 Here]

Estimates of decomposition analysis for the contribution of various predictors for IADL among older adults in India were presented in *Table 4*. The negative CI denotes that IADL among older adults was concentrated among poor older adults for that particular predictor and vice-versa. Older adults aged 70-79 years, women, living with a spouse, working older adults, having children, poor self-rated health, Scheduled Tribe, OBC, and substance use concentrated more among the disadvantaged population IADL. On the other hand, having secondary or higher education, currently in a union, living with children, suffering from chronic diseases, belonged to Muslim or Sikh religion, and lived in urban areas inclined to better concentrate. Education status of older adults, wealth quintiles of household, self-rated health, and place of residence were the significant contributors to the inequalities for IADL among older adults. For instance, older adults' education explained 67% of SES-related inequality, and the household's wealth responsible for 38.2% of the SES-related inequality. Self-rated health and place of residence made a substantial contribution to the inequalities in IADL among older adults, explaining 5.6% and 2.2% of the total inequality, respectively.

Table 4: Estimates of decomposition analysis for contribution of various explanatory variables for IADL among older adults in India

Background characteristics	Coefficient	Elasticity	Concentration Index	Absolute contribution	% Contribution
Age (years)					
60-69					
70-79	0.62*	0.032	-0.015	-0.002	1.3
80+	1.63*	0.028	0.019	0.002	-1.4 -0.1
Gender					
Men					
Women	-0.55*	-0.063	-0.033	0.008	-5.7 -5.7
Educational Status					
No Education					
Below 5 years	-0.56*	-0.026	0.001	0.000	0.1
6 to 10 Years	-0.83*	-0.045	0.260	-0.046	31.7
11+ years	-1.58*	-0.021	0.614	-0.051	35.2 67.0
Marital Status					
Not in Union					
Currently in Union	-0.21*	-0.027	0.040	-0.004	2.9 2.9
Living Arrangement					
Alone					
With Spouse	1.03*	0.029	-0.197	-0.023	15.5
With children	1.42*	0.191	0.089	0.068	-46.5
Others	1.38*	0.021	0.092	0.008	-5.4 -36.5
Working Status					
No					
Yes	-0.76*	-0.039	-0.174	0.027	-18.8
Retired	-0.21*	-0.001	0.518	-0.002	1.5 -17.3
Having children					

Yes						
No	0.03	0.001	-0.359	-0.001	0.8	0.8
Self-rated health						
Good						
Poor	0.55*	0.054	-0.038	-0.008	5.6	5.6
Chronic diseases						
No						
Yes	0.14*	0.012	0.051	0.002	-1.6	-1.6
Substance use						
No						
Yes	-0.08	-0.004	-0.120	0.002	-1.3	-1.3
Wealth quintile						
Poorest						
Poorer	-0.13	-0.009	-0.338	0.011	-7.8	
Middle	-0.16	-0.010	0.138	-0.006	3.8	
Richer	-0.30*	-0.015	0.522	-0.031	21.0	
Richest	-0.33*	-0.010	0.761	-0.031	21.3	38.2
Religion						
Hindu						
Muslim	0.41*	0.005	0.146	0.003	-2.1	
Sikh	0.06	-0.001	0.311	-0.002	1.2	
Others	-0.17	-0.002	0.295	-0.002	1.4	0.6
Caste						
Scheduled Caste						
Scheduled Tribe	0.06	0.000	-0.444	0.001	-0.5	
Other Backward Class	-0.05	0.002	-0.029	0.000	0.1	
Others	0.06	0.004	0.220	0.004	-2.5	-2.8
Place of residence						

Rural						
Urban	-0.16*	-0.003	0.248	-0.003	2.2	2.2
State						
Himachal Pradesh						
Punjab	0.05	-0.001	0.331	-0.001	0.5	
West Bengal	0.56*	0.010	-0.163	-0.007	4.7	
Orissa	0.79*	0.015	-0.368	-0.023	15.4	
Maharashtra	-0.26*	-0.009	-0.126	0.005	-3.2	
Kerala	-1.04*	-0.030	0.350	-0.042	28.9	
Tamil Nadu	0.22*	0.003	-0.221	-0.003	1.7	48.0
Calculated CI				-0.146	100.0	
Actual CI				-0.073		
Residual				0.072		

Discussion:

The current study examined functional disability along with impairments among older adults in India. Functional disability was measured with ADL and IADL, whereas impairments among older adults were measured with six reported impairments such as; hearing, vision, walking, chewing, speaking, and memory. To our knowledge, this is the first research to evaluate the ADL and IADL, along with various impairments among older adults in India. We proposed to decompose socio-economic factors for all the three measurable outcomes, i.e., ADL, IADL, and impairments. However, we ended up decomposing IADL only as the other two outcomes (ADL and impairments) were having negligible socio-economic differences when calculated with the concentration curve. The results observed that nearly 7.5 percent of older adults reported ADL, more than half of the older adults (56.8%) reported IADL, and nearly three-fourths of the older adults (72.6%) reported impairments. The overall prevalence of ADL and IADL among older adults in India was higher than the prevalence of ADL and IADL among older adults in China [21] and in the United States [22].

Activities of Daily Living among Older Adults:

In this study, ADL was significantly higher in older adults aged 80+ years, currently living with children, currently not working, having poor self-rated health, and those who have chronic diseases. The findings are in concordance with the previous studies in the Indian setting [6]. Increasing age is one of the most significant variables in the study of ADL. Previous studies have unanimously highlighted that as age increases, people tend to observe a lower score on ADL means they are more likely to face functional

disability related to ADL [23]. In general, we observed that a higher percentage of older women reported poor ADL scores than older men. However, we could not find the significance of this result in our logistic regression model. However, various previous studies have significantly earmarked that older women tend to have a higher functional disability than older men [6,11]. Women in India tend to ignore their health and generally avoid seeking health care, which may further cause poor functional disability among them [24].

The study noted that working older adults were less likely to report problems associated with ADL than non-working older adults. Previous studies are in line with this study in finding that older adults who work were less likely to report issues on ADL than their counterparts [25]. Working protects older adults and acts as a safety net against reducing activities of daily living [25]. Working older adults have to travel every day in quest of their work, and hence they are less likely to report poor scores on activities of daily living. Self-rated health and chronic diseases were also found to be a significant crusader for ADL among older adults. Poor self-rated health and older adults with chronic diseases were more likely to report issues with ADL than their counterparts. Studies unanimously highlighted that chronic diseases and poor self-rated health are the two most significant variables in ADL study [6,26]. Studies have noted that older adults tend to suffer from various chronic diseases, and these chronic diseases result in functional disability among them [27]. A study is of the opinion that chronic disease is the most important factor affecting ADL among older adults [13].

Instrumental Activities of Daily Living among Older Adults:

As the age of the older adult increases, functional disability related to IADL increases among older adults. This finding is in concordance with previous studies, where a positive association was observed between poor responses on IADL and the increasing age of the older adults in various settings [28,29]. Results noticed that women older adults had a better outcome on IADL than men older adults; this means men older adults tend to have poor IADL than women older adults. Studies have mixed response to this finding as some studies noted that women older adults have higher levels of health-related limitations of IADL than men older [30], whereas some studies are in concordance with this study in finding that men older adults have greater levels of health-related limitations of IADL than women older adults [29,31]. A study noted that men were more likely to report needing help with cooking meals, doing laundry, and taking medicines, and this has substantial weightage on why a higher percentage of older men report limitations with IADL than older women [32].

This study has found that an increase in education decreases the IADL related limitations among older adults. Older adults with 11+ years of education were around 80 percent less likely to report limitations for IADL than older adults who had no education. Previous literature also highlighted the importance of educational attainment in decreasing the likelihood of reporting limitations for IADL among older adults [33]. Hu et al. (2005) believe that increased resource availability associated with higher education may improve self-perception and may decrease limitations with various health conditions [33]. The study noticed that older adults living alone had lower odds of limitations related to IADL than older adults living with a spouse or with children, or with anyone. This finding implicates that older adults living alone tend

to help themselves by carrying out work required for daily living; thus, they are less likely to report limitations with IADL than their counterparts. Francisco et al. (2018) also noticed that older adults who live alone tend to achieve better outcomes on activities related to IADL [34].

Results highlighted that working older adults had lower odds of reporting poor IADL than non-working older adults. Previous studies agree with this study in noticing differences in IADL with working status [31]. It can be understood that working older adults may tend to be physically active, which is why they report better outcomes for IADL. Studies have noted that physical activities improve IADL among older adults [35]. Poor self-rated health and chronic diseases among older adults were linked with a poor score on IADL. Previous studies also highlighted that chronic disease and poor self-rated health affect limitations related to IADL among older adults [29,34]. Regarding the possible relationship between SRH and IADL, Tomioka, Karumatani, & Hosoi (2017) believe that older adults with better SRH may be more likely to engage in social activities that promote better outcomes for IADL among them [29].

This study also examined socio-economic inequality in the prevalence of IADL among older adults in India. Results noticed that educational status and wealth quintile explained most of the socio-economic inequality in the prevalence of IADL among older adults. Previous studies also highlighted the importance of wealth in reducing inactivity related to IADL among older adults [35]. Income provides access to older adults to modify their current living conditions, positively affecting IADL [36].

Impairments among Older Adults:

This study also examined various impairments (hearing, vision, walking, chewing, speaking, and memory) among older adults, along with examining ADL and IADL. Results noticed that impairments were higher among older adults aged 80+ years, older adults with poor self-rated health and suffering from chronic diseases, older adults indulged in substance use. The impairments were lower among working older adults and older adults who were currently in a union. Previous studies unanimously highlighted that as age increases, older adults tend to perform poorly with hearing, vision, and other impairments [37]. About impairments, such as hearing, a study has noticed that age-related hearing loss was the third most prevalent chronic medical issue among older adults [38]. As age progresses, a study has highlighted that memory hampers among older adults, which is inadvertently not associated with education level among them [39].

Strengths and Limitations of the Study:

One of this study's main limitations is the self-reporting of data related to ADL, IADL, and impairments. Previous studies also assessed these measures as per the self-reporting of the respondents [11]. Furthermore, the study used chronic disease and self-rated health as two independent variables. These measures were also self-reported and may have biasness. Previous studies also used a self-reported measure of chronic disease and self-rated health as measuring chronic disease clinically may not be feasible [11]. Furthermore, due to the cross-sectional study, we could not identify a causal relationship. Despite various limitations, this study has quite a few strengths that make this study unique. At first, this

study examined various factors associated with impairments along with ADL and IADL, thus, adding one extra dimension to the study related to ADL and IADL. Moreover, the study intends to decompose the factors associated with inequality in the prevalence of ADL, IADL, and impairments; however, ended up decomposing only IADL as the other two factors were not having any significant observed socio-economic inequality.

Conclusion:

This study examined factors associated with functional disability and impairments among older adults in India. The study also intends to examine the contribution of various socioeconomic inequality factors in ADL, IADL, and impairments but ended up examining socio-economic inequality for IADL only as the other two factors did not show considerable socio-economic differences as measured through the concentration curve. The results of this study confirmed that older adults aged 80+ are more vulnerable than their counterparts. Additionally, it was revealed that the relationship between ADL, IADL, and impairments, and various socio-economic variables significantly varies by socio-economic factors. Although we cannot rule out the possibilities of other confounding factors, increasing age was found to be one of the most important variables in the present study. It is proposed that while recommending any policy for older adults, it is important to consider the age and gender of the older adults. It is recommended that the government advise older adults to adopt health-promoting approaches, which may be useful. This study has demonstrated a substantial burden of chronic diseases on ADL, IADL, and impairments among older adults, further supporting the public health relevance of multi-morbidity among older adults. Therefore, there is a pressing need to deliver quality care to older adults suffering from chronic conditions.

Abbreviations

ADL: Activities of Daily Living

BKPAI: Building a Knowledge Base on Population Aging in India

CI: Concentration Index

CI: Confidence Interval

IADL: Instrumental Activities of Daily Living

IEG: Institute for Economic Growth

ISEC: Institute for Social and Economic Change

OBC: Other Backward Class

OR: Odds Ratio

PSU: Primary Sampling Unit

SC: Scheduled Caste

SES: Socio-economic Status

ST: Scheduled Tribe

TISS: Tata Institute for Social Sciences

UNFPA: United Nations Population Fund

Declarations

Ethics approval and consent to participate: The data is freely available in public domain and survey agencies that conducted the field survey for the data collection have collected a prior consent from the respondent.

Consent for publication: Not applicable

Competing Interest: The authors declare that they have no competing interests.

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Author's Contribution: The concept was drafted by PK, SS, RP and SC. PK, MG and SS contributed to the analysis design. DJS and MG advised on the paper and assisted in paper conceptualization. SC and RP contributed in the comprehensive writing of the article. All authors read and approved the final manuscript.

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Figures

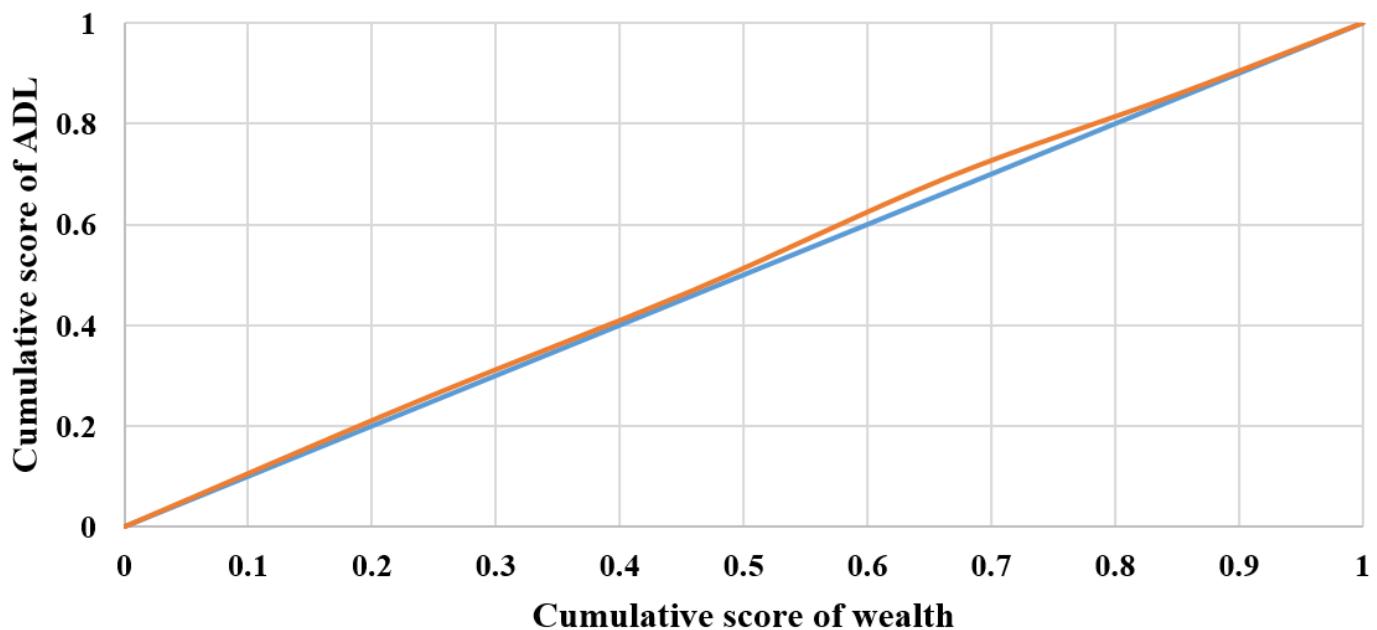


Figure 1

Concentration curve for ADL among older adults in India
Legend: Cumulative score of wealth

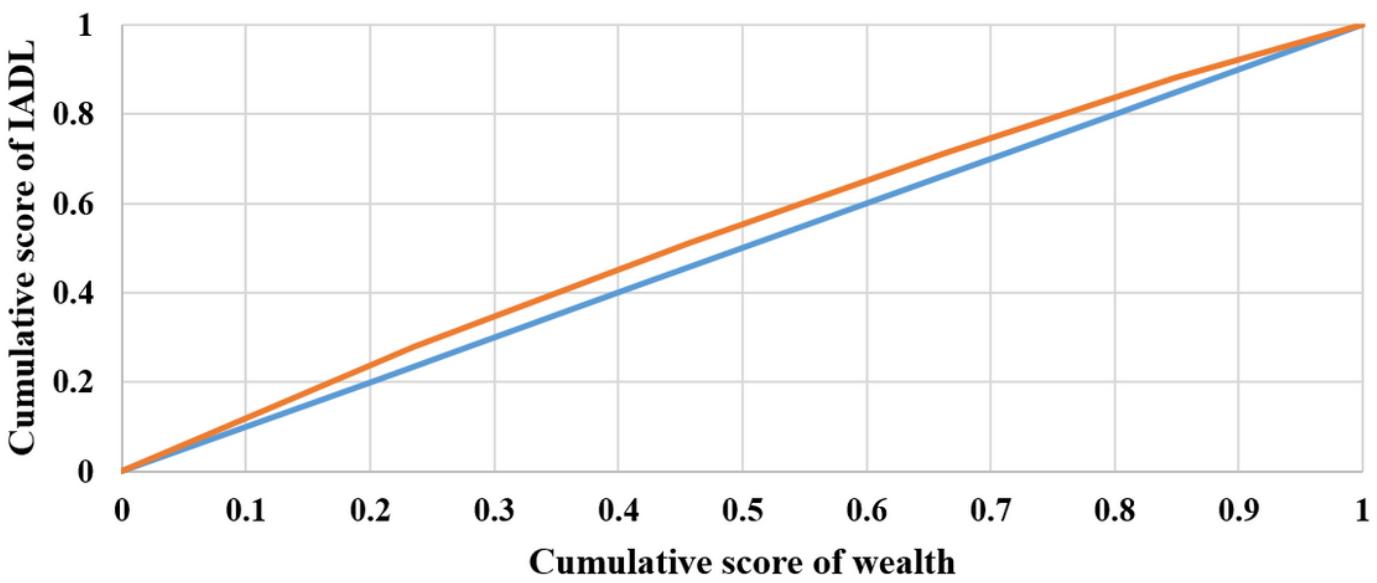


Figure 2

Concentration curve for IADL among older adults in India
Legend: Cumulative score of wealth

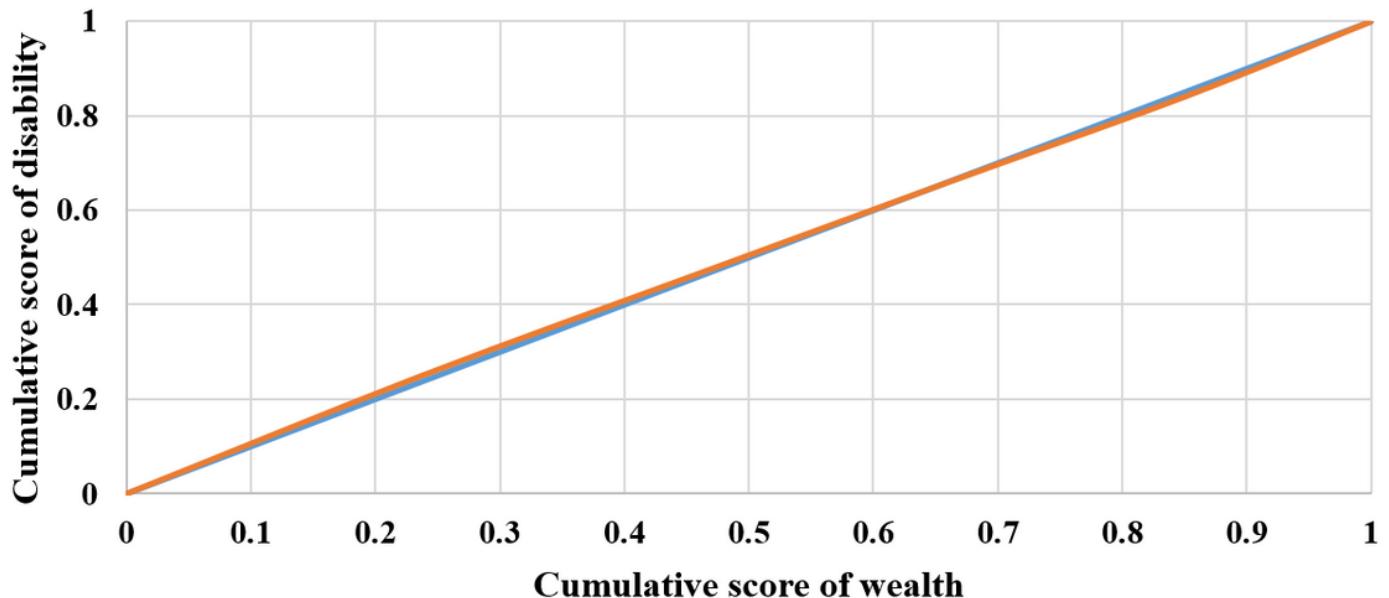


Figure 3

Concentration curve for disability among older adults in India Legend: Cumulative score of wealth

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