Social Gradient in Physical Mobility: An Investigation Among the Older Population in India

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Abstract

In densely populated developing countries like India, the constant rise in the older population has worsened the burden of palliative care. Palliative care is primarily required for older people who are physically disabled. To address the issue of palliative care, a thorough understanding of physical immobility among the older population is required. Therefore, the present study aims at an in-depth understanding of the trajectory of mobility decline as well as the critical nexus between physical immobility and social status in late life. The study uses nationally representative unit-level secondary data from two rounds of the National Sample Survey of India conducted in 2004 and 2014 to examine the underlying association between socioeconomic class and physical mobility loss among older individuals. The findings suggest that physical immobility among older adults is closely related to the social gradient. Socioeconomic factors like socioreligious identity, income, education level, household type, living environment, and gender significantly influence the physical immobility in old age. The results of this study contribute to understanding the dynamics and variability of physical immobility among older individuals and help in developing policies to reduce the future burden of palliative care.

Keywords

Health trajectory; India; older individuals; physical immobility; social gradient

Introduction

The world is witnessing a rapid increase in the aging population. According to the World Report on Aging (United Nations, 2015), the proportion of older people aged 60 and over will increase from 9.1 million in 2015 to 2.1 billion in 2050. The problem of population aging began in developed countries, but forecasts suggest that developing countries, particularly Asian countries, will soon become the dominant domicile of older adults (He et al., 2016). For example, India is the world's second-most populous country[1], and has the fastest-growing aging population. Projections suggested that in India, the aging population will grow at a rate of nearly 62%, and by 2050, the number of older people will be triple compared to 2015 (United Nations, 2015).

The risk of morbidity and loss of functional capacities increases with age. Two contrasting theories attempt to explain the relationship between morbidity and disability in the later stages of life (World Health Organization, 2011). The first school of thought contends that morbidity-compression is the cause of prolonged life. The authors believe that longevity gain is possible by curtailing the severity of morbidities and preventing potential disabilities. The second strand of the literature argues that as people live longer, morbidity increases (Wiggins et al., 2004). According to the authors, modern medicine can only slow down the progression of the disease, reduce the severity of the symptoms to some extent, and delay the onset of the disorder. However, medication does not completely reduce the risk of morbidity and functional impairment as people age.

India has a substantially high morbidity rate, accounting for almost 21% of all cases worldwide (World Health Organization, 2007). Although chronic illnesses are more common as people get older, loss of functionality can be delayed or managed with adequate medical treatment and proper healthcare. However, due to the uneven distribution of endowments, healthcare-seeking behavior in India is skewed in favor of advantaged social groups. As a result, health outcomes of older individuals differ across income (Berkman et al., 1993), social status (Mendes de Leon et al., 1995), socioeconomic classes (Goldman et al., 1995; Melzer & Parahyba, 2004; Mollenkopf et al., 2004), marital status (Goldman et al., 1995), and levels of education (Shumway-Cook et al., 2005). In addition, most of the older persons in India are often unable to cope with excess private healthcare spending (Pal, 2012) with meager income and savings (Alam, 2008) and get trapped into a vicious cycle of poverty (Brinda et al., 2012; Mohanty et al., 2014), malnutrition (Vedantam et al., 2010), and unhealthy living conditions (Prakash, 1999). As a result, the majority of the population experience further deterioration in health in terms of morbidity and disability in later life (World Health Organization, 2001).

Unlike in developed countries, the public healthcare facilities in India are inadequate (Alam, 2006), disproportionately distributed (Ghosh, 2014; Prakash, 1999; Srinivasan et al., 2010), and insufficient to meet the changing demographic demand (Ingle & Nath, 2008). As a result, the health trajectories of people vary widely across different socioeconomic categories (United

[1] https://worldpopulationreview.com/countries

Nations, 2015). Several studies explored the impact of socioeconomic factors on the health of India's older citizens. For example, Alam (2008) argued that caste, widowhood, and lack of public healthcare facilities are the key predictors of geriatric health conditions in rural India. Gupta and Sankar (2003) found that financial and living structures influence the chronic morbidity and disability perceived physical susceptibility of the older population. Mini (2009) examined the factors that influence self-reported health, illness, and physical mobility among Kerala's older inhabitants and found that women have fewer health complaints than men. Earlier studies suggested that health outcomes in late life are widely distributed across the social echelons in India (Roberts et al., 2015).

The concept of a "social gradient on health" emerged in developed countries (Court, 1981). According to the social gradient on health, people with low socioeconomic status have poorer health outcomes than their more affluent peers (Donkin, 2014; Kosteniuk & Dickinson, 2003; Orpana & Lemyre, 2004). Lack of endowments, such as a low level of formal education and financial insecurity in old age, cause the older people to hesitate to seek healthcare (Gupta et al., 2001). Systematic healthcare negligence among the underprivileged members of society causes a higher risk of late-life chronic illness (van Groenou et al., 2003) and irreversible impairment of functional ability (Gennari, 2001; Schilling, 2012). For example, osteoporosis often induces physical restriction among the socioeconomically disadvantaged older individuals due to a persistent deficiency of vitamin D and calcium in their diet (Wong et al., 2013).

In the literature, the impact of social gradients on health is extensively documented (Kosteniuk & Dickinson, 2003; Kuhle & Veugelers, 2008; Orpana & Lemyre, 2004; Tenkorang & Kuuire, 2016; Thakur & Sangar, 2020). However, understanding the social gradient of physical immobility among the older population is lacking in the literature. Earlier studies are mainly confined to investigating the impact of social gradients on health outcomes such as life expectancy (Vani, 2010), the presence of noncommunicable diseases (Jeemon & Reddy, 2010; Tenkorang & Kuuire, 2016), and psychological well-being (Kosteniuk & Dickinson, 2003; Marmot, 2012). However, according to the author's knowledge, no study examined the impact of the socioeconomic gradient on physical immobility, particularly among the older individuals in developing countries. Health status in later life reflects life-long exposures and opportunities. Furthermore, physical mobility is also expected to substantially vary across socioeconomic segments among the elders because India has a heterogeneous society. However, there is no literature that explores physical immobility among older persons across socioeconomic clusters.

Furthermore, independence in physical mobility is an essential indicator of active aging. The promotion of active aging reduces the burden of long-term palliative care on society. However, to design any policy for the promotion of active aging, we need an in-depth understanding of the indicators of physical mobility in society. To fill the gaps in the literature, the current study focused on two research questions: first, how the physical mobility problem among the older people has changed over time in India; and second, how socioeconomic gradient is connected with the incidence of physical immobility during later life.

Methodology

Data

The study used nationally representative unit-level secondary data from the 60th (2004) and 71st (2014) rounds of the Government of India's National Sample Survey (NSS)[2]. The purpose of the surveys was to collect quantitative data on India's health. The multi-stage stratified sampling technique is used in both NSS rounds. The First Stage Units (FSU) of surveys in rural and urban regions were central villages and urban blocks, respectively, whereas households were considered as the Ultimate Stage Units (USU). Ten homes were chosen at random from each FSU, and interviews with a randomly selected household member were conducted. In the 60th and 71st rounds, NSS surveyed 73,868 and 65,932 households, respectively, and interviewed 383,338 and 333,104 individuals. However, the present study extracted the data on 34,831 and 27,245 individuals 60 years and older, from the 60th and 71st rounds, respectively.

Description of variables

The study's dependent variable is "physical immobility" in an older individual. The dependent variable has two categories: physically mobile (0) and immobile (1); it is dichotomous. Although the information on disability across the rounds was comparable, there was a small difference in the categorization of physical immobility. In the 71st round, respondents were categorized into three categories: "confined to bed" (2.23%), "confined to home" (7.83%), and "fully mobile" (89.96%). In the 60th round, the corresponding percentages were 1.96%, 7.51%, and 90.53%, respectively. However, the 71st round had an additional category, i.e., "confined to a wheelchair" (0.52%). Due to low frequencies, the first two groups (and an additional category from the 71st round) were merged to compute the measurement of the disability of the aged.

Analysis was conducted by the sectors due to disparities in opportunities and socioeconomic conditions in rural and urban areas (Das & Pathak, 2012). Based on the earlier literature and logic, the present study selected the characteristics of socioeconomic status and social opportunities that can affect mobility in the later stage of life. The list and description of the selected determinants of physical immobility are given in Table 1.

[2] Data is available at: http://www.icssrdataservice.in/datarepository/index.php/catalog

Table 1: Descriptions of Variables

Variables	Measurement of the variable	Remarks
Gender	Gender, in our study, is a dichotomous variable where 0 stands for male and 1 for female	Females have a lower position in society and less access to healthcare resources, and therefore gender difference in health is expected (Sen & Östlin, 2008), particularly in old age.
Socio-religious identity	The variable combines information of social (originally coded as scheduled tribe - 1, scheduled caste - 2, other backward class - 3, others - 9), and religion group (originally coded as Hinduism - 1; Islam - 2; Christianity - 3; Sikhism - 4; Jainism - 5; Buddhism - 6; Zoroastrianism - 7; Others - 9). The combined that is included in the analysis has six categories: • Upper Caste Hindu (H-UCs) = 0; • Hindu Schedule Caste (H-SCs) = 1; • Hindu Schedule Tribe (H-STs) = 2; • Hindu Other Backward Classes (H-OBCs) = 3; • Muslims = 4; and • Other Minorities (Others) = 5.	Compared to the socially privileged segment, lower social caste people (Thorat & Neuman, 2012) and minority religions' people are often deprived; and often suffer from limited access to necessary resources like hospitalization facilities (Roy & Chaudhuri, 2008). Therefore, socio-religious identity is included because social influence and religious majority play an important role in Indian society.
Income	The present study uses a proxy of income status using the log of Monthly Per Capita Expenditure (MPCE) of the household.	A low level of income accelerates the incidence of morbidity (Abdulraheem et al., 2017; Woo et al., 2007), and physical disability (Duba et al., 2012).
Household type	Household type is measured for rural areas as: • Self-employed in agriculture (= 1); • Self-employed in non-agriculture (= 2); • Agriculture labor (= 3); • Non-agriculture labor (= 4); • Rural others (= 5); and for urban areas as: • Self-employed (= 6); • Wage & salaried (= 7); • Casual labor (= 8); • Urban others (= 9).	Household type is used to capture the characteristics of household occupation because the occupation influences health outcomes (Amaducci et al., 1998).

Variables	Measurement of the variable	Remarks
Household size	It is calculated by the total number of members who reside in a house.	The greater the number of household members, the higher is the chance of good health in late life. The large size of the household indicates multigenerational residence, where young people care for the older family members.
Living environment	Using Principal Component Analysis (PCA), scores of the living index are generated. Details of the computation of PCA are given in the next section.	Farias and Buchalla (2005) identified that health outcome is influenced by "the environment where the person lives."
Geographical region	All Indian states and union territories are divided into six geographical regions, given below: North (includes Jammu & Kashmir, Himachal Pradesh, Punjab, Chandigarh, Uttaranchal, Haryana, Delhi, Uttaranchal, and Rajasthan) = 1; Central (includes Uttar Pradesh, Chhattisgarh, and Madhya Pradesh) = 2; East (includes Bihar, West Bengal, Jharkhand, and Orissa) = 3; Northeast (includes Sikkim, Arunachal Pradesh, Assam, Meghalaya, Tripura, Mizoram, Manipur, and Nagaland) = 4; West (includes Goa, Maharastra, Daman & Diu, Dadra & Nagar Haveli and Gujrat) = 5; and South (includes Tamil Nadu, Kerala, Karnataka, Lakshadweep, Puducherry, Andaman & Nicobar Island, and Andhra Pradesh) = 6. Information on Telangana is given separately only in the 71st round, and it is included in the South region.	Geographical region is included in the analysis because the spread of aging diverges across the boundaries of states in India (Chauhan & Arokiasamy, 2018).
Age group	Three age categories are included in the analysis. • Young-older adults (60 years or above to less than 70 years) = 1; • Middle-older adults (70 years or above to less than 80 years) = 2; and • Older-older adults (80 years or above) = 3	The older people, belonging to higher age groups, have a greater likelihood of suffering from multimorbidity (Abdulraheem et al., 2017; Kaur et al., 2017) and a greater risk of disability (Duba et al., 2012).

Variables	Measurement of the variable	Remarks
Education	Categories of education are as follows: • Illiterate (reference category) = 0; • Literate without formal school (it combines "Literate without any schooling," "Literate without formal schooling: through NFEC[a]," "Literate through TLC[b]/AEC[c]" and 'Others') = 1; • Below primary = 2; • Primary = 3; • Middle = 4; • Secondary = 5; • Higher secondary [it combines "Higher secondary," "Diploma/Certificate course (up to secondary)," "Diploma/Certificate course (higher secondary)" and "Diploma/Certificate course (graduation & above)"] = 6; and • Graduate & above (combines "Graduate and "Post-graduate & above") = 7.	Education is an important indicator of social status and is strongly associated with health status (Duba et al., 2012; Kawachi & Berkman, 2014).

Note: [a]NEFC, [b]TLC, and [c]AEC stand for "Non-formal Education Centre," "Total Literacy Campaign," and "Adult Education Centers," respectively.

Construction of living environment index

An Index of Living Environment was generated using Principal Component Analysis (PCA). The variables, related to household members living conditions like (1) Type of latrine (originally coded as Service latrine - 1, Pit - 2, Septic tank/Flush system - 3, No latrine-4 and Others - 9); (2) Type of drainage (originally coded as Open katcha - 1, Open pucca - 2, Covered pucca - 3, Underground - 4, and No drainage - 5) were used to calculate the index. All the considered variables first were undergone through the Kaiser-Meyer-Olkin and Bartlett test of sphericity to check whether PCA is permitted under the data structure. Test results of Kaiser-Meyer-Olkin (Kaiser, 1970; Kaiser & Rice, 1974) statistic (0.709) and Bartlett test (Bartlett, 1950) of sphericity (i.e., Chi-square = 51,389.802 and significant at 1% level) suggest that PCA is possible for the observed variables of living condition. The Kaiser criterion suggests taking as many as there are eigenvalues greater than unity. Since our data had only one eigenvalue greater than unity (1.49779), a single factor solution was used to create the index. Using predict the score, we first generated the factor scores and then normalized [(Maximum value-Actual value) / (Maximum value-Minimum value)] each score to generate a variable, i.e., "Living environment," the representative of the overall living condition of each household.

Data analysis

The study adopted descriptive analysis, followed by econometric analysis. The descriptive analysis employed a diagrammatic representation of the percentage of older persons who are physically immobile across social categories. On the other hand, the econometric analysis estimated logistic regression models to explore the impact of the independent variables. Specifications of econometric models are given in the next section. The study uses STATA 13 software for data analysis.

Model specification for econometric analysis

Logistic regressions were adopted to identify the determinants of Physical Immobility (PI) because of the dichotomous nature of the dependent variable. Suppose the probability of occurrence of the incident or PI is equal to 1 is p, and the probability of its non-occurrence is (1-p). Therefore, the expected value for PI is the occurrence of an event or suffering from mobility problem can be expressed as:

$$E(y_{PI}) = p \times 1 + (1-p) \times 0 = p \ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 1}$$

Now consider the probability (mentioned in Equation 1) is a function of a set of explanatory variables (X) and a vector of unknown parameters (β), we can write the binary choice model for PI as,

$$Prob(y_{PI}) = 1|\, X = F'(\beta X) \ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 2}$$

The logit model corresponding to Equation 2 can be defined as,

$$F'(\beta_{PI}X_{PI}) = \frac{e^{\beta_{CA}X_{CA}}}{1 + e^{\beta_{CA}X_{CA}}} \dots\dots\dots\dots\dots\dots \text{Equation 3}$$

Let the latent response variable y^*_{CA} and the related functional form can be defined as follows,

$$y^*_{PI} = \beta'_{PI}x + u \dots\dots\dots\dots\dots\dots \text{Equation 4}$$

and the observed y_{CA} is related with y^*_{CA} by

$$y_{PI} = \begin{Bmatrix} 1\ if & y^*_{PI} > 0 \\ 0\ if & y^*_{PI} \leq 0 \end{Bmatrix} \dots\dots\dots\dots\dots\dots \text{Equation 5}$$

Combining Equation 4 and Equation 5, we can write Prob ($y_{PI} = 1$) = Prob($y^*_{PI} > 0$) = Prob(u > $-\beta'_{PI}x$); where, u assumes that the density of u is logistic or equal to $e^{-u}_{PI}(1 + e^{-u}_{PI})^{-2}$.

Six models were estimated: Model I (for rural areas in 2004); Model II (for urban areas in 2014); Model III (for rural areas in 2014); Model IV (for urban areas in 2014); Model V (for rural areas and time dummy); and Model VI (for urban areas and time dummy). A dummy variable for time (2004 = 0 and 2014 = 1) was included to measure the change in the likelihood of physical immobility among the aged population over time.

Results

Distribution of physical immobility among older individuals

Figure 1 demonstrates that the percentage of older people who are physically immobile has increased over time in both rural (0.72%) and urban (0.86%) locations. Physical immobility among older women has increased over time, rising from 10.5% to 11.6% in rural areas and from 11.1% to 12.4% in urban areas. On the other hand, physical immobility among older men has increased marginally in urban regions while decreasing in rural ones. The findings suggest that physical mobility among older people in rural and urban regions has deteriorated over time, with females suffering more than males.

Figure 1: Prevalence of Physical Immobility Among Older Individuals - by Areas

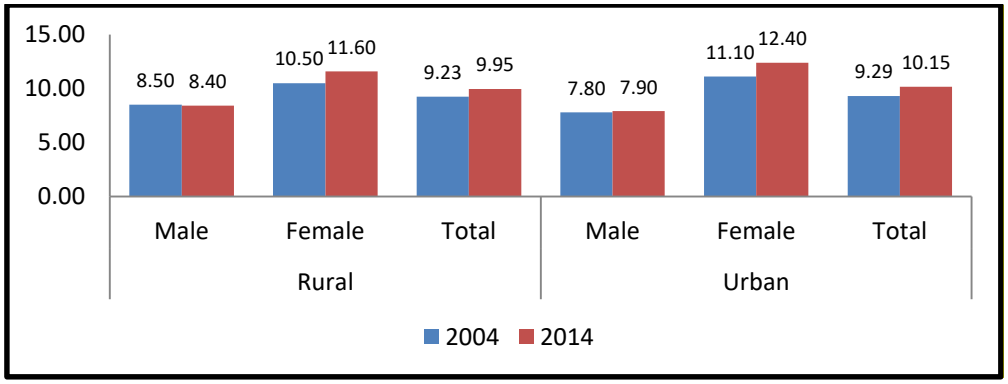


Table 2 shows the percentages of older persons who are physically immobile across the socioeconomic groups. Except in rural areas and small urban homes with one or two members, the findings imply that physical immobility is more widespread among females, regardless of time or sector. In most situations, older males have fewer mobility issues than their female counterparts, implying that men have superior health in the later phase of life. The mobility-related problem is most prevalent in rural areas among financially well-off households, agricultural laborers, and houses with fewer than five members. Surprisingly, in South Indian families with a moderate living environment, the share of immobility has increased with time (the third quintile score). Surprisingly, in South India, the proportion of older adults who are immobile has increased over time among those who live in a moderate living environment (the third quintile score). Age clearly has an impact on mobility, and the findings show that the oldest group (those aged 80 and up) has more mobility issues than the other age groups. Findings also suggest that physical immobility is comparatively higher among the poorly educated older people in rural and urban areas.

Table 2: Percentages of Older Individuals Suffering from Physical Immobility – by Sectors

Indicator	Rural				Urban			
	2004		2014		2004		2014	
	Male	Female	Male	Female	Male	Female	Male	Female
Socio-religion identity#								
H-UC[a]	9.24	10.07	8.27	12.48	8.23	12.00	8.17	12.69
H-STb	8.01	9.95	7.59	12.10	4.76	10.23	13.46	16.82
H-SCc	8.21	10.59	7.51	10.47	6.54	9.49	7.91	9.08
H-OBCd	7.98	10.09	8.97	10.89	7.48	9.39	7.08	11.20
Muslims	9.55	11.67	8.29	13.93	9.22	14.03	9.11	15.84
Other minorities	8.56	12.37	8.54	11.36	6.96	10.77	6.24	13.09
Expenditure group[e#]								
Low income	8.98	10.42	8.45	13.00	8.40	10.72	7.85	12.72
Low middle income	8.72	11.13	8.38	10.77	8.95	9.88	7.01	10.95
Middle income	8.67	9.84	7.81	10.97	7.33	11.40	8.79	12.75
High middle income	8.55	10.26	8.30	12.16	8.05	11.60	7.58	11.13
High income	7.93	10.72	8.83	11.31	7.01	11.71	8.00	14.00
Household type#								
Self-employed in agriculture	7.32	10.67	7.42	11.75				
Self-employed in non-agriculture	8.04	12.18	10.02	11.07				
Agriculture labor	8.16	8.96	7.68	13.46				
Non-agriculture labor	9.68	11.29	7.44	12.69				
Rural others	13.19	9.81	10.46	10.10				
Self-employed					7.51	10.86	6.82	11.89
Wage & salaried					8.39	12.90	9.60	13.11
Casual labor					8.96	9.97	8.11	11.41
Urban others					7.16	9.06	7.52	12.75
Living environment[f#]								
Worst living environment	8.63	9.78	7.52	13.31	7.54	10.00	7.92	13.21
Poor living environment	9.50	11.12	8.16	10.55				

Indicator	Rural				Urban			
	2004		2014		2004		2014	
	Male	Female	Male	Female	Male	Female	Male	Female
Intermediate living environment	8.07	9.35	8.61	10.99	7.88	10.88	8.60	13.00
Satisfactory living environment	8.81	11.14	9.21	11.68				
Best living environment	7.65	11.60	8.28	11.33	7.89	11.69	7.43	11.67
Household size#								
1 – 2	6.87	6.11	7.64	8.87	6.33	6.13	6.58	12.06
3 – 4	7.76	9.86	8.46	13.26	7.22	12.17	8.95	14.64
5 – 6	9.65	12.08	9.11	11.65	9.02	12.46	8.28	11.14
7 – 8	9.71	12.06	8.67	12.52	7.50	12.29	6.04	13.42
More than 8	8.10	12.07	7.11	11.02	8.06	10.74	8.85	11.52
Geographical zone#								
North	7.98	10.98	7.98	12.10	7.17	10.64	6.33	11.02
Central	7.77	9.93	8.04	12.03	6.97	10.96	9.57	14.36
East	8.93	10.84	7.46	12.95	10.30	12.57	7.83	14.60
Northeast	9.28	12.86	9.81	12.62	7.44	15.20	8.27	10.18
West	7.38	9.30	8.68	8.12	6.75	10.40	9.11	11.17
South	9.14	10.03	8.46	10.47	7.56	10.21	6.25	11.53
Age group#								
Young-older adults	5.08	5.71	3.92	6.34	4.01	5.31	4.29	6.69
Middle-older adults	11.19	15.73	12.01	15.20	10.89	16.05	10.87	16.42
Old-older adults	25.99	34.27	28.02	37.38	25.23	34.58	22.14	34.80
Level of education#								
Illiterate	9.23	11.14	9.80	13.41	9.23	11.14	9.80	13.41
Literate without form	8.60	11.65	10.14	15.57	8.60	11.65	10.14	15.57
Below primary	8.02	9.83	7.41	10.17	8.02	9.83	7.41	10.17
Primary	8.60	9.72	8.73	8.58	8.60	9.72	8.73	8.58
Middle	6.19	9.89	6.93	7.49	6.19	9.89	6.93	7.49
Secondary	7.63	6.02	6.65	10.14	7.63	6.02	6.65	10.14
Higher secondary	6.61	9.40	6.01	7.87	6.61	9.40	6.01	7.87
Graduate & above	5.37	4.71	6.54	6.01	5.37	4.71	6.54	6.01

Note: [a]H-UC, [b]H-ST, [c]H-SC, and [d]H-OBC stand for "Upper Caste Hindu," "Hindu Schedule Caste," "Hindu Schedule Tribe," "Hindu Other Backward Classes," respectively. [e]Expenditure group is computed by the five quintiles of MPCE, whereas are named in ascending order from 'low income' (the lowest quintile) to the 'high income' (the highest quintile). [f]Groups of living environments in rural and urban areas are computed by five and three quintile scores, respectively.
#represents variable.

The trajectory of physical immobility among older individuals

In Table 3, the logistic regression coefficients for physical immobility are reported. In comparison to the reference category, a positive coefficient value indicates a positive relationship, whereas a negative value implies an inverse relationship. Results suggest that the likelihood of physical mobility has not significantly changed over time in rural and urban areas.

Table 3: Percentages of the Older Individuals Suffering from Physical Immobility – by Sectors

Sociodemographic variable	2004				2014				Combined			
	Rural		Urban		Rural		Urban		Rural		Urban	
	β	S. E.	β	S. E.	β	S. E.	β	S. E.	β	S. E.	β	S. E.
Time# (Ref: 2004)									0.10	0.11	-0.10	0.07
Gender# (Ref: Male)	0.53**	0.15	0.34**	0.10	0.10	0.10	0.34**	0.08	0.27**	0.08	0.34**	0.06
Socio-religion identity# (Ref: H-UC[a])												
H-STb	0.66	0.42	-0.5	0.40	-0.4	0.30	0.53*	0.25	-0.11	0.26	0.17	0.21
H-SCc	-0.27	0.29	-0.2	0.20	-0.2	0.20	-0.17	0.14	-0.23	0.16	-0.20	0.11
H-OBCd	-0.32	0.17	-0.22*	0.10	-0.1	0.10	-0.1	0.10	-0.16	0.10	-0.15*	0.07
Muslims	-0.02	0.24	0.24	0.10	0.34*	0.20	0.21	0.12	0.19	0.14	0.22**	0.09
Other minorities	-0.12	0.2	-0.1	0.10	-0.00	0.20	0.01	0.14	-0.08	0.13	-0.00	0.09
Log of MPCE[e]#	-0.04	0.15	0.07	0.10	0.1	0.10	0.24**	0.07	0.05	0.09	0.18**	0.06
Household type# (Ref: Self-employed in agriculture for rural; Wage & salaried workers for urban)												
Self-employed in non-agriculture	0.24	0.18			-0.2	0.20			-0.03	0.11		
Agriculture labor	-0.15	0.38			0.2	0.20			0.13	0.18		
Non-agriculture labor	0.70**	0.28			-0.3	0.20			0.05	0.17		
Rural others	0.12	0.17			0.00	0.10			0.06	0.10		
Self-employed			0.12	0.10			0.23**	0.08			0.18**	0.06
Casual labor			-0.1	0.20			-0.08	0.16			-0.10	0.13
Urban others			-0.28*	0.10			0.14	0.11			-0.10	0.08
Living environment#	0.00	0.09	-0.00	0.10	-0.00	0.10	-0.09	0.07	-0.01	0.06	-0.10	0.05
Household size#	0.02	0.02	0.00	0.00	-0.00	0.00	-0.02	0.01	0.00	0.01	-0.00	0.01
Geographical zone# (Ref: North)												
Central	-0.11	0.24	0.02	0.10	0.40*	0.20	0.44**	0.13	0.24	0.14	0.26**	0.09
East	0.59**	0.23	0.27*	0.10	0.58**	0.20	0.34**	0.13	0.60**	0.15	0.31**	0.09
Northeast	0.62**	0.22	0.42**	0.20	0.30	0.20	0.20	0.16	0.46**	0.14	0.29**	0.11
West	-0.27	0.25	-0.00	0.10	0.10	0.20	0.27*	0.13	-0.03	0.14	0.12	0.09
South	0.06	0.20	-0.00	0.10	0.20	0.20	0.08	0.13	0.20	0.12	0.05	0.09

Sociodemographic variable	2004				2014				Combined			
	Rural		Urban		Rural		Urban		Rural		Urban	
	β	S. E.	β	S. E.	β	S. E.	β	S. E.	β	S. E.	β	S. E.
Age group# (Ref: Middle-older adults)												
Young-older adults	-1.02**	0.15	-1.17**	0.10	-0.85**	0.10	-1.00**	0.08	-0.91**	0.09	-1.08**	0.06
Old-older adults	0.87**	0.16	1.03**	0.10	1.29**	0.10	0.84**	0.09	1.12**	0.10	0.92**	0.07
Education# (Ref: Primary)												
Illiterate	0.13	0.21	0.10	0.1	0.35*	0.20	0.18	0.12	0.30*	0.13	0.15	0.09
Literate without formal school	0.06	0.44	-0.40	0.3	0.30	0.40	-0.02	0.27	0.27	0.29	-0.20	0.20
Below primary	-0.01	0.26	-0.10	0.2	-0.20	0.20	-0.15	0.15	-0.10	0.17	-0.10	0.11
Middle	-0.49	0.33	-0.10	0.2	-0.20	0.30	-0.34*	0.16	-0.29	0.20	-0.20	0.11
Secondary	-0.11	0.32	-0.10	0.2	-0.20	0.30	-0.24	0.15	-0.13	0.20	-0.20	0.11
Higher secondary	-0.80	0.63	-0.00	0.2	-0.60	0.40	-0.31	0.18	-0.63	0.34	-0.20	0.13
Graduate & above	-0.52	0.63	-0.50**	0.2	0.00	0.40	-0.64**	0.16	-0.11	0.30	-0.56**	0.12
Constant	-2.21	1.08	-2.51**	0.7	-2.87**	0.90	-4.02**	0.62	-2.80**	0.65	-3.34**	0.43
Model summary												
Observations	3,183		9,176		5,252		9,857		8,435		19,033	
LR χ^2 (degree of freedom)	209**(n=27)		636**(n=26)		369**(n=27)		610**(n=26)		537**(n=28)		1206**(n=27)	
Pseudo R^2	0.10		0.11		0.11		0.095		0.20		0.10	

Note: 'n' represents Degrees of freedom of LR χ^2.

***and *imply 1% and 5% significance levels, respectively.*

#represents variable.

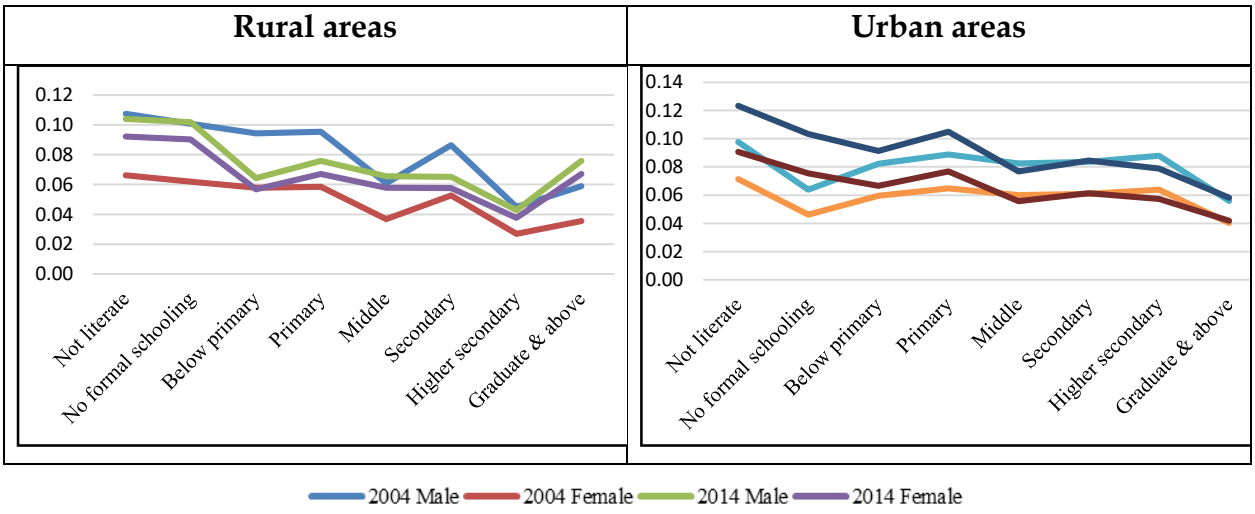
aH-UC, bH-ST, cH-SC an,d dH-OBC stand for "Upper Caste Hindu," "Hindu Schedule Caste," "Hindu Schedule Tribe," "Hindu Other Backward Classes," respectively. eMPCE stands for Monthly Per Capita Expenditure of a household.

Determinants of physical immobility of older individuals

Gender is a strong determinant of physical immobility regardless of residence or time (except in rural areas in 2014). Older females always have a more significant problem of immobility than their male counterparts. Except for the urban areas in 2014, the log of MPCE plays no significant function in determining physical immobility. The combined model shows that the likelihood of physical immobility increases with a rise in per capita household expenditure. The positive link between wealth and the occurrence of physical immobility may reflect the prevalence of upper-class sickness and disability among financially well-off older individuals. When upper-caste Hindus are regarded as the reference group, physical mobility does not differ significantly between socio-religious groups; however, there are some exceptions. Physical immobility was much lower for Hindu-OBC in rural areas in 2004 than for the reference group, but it became more prominent among Hindu-ST and Muslims in urban areas in 2014. In 2004, the older people from all sorts of households (excluding agricultural labor) were more likely to have mobility issues than the self-employed individuals in agriculture.

Nonetheless, over time, the impact of dwelling style on physical immobility has diminished. Physical immobility is more prevalent in the central (both rural and urban regions in 2014), eastern (both areas and time), and northeastern (both rural and urban areas in 2004) states than in the northern region. In 2014, however, there is no significant difference in the likelihood of physical mobility in the western (excluding metropolitan areas) and southern states compared to the northern counterpart. Relative to the middle age group, physical immobility is significantly lower among the young-older-adults but higher for the oldest age group (old-older-adults), which suggests a positive association between functional degradation and progression of age. Physical immobility is much higher among the older individuals who are illiterate (in rural areas in 2014) and better educated (for example, graduate and above in metropolitan areas in 2004 and 2014) than among those who are primarily educated. Education probably equips individuals with greater health awareness and better health management skills as they get older.

Figure 2: Prevalence of Physical Immobility by Sociodemographic Indicators



According to the study (Figure 2), physical mobility problems intensify with lower levels of schooling. Regardless of their level of education, females have more mobility challenges than males. In 2014, physical immobility increased in rural areas among all females, irrespective of education level.

Discussion

The present study focuses on the physical immobility trajectory among older people and its causal relationship with socioeconomic hierarchies. Aging is documented as an essential driver of functional autonomy, but an in-depth analysis of physical immobility among the elders is lacking in the literature, particularly in the context of developing countries like India. Few earlier studies have focused on the geriatric health and socioeconomic indicators (Alam, 2006; Alam & Mukherjee, 2005; Albert et al., 2005; Rajan, 2006), but they neither considered physical immobility as the health status; nor explored the change in health condition over time. Only Husain and Ghosh (2011) compared the subjective health of two rounds of NSSO data (1994–1995 & 2004) and identified the change in the health condition of the older people in India by considering self-reported health. However, self-reported health is challenged in the literature (Husain & Ghosh, 2017) due to its subjectivity (Sen, 1993).

Therefore, the present study considers the objective health status, such as physical immobility, and attempted to identify the change in health conditions of the older population over a decade. The descriptive statistics suggest a marginal increase in mobility problems among older women. However, there is no significant change in immobility for the older population as a whole. The current study, like prior studies (Shumway-Cook et al., 2005; Statistics Canada, 2007), indicates a significant gender difference in the likelihood of immobility, but only in urban areas for the year 2014. The neglect of health and postmenopausal calcium shortage could be the causes of women's increased physical immobility (Black & Rosen, 2016). Low education (Duba et al., 2012; Zeki Al Hazzouri et al., 2011) and income (Duba et al., 2012; Shumway-Cook et al., 2005) are further factors that contribute to mobility loss, which is primarily related to improper management of diseases (Rothman et al., 2004). We identified a significant positive association between the log of MPCE and immobility in urban regions in 2014, probably because people live longer in cities and have more mobility issues as they get older. Furthermore, we discovered that, contrary to other studies (Aghamolaei et al., 2010; Cheshmberah et al., 2014), functionality loss is more common among the oldest people than the lower age groups.

Morbidity is ubiquitous in late life, and the condition worsens when it manifests physical immobility. Physical immobility increases the cost of long-term palliative care amid the demographic dividend. In an inequitable country like India, managing palliative care is costly and challenging. Policies are needed to reduce such difficulties from the perspective of social welfare. On the other hand, the direction and distribution of the problem are essential in designing any social policy. The current study is important because it captures the direction of change in physical immobility among older people, as well as its relationship to the social gradient.

The present study has certain limitations. Firstly, the study neglects the onset of disability symptoms that can lead to variation in physical immobility. Secondly, it ignores the preventative measures taken by older individuals to avoid future functional disability. Finally, the study does not capture whether the living environment is age-friendly or adversely affects independent living due to loss of physical mobility in old age.

Conclusion

Our study focuses on the burden of old-age healthcare in India, where government support for older individuals is limited. It emphasizes how socio-economic disadvantages frequently cause physical disability in late life. Over time, the gap across social groups (H-UC & H-ST), or between MPCEs, becomes large, indicating a dramatic divergence in health outcomes between socio-economic groups. The study also emphasizes the impact of regional diversity and educational factors on functional impairment in old age. The findings show that, despite multiple government efforts, the benefits of healthcare services in preventing negative health outcomes in old age are still lagging at the implementation level.

The study has important policy implications. It suggests focusing more on the poorly educated, economically weak, scheduled tribe and females of rural areas for preventive and control treatments at an early stage of health problems. Policies are required to decrease the future burden of providing long-term palliative care.

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