

Socio-Economic determinants of old age Functional Limitations in India: A principal components analysis approach.

Contextual and theoretical background:

India with its 1.4 billion people represents approximately one-fifth of the global population and has recently been estimated to have become the most populous country. As the country moves into the final stage of its demographic transition, population aging is emerging as a significant concern. The 2011 census estimated that India had the second-largest population of individuals over the age of 65, accounting for 5.0% of the Indian population and 10.8% of the global population over 65. Since the last census, projections indicate that the male life expectancy at birth has increased from 64.9 in 2011 to 69.4 in 2021, while the female life expectancy at birth is expected to have increased from 68.2 to 72.8. The increase in population and life expectancy at birth will result in a predicted increase in the male population 65 and over from 32.37 to 42.84 million during the period from 2011 to 2021. Similarly, the 65 and over female population is expected to increase from 33.82 to 46.84 million over the same ten-year period. (Mishra 2020). A rise in Life expectancy and a rise in the number of elderly has led to a rise in the prevalence and magnitude of elderly individuals with functional limitations. In 2005, the number of adults above the age of 60 who had at least 1 functional limitation was 9 percent. The same figure in 2012 was 37 percent (Paul et al. 2021). As we will see, this rise in the prevalence of functional limitations was not uniform across socioeconomic and demographic characteristics. Although there is unambiguous evidence regarding certain characteristics, such as gender and its correlation with functional limitations. The correlation between socioeconomic conditions and functional limitations in older adults is complex, with some studies finding no correlation between functional limitations and wealth quintiles or social groups, while others find wealth and caste significant even after controlling for other covariates.

The Fundamental Causes Theory argues that inequalities in access to resources, including wealth, income, and social privilege, are a driver of health outcomes. These resources enable individuals to avoid disease and seek treatment, while those deprived of these resources face barriers to health-promoting behaviors and achieving desirable health outcomes. The Fundamental Causes Theory has been used to explain various health disparities related to socioeconomic status, race, ethnicity, and geographic location, among others (Clouston and Link 2021; Link and Phelan 1995). The Cumulative Advantage Theory complements the Fundamental Causes Theory by suggesting that advantages and disadvantages accumulate over the lifetime to shape late-life outcomes. Initial advantages, such as better access to healthcare, education, and resources, are more likely to lead to better health outcomes and greater opportunities, whereas initial disadvantages are likely to result in poor health outcomes and perpetuate existing health disparities (DiPrete and Eirich 2006). Thus, to fully understand the health outcomes of older adults, it is important to consider both current and lifelong socio-economic positions.

Over the last two decades, India has undergone remarkable economic progress, with incomes skyrocketing. With a big private health sector, the expanding gap could lead to increased inequality in access to health care, which is especially critical for adults in their middle to late years. Simultaneously, the government has made significant efforts to expand health services, insurance, and public healthcare delivery (Basu 2020). As a result, these government initiatives may function as a leveler, reducing health disparities. The socioeconomic disparity is complexly manifested in Indian society. While education, income, and wealth are commonly used as indicators of socioeconomic status around the world, it is undeniable that the caste system and religion are prominent features of social stratification, given the deep-rooted systemic inequality and discrimination faced by lower caste and non-Hindu groups (Desai and Dubey 2011; Deshpande 2000).

Given this context, the paper tries to look at the correlation between socioeconomic conditions and changes in functional limitations among older adults using a panel dataset, incorporating a comprehensive examination of individuals' long-term and short-term indicators of socioeconomic position. The paper contextualizes the findings within the shifting economic and social conditions in India.

SES and Functional Limitations in the Indian Context

The prevalence of functional limitations in older adults in India is gendered. More than half of older women, 53 percent, suffer from functional limitations, compared to 35 percent of men (Malik 2022). Controlling for age the probability of onset was also higher for women than for men, while the probability of recovery did not show any gendered differences (Patel et al. 2021). The odds of women suffering from functional limitations hold even after accounting for other demographic and socio-economic characteristics like age (Kastor and Mohanty 2016; Parmar and Saikia 2018; Sharma, Maurya, and Muhammad 2021). Researchers also found that the odds of having functional limitations are higher for individuals not in a marital union or living alone (Parmar and Saikia 2018; Patel et al. 2020; Sharma et al. 2021). Similarly, education levels seem to display a consistent negative gradient with odds of having functional limitations in older adults (Arokiasamy, Uttamacharya, and Jain 2015; Kastor and Mohanty 2016; Patel et al. 2020; Sharma et al. 2021)

When it comes to explaining the correlation between socioeconomic conditions and functional limitations, the relationship seems to be a bit more complicated. While some studies find no correlation between functional limitations and wealth quintiles or social groups after controlling for other covariates, others suggest that wealth and caste are significant determinants of functional limitations. Household wealth and caste had no discernible association with functional limitations when controlling for correlates (Arokiasamy et al. 2015). Using a different data source in India, it was reported that although there was no evident negative gradient between the functional limitation and the wealth index, individuals in all other wealth quintiles had lower odds of having functional limitations as compared to individuals from the lowest wealth quintile (Parmar and Saikia 2018). Yet another study found only the top two but not the middle quintiles significantly correlated with the odds of having functional limitations (Patel et al. 2020). When considering monthly per capita consumption expenditure, a study did not find any statistically significant difference between individuals of any other wealth quintile except the middle quintile compared to individuals from the lowest wealth quintile (Sharma et al. 2021).

Limited evidence exists about the longitudinal aspects of functional limitations in India. In a longitudinal survey, individuals in the middle, richer, and richest wealth quintiles were found to have a lower likelihood of developing functional limitations as compared to individuals in the poorest wealth quintile (Patel et al. 2021). Another study, which also used the same dataset, contradicts these findings by reporting no statistically significant difference in the odds of an individual acquiring functional limitations based on wealth quintiles (Paul et al. 2021). One study observed a significant positive association between an individual's wealth quintile and their odds of recovering from functional limitations over two waves of a longitudinal survey, finding a clear gradient in recovery rates across wealth quintiles (Patel et al. 2020). In contrast, a different study using the same data set did not observe any difference in the odds of recovery (Paul et al. 2021). Similarly, both studies do not agree on the effect of poverty status on the odds of recovery.

Thus, the correlation between economic status and odds of having functional limitations in older adults seems to depend on the data source, a proxy of capturing economic status, and the controls included in the model. The reason behind the discrepancy remains unclear, any of the possible factors, the data source, the covariates, and the way economic status is measured could potentially affect the results.

Measuring socio-economic factors affecting the health of adults is challenging. Adult health outcomes are an outcome of cumulative advantages and disadvantages that older adults have experienced throughout their lifetime. Furthermore, the assessment of socio-economic status must also account for an individual's present capabilities and resources. Consequently, an effective metric of socio-economic status should encompass both current and lifelong capabilities and resources (Grundy and Holt 2001). Research has suggested that conceptualizing socio-economic status as a singular construct may be inadequate, as each dimension of socio-economic position operates through distinct mechanisms to impact health outcomes. Specifically, while short-term increases in income have been associated with negative health consequences, long-term measures of income and wealth exhibit positive associations with health outcomes. (Cutler and Miller 2005). Although the mechanisms are different, the measures commonly used to measure socio-economic position are co-related. In the Indian context for example, although co-related, income, consumption, and wealth are all shown to have an independent effect on mortality (Po and Subramanian 2011). Similar conclusions were drawn from a study of self-rated health of older

individuals in Finland, both income and wealth were shown to affect the outcome (Aittomäki et al. 2010). Findings from a study suggest that depending on the type of health outcome being measured, the choice of indicator for measuring socioeconomic position, either income or wealth, can have varying levels of sensitivity; while wealth may be a more accurate indicator for measuring socioeconomic differences in the use of dental services among older adults, no consistent pattern was found when measuring disparities in physician services (Allin, Masseria, and Mossialos 2009).

Aims:

With This background the paper asks two questions, first, ‘How does the probability of acquiring a functional disability vary by the socioeconomic status of older adults in India.’ Second, ‘How does the probability of recovery from a functional disability vary by the socioeconomic status of older adults in India.’ The paper aims to make two crucial contributions to the current body of literature that examine the relationship between socioeconomic status and the change in status of functional limitations among elderly individuals.

Firstly, this study proposes to correlate functional capabilities with socio-economic position using a singular indicator of socio-economic status that takes into account both short-term capabilities, as indicated by income and consumption, and long-term capabilities, as measured by wealth. Secondly, this study proposes factoring in mortality between two consecutive survey waves. Research indicates that functional limitations increase the likelihood of mortality, particularly in the short run (Andrasfay 2020). The inclusion of mortality as a factor is important because those with the worst functional limitations may have a higher likelihood of mortality, which could result in a selective sample that biases the study results.

Data

The paper uses data from the India Human Development Survey (IHDS). IHDS was conducted by the University of Maryland and the National Council for Applied Economic Research (NCAER). IHDS is a nationally representative multi-topic longitudinal data set. The first wave of data was collected in 2004-05 and the second wave was conducted in 2011-12. The first wave of IHDS covered 41,544 households in 1503 villages and 971 urban neighborhoods in India. Information on every member of the household was obtained on various topics such as employment, health, income, education, and so on. Information on a total of 215,754 individuals was collected. The second wave of the survey conducted in 2011-12 covered 42,152 households in 384 districts, 1420 villages, and 1042 urban neighborhoods. This covered a total of 204,569 individuals.

The paper uses explanatory variables in the first wave of the dataset to explain the change in functional limitations of older adults in the second wave. The paper defines older adults as individuals who were aged 50 and above in the first wave of the data. Given that the data for two waves were collected 7 years apart, the individuals were aged at least 57 in the second wave of the data.

The paper leverages the panel nature of the data set to observe the change in the functional limitation status of older adults. In the second round of IHDS, approximately 83 percent of the families questioned in the first wave were re-interviewed. Thus, the paper only considers individuals aged 50 and over in wave 1 of IHDS from those households for whom data exists for both rounds. This gives us a total of 28,963 individuals. Of these, 5,932 individuals were confirmed to have died between the two rounds, and 23,031 were observed in both rounds.

Outcome Variable

The health and education module administered to the households in the IHDS contains information on the health and well-being of all individuals in the household. Functional limitations in form of the capability to perform Activities of Daily Living were captured. Information on 7 such activities was collected. The question asks “Now, I am going to ask you about any physical difficulty that people above the age of 7 in this household may have”, and “Does anyone in the household have a problem [ACTIVITY]”. The list of Activities includes Walking 1 km, Going to the Toilet without Help, Dressing Without Help, Hearing Normal Conversation, Speaking Normally, Seeing distant things, and seeing near objects such as reading/sewing. Each of these seven activities is asked separately, if the

answer to any of these is 'Yes', a follow-up question is asked. The follow-up question reads "Can [NAME] still do it with some trouble or is she/he unable to do it". The response to the follow-up question is coded as "Can do with difficulty" or "Unable to do it".

Functional limitation score. The value of 0 is assigned to every activity that an individual can undertake without any difficulty, value 1 is assigned to every activity that the individual "Can do with difficulty, and value 2 is assigned to every activity that the individual is "Unable to do it". Thus, for every activity, the score for each individual can range between 0 to 2. The score for all 7 activities is added up to get a total score of between 0 to 14 for each individual. The paper considers individuals with a score of 2 or higher to be functionally limited. A Score of 2 or higher would mean that the individual would have to have at least 1 activity that they are not able to perform or at least two activities that the individuals can perform with some difficulty.

Explanatory Variable and Covariates

The paper proposes to use a score of socio-economic status based on the principal components analysis of income, consumption, and wealth of the households. In the Indian context, most studies use wealth quintiles to explain health outcomes (Parmar and Saikia 2018; Singh et al. 2019; Subramanian et al. 2006). Some exceptions use Consumption and expenditure to explain health outcomes (Childers and Chiou 2016). However, income, Consumption, and Wealth are All shown to have an independent effect on mortality in the Indian context (Po and Subramanian 2011). All three aspects although closely related, indicate and work in different ways to affect health outcomes. Wealth indicates the long-term SES of the household, whereas Income usually captured with an annual recall period, captures the (relative) short-term status of the household.

The paper proposes to use Principal Components Analysis (PCA), a dimensionality reduction technique to capture relatively but not completely correlated dimensions of income, consumption, and wealth. PCA allows for dimensionality reduction by identifying the most important components or patterns that explain the variation in the data. In situations where the independent variable is highly correlated, PCA can aid by reducing the dimension of the data and generating new uncorrelated variables known as principal components. This can help to avoid problems caused by multicollinearity (Vyas, 2006).

The paper controls for demographic characteristics including, including age, gender, and marital status. Age is categorized in intervals of 5 starting from 50 to 54 and ending with 70 and above. Gender is binary coded with men and women as categories. Marital status is coded as Married vs Divorced, separated, Widowed, and Never Married. The location of individuals in terms of urban and rural is considered. Other socioeconomic characteristics being controlled include caste and religion.

Bivariate Statistics

The preliminary analysis of the data suggests that there were, 21,463 persons above the age of 49 in wave 1, and for whom we obtained data for both rounds did not indicate any functional restrictions. Whereas 1568 did acknowledge report some kind of functional limitation. Of the 21,463 individuals who reported functional limitation, 74 percent were free of functional limitation in wave 2, 7 years later, while 26 percent acquired functional limitation between two waves. Bivariate statistics suggest that women are more likely to develop functional limitation, with 29 percent of women who were free of functional limitation developing functional limitation between two rounds while only 22 percent of men did. Rural individuals were more likely to develop functional limitations. 30 percent of individuals in the lowest wealth quintile developed functional limitations between two rounds while 24 percent in the highest quintile developed functional limitations. 18 percent of individuals with some college education developed functional limitations between two rounds, while 28 percent of individuals with no formal education developed functional limitations.

With a growing population of older adults in India and increased life expectancy, the prevalence of functional limitations in older adults is on a rise. The correlation between socioeconomic conditions and functional limitations in India remains unclear, with some studies finding no correlation between functional limitations and wealth quintiles or social groups, while others find wealth and caste significant even after controlling for other covariates. The paper hopes to add to a growing literature that uses

Principal Components Analysis to look at the relationship between the health of older adults and socioeconomic conditions. Adult health outcomes are an outcome of cumulative advantages and disadvantages that older adults have experienced throughout their lifetime as well as their current capabilities and resources. Growing literature uses PCA as a dimensionality reduction technique to look at the health outcomes of older Adults. Beydoun and Popkin (2005) use quintiles based on the Principal Components Analysis of income, wealth, and education to look at the functional limitations of older adults in China. Payne and Xu (2022) also look at functional limitations in older adults in China and explain the outcomes using a Principal Component Analysis of childhood and adulthood socioeconomic conditions. Additionally, the paper hopes to leverage the panel nature of the data to also look at mortality when explaining the change in status of functional limitations over time. \

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