Socioeconomic and age gradients of health of Indian adults: an assessment of self-reported and performance-based measures of health

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Abstract

Objectives: *This paper describes the age patterns of socioeconomic gradients of health of Indian adults for multiple health indicators encompassing the multidimensional nature of health.*

Methods: *Cross-sectional data on 11,230 Indians aged 18-plus from the WHO-SAGE India Wave 1, 2007 is used. Multivariate logit models were estimated to examine the effects of socioeconomic status (education and household wealth) and age on four health measures: self-rated health, self-reporting functioning, chronic diseases, and performance-based health indicators. .*

Findings: *Socioeconomic status was positively associated with each health measure but with considerable heterogeneity across age groups. SES relationship with biomarkers (hypertension and COPD) was inconclusive. SES effects are significant while adjusting for background characteristics and health risk factors. The age patterns of SES gradient of health depict divergence with age, however, no conclusive age pattern emerged for performance-based health indicators.*

Discussion: *Overall, results in this paper dispelled the conclusion of negative SES-health association found in some previous Indian studies and reinforced the hypothesis of positive association of SES with health for Indian adults. Higher prevalence of negative health outcomes and SES disparities of health outcomes among older age-groups highlight need for inclusive and focused health care interventions for older adults across socioeconomic spectrum.*

Keywords: *Socioeconomic status, gradients, self rated health, functional health, chronic disease, biomarkers*

Introduction

A large volume of research in the areas of social epidemiology and medical sociology has investigated the profound nature of the impact of socioeconomic status (SES) on health. Studies in this area have concluded that there exists an overall positive relationship between socioeconomic status and health (Adler and Ostrove, 1999; Kitagawa & Hauser, 1973). Many studies have shown that overall health improves as socioeconomic status improves (Adler et al., 1994; Marmot et al., 1991; Marmot, 1999), confirming a consistent socioeconomic gradient of health.

However, a majority of studies demonstrating the SES gradients of health focussed on the developed countries. The lack of reliable data on adult health contributes to the few studies available from developing countries; however, more studies in non-western developing countries of Asia and Latin America have become available (Hurt, Ronsmans, & Saha, 2004; Palloni & McEniry, 2004; Rosero-Bixby & Dow, 2009; Smith & Goldman, 2007). Findings from these studies demonstrated SES-health relationship similar to that documented for developed countries. While some studies from developing countries documented inverse SES-health relationship (Rosero-Bixby & Dow, 2009), other studies did not find any conclusive pattern across all the indicators of adult health (Zimmer et al., 2002).

In India, most of the previous studies on adult health used self-reports on morbidity primarily from the three rounds of National Sample Survey (NSSO 1986-87, 1995-96 and 2004). Findings from these studies revealed an inverse SES-health relationship (Dilip, 2002; Satyashekhar, 1997). Results from a few other studies with small sample sizes using objective, clinical assessments of chronic diseases have also reported inverse SES-health relationship (Chadha et al., 1990). Alternately, other recent studies in India have shown that populations from lower socioeconomic strata are at higher risk of diseases (Gupta et al., 2010). Such contrasting findings point to inconclusive nature the SES-health relationship in India and illustrate the importance of clearly defining the health measure. Also, majority of

the studies on SES-health relationship in India have focused on the chronic diseases ignoring the other dimensions of health like functional health and the biomarkers. Our study investigates the SES-health relationship with self-reported chronic conditions plus an additional three health measures: self-reported overall general health, functional health and measured performance tests for adults.The objective is to describe the SES gradients of health across broad adult age groups in India.

Socioeconomic status and health: review of literature

Relationship between socioeconomic status and health

Previous studies have observed positive socioeconomic gradients of health across countries, time periods and demographic groups for a range of health indicators such as mortality (Kitagawa & Hauser, 1973), disease prevalence (Marmot et al., 1991), functional limitations (Hemingway et al., 1997), health behaviour (Cutler & Lleras-Muney, 2010) and health biomarkers (Crimmins & Seeman, 2004). These health indicators have been associated with numerous measures of SES including income (House et al., 1990), wealth (Ostrove, Feldman, Adler, 1990), occupation (Marmot et al., 1991), and education (Cutler and Lleras-Muney, 2008). Each of these SES indicators represent a unique dimension of the socioeconomic position of the individuals and may demonstrate varying role in determining health as they tend to provide different material and social resources (Lynch & Kaplan, 2000; Galobardes et. al, 2006).

The important question that arises is how SES and health are related. The social determinants framework envisages that within a country, social, political and economic mechanisms determine the socioeconomic position, whereby populations are stratified according to income, education, occupation, wealth, gender and race/ethnicity. These socioeconomic positions of individuals are referred to as structural or social determinants of health (CSDH,

2008). The underlying mechanisms operate through a set of intermediate variables and contribute to health outcomes. These intermediate variables can be distilled into three main groups: material circumstances like housing quality, consumption potential, and the physical work environment (Adler and Newman, 2002); psychosocial circumstances which includes psychosocial stressors, stressful living conditions and relationships, and social support (Brunner, 1997); and behavioural and biological factors like physical activity, tobacco consumption, alcohol consumption and nutrition (House, 2002). Socioeconomic status mediates an individual's exposure to virtually all types of known psychosocial, biomedical and behavioural risk factors of health; consequently, individuals in lower socioeconomic strata are more prone to exposure to risk factors that adversely impact health (Lantz et al., 2001).

Different indicators of SES have been found to affect health differently. For example, income has been shown to promote health by affecting nutrition, housing quality, exposure to environmental hazards, stress, and access to adequate health care (House et al., 1994; House 2002; Lantz et al., 2005). Education contributes to good health through generating economic resources (income and employment) and social-psychological resources like healthy behaviours (Ross and Wu, 1995), ability to cope with stress (Lantz et al., 2005), a sense of personal control (Mirowsky and Ross, 1998), and knowledge and skills by which people are able to better self-manage illness and disease (Goldman and Smith, 2002).

Socioeconomic status, health and age: Convergence or divergence with age

Substantial body of research has identified that socioeconomic gradient on health is not necessarily a phenomenon related to a particular age-group but might characterize similar or heterogeneous pattern with age. Studies dealing with age patterns of socioeconomic gradients on health have documented two contrasting patterns with different theoretical premises. First,

Aging may be a levelling process where those in upper socioeconomic groups postpone functional limitations into later years of life while among lower socioeconomic groups adverse health conditions rise throughout middle and early old age, but level out in older age when some combination of social and biological factors reduces socioeconomic differences in health (Beckett, 2000; House et al., 1990; House, Lantz & Herd, 2005).

A few other studies have challenged this notion arguing that the health disadvantage by socioeconomic status may accumulate over the life course resulting in enhanced health differentials in older ages. For example, education is shown to be associated with increasing disparities with increasing age (Dupre, 2008; Ross and Wu, 1996). Also, long term economic hardship is proved to have cumulative effects on health at older ages (Lynch et al., 1997). The advocates of this notion base their arguments on the theory of cumulative disadvantage which says that the health risks accumulate over life course, thereby increasing the heterogeneity in later life (Dannefer 1987; Dannefer 2003).

In this study, cross sectional data from SAGE India Wave 1 is used to illustrate the relationships between SES and age with health.

Methods

Data

The WHO Study of global AGEing and adult health inIndia (SAGE-India) Wave 1was used in this study. SAGE-India was implemented in 2007 in six selected states of Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal, including a total of 11,230 respondents aged 18 years and older. The number of completed individual interviews by age and sex are: 3624 female aged 18-49, 1046 male aged 18-49, and 6,560 persons (3,311 male and 3,249 female) in age group 50-plus. SAGE-India (2007) provides data on several critical domains of adult health which include: measured health based on key biomarkers, self reported health data on: chronic diseases, self rated health, cognition, psychological health, and functional health for adults in age 18 and above with special focus on older population

(age 50 and above). More detailed information about weights and survey design is available at:

http://apps.who.int/healthinfo/systems/surveydata/index.php/catalog.

Health outcomes

Four health measures were generated:

1) Self-rated overall general health based on the question, "In general, how would you rate your health today?" The response categories used a 5-point Likert type scale from very good to very bad. For the convenience of analysis, we combined poor and very poor health categories as 'poor health' and rest into other (good health) to derive a dichotomized health variable. 'Poor health' was the outcome of interest in the analysis.
2) Self-rated functional health was assessed through a set of questions based on the Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADL). SAGE-India collected data on ADLs and IADLs based on self- reports about particular activities in the last 30 days on a five-point scale ranging from none to extreme difficulty. In this study, severe and extreme difficulties were combined. The ADLs include sitting, walking, standing-up, standing, climbing, crouching, picking up, eating, dressing, using toilet, moving around in home, transferring and concentrating for about 10 minutes. The IADLs include using public transport, carrying out household responsibilities, joining community functions and getting out of the household;
3) Presence of a total of four chronic health conditions (angina, arthritis, asthma, and depression) based on symptom-based reporting combined with diagnostic algorithms to improve estimation of chronic disease prevalence. The symptom-reporting plus algorithm method to ascertain prevalence of each specific disease is given in Table1 of Appendix-A (online material); and,
4) More objective health measures were collected for the first time in India, including the use of blood pressure devices to assess hypertension, spirometry to assess chronic lung

disease, LogMAR Tumbling "E" vision chart to assess near and distant visual acuity and measured weight and height to estimate levels of under-nutrition (BMI $\leq$ 18.5). The detailed procedure used to create aforementioned measured health indicators is given in the Appendix-A (online material).

Overall, twelve indicators from the four domains of health are selected to encompass the multidimensional nature of health. The first three set of indicators listed above are commonly used self-reported health measures in epidemiological studies. The fourth set is more objective health measures used in this study, and are relatively unexplored in the literature on health research in India.

Indicators of socioeconomic status

In this analysis, years of schooling and household wealth quintile were used to represent socioeconomic status. In the literature on social determinants of health, education is recognized as a key measure of socioeconomic status and a more plausible exogenous determinant of health than income and occupation (Elo and Preston, 1996; Lynch and Kaplan, 2000). Enhanced health knowledge, decision-making ability and greater access to and use of resources and health are recognized as possible pathways in explaining the education-health relationship (Ross and Wu, 1995; Cutler and Lleras-Muney, 2008). For analytical convenience, years of education has been grouped into four categories: no schooling, 1-5 years, 6-9 years and 10 and above years of schooling.

In addition to education, an asset-based approach was used to generate household wealth quintiles. The wealth score has been generated using factor analysis on these indicators and the wealth score is grouped into 5 categories namely lowest, lower, middle, higher and highest with cutoff points of 20% quintile each. The detailed list of items for wealth score is given in **Appendix-B** (Online material). Researchers have suggested using wealth as an

indicator of socioeconomic status in health research can buffer the income loss or short term income fluctuations (Pollack et al., 2007).

Control variables

Two sets of control variables, background factors and health risk factors, are included in this study. The background variables include: state of residence, locality (urban or rural), religion (broadly categorised as Hindu, Muslim and other), caste (categorised as Scheduled Castes/Scheduled Tribes and other), gender (men or women) and marital status (currently married/cohabiting and other). The health risk variables consist of: tobacco use (current users (daily or non-daily) or non-user); alcohol consumption (current user (consumed alcohol in the last 30 days) or non-user); physical activity (categorised as active if involved in vigorous/moderate physical activity for more than 300 minutes per week or otherwise inactive); and, waist-to-hip ratio (categorised as low, moderate and high risk). The waist-hip ratio is measured from the anthropometric assessment, with cut-offs for risk estimation provided in the biomarkers section of Appendix-A (online material).

Analytical approach

A three stage analysis has been performed. First, results on overall prevalence of poor health outcomes are presented by the education categories and household wealth quintiles. Second, considering that the dependent variables are binary, we estimated multivariate logit regression models to examine the overall age and socioeconomic gradients for various indicators of health. The model is specified as follows:

$$\text{logit}(p(Y_i = 1) = \beta_0 + \beta_1 X_i + \beta_2 \text{Age}_i + \beta_3 \text{SES}_i + \varepsilon_i$$

Where, Yi is health variable, Xi is a vector of control variable and SES is socioeconomic status, and ε is assumed to be a zero- mean error term. Third, we estimated logit models for each broad age-group separately to examine effects of socioeconomic status on various health indicators across age-groups (18-49, 50-59, 60-69 and 70+). To compare SES disparities in health across age-groups, we estimatedthe predicted probabilities from age-specific logit

models. In all the regression models, the control variables are used generate adjusted estimates.

Results

Sample characteristics

Table1 presents the percent weighted distribution of the sample population by major demographic, socioeconomic and behavioural characteristics. The study covered a nationally representative total sample of 11,230 individuals, of which 42% are aged18-49 years and 58% are aged 50 and above. The weighted sample was proportionately higher in Uttar Pradesh (33%) followed by Maharashtra (20%). Thirty-eight percent of the sample is men and 25% from urban areas. Forty-five percent had no schooling. Twenty-five percent belong to scheduled caste or schedule tribe groups and 16% of the sample was non-Hindu population.

[Table1 around here]

Prevalence of chronic diseases and other health conditions

Table2 compares the differences in self-rated poor health and ADL and IADL limitations, and reported prevalence rates of chronic diseases (algorithm based) for the national sample by years of schooling and wealth quintiles. Overall, 11% of Indian adults have rated their health to be bad, 27% have reported difficulty in at least one ADL and 14% have reported difficulty in at least one IADL. The prevalence of chronic diseases was highest for arthritis (13%) followed by angina (12%) and depression (12%). By objective health measures, COPD prevalence was highest (44%), followed by prevalence of under-nutrition (35%). Education and household wealth quintile showed negative gradients on ‘poor health’ vice-versa positive gradient on ‘good health’. The prevalence of ‘poor health’ was highest in the lowest SES categories and lowest in the highest SES stratum.

[Table2 about here]

SES-health relationship

This section presents the results of multivariate logit models estimated to examine the effects of socioeconomic status on various health indicators of Indian adults. For this purpose, we estimated four models that progressively included the control variables and socioeconomic indicators. The first model included years of schooling as the only predictor, the second model built on this adding household wealth, the third model further added selected background characteristics (age, sex, marital status, state, rural residence, caste and religion), and the fourth model added the behavioural health risk factors namely tobacco consumption, alcohol consumption, physical activity and waist-hip ratio. Such stage-wise model building strategy has two-fold objectives: first was to examine if adding household wealth along with the education has significant impact of model fit; second aim was to examine whether the SES effect remained significant after adding background variables and behavioural health risk factors progressively in the analysis. Table3 provides likelihood ratio test statistics for these models and strength of associations between education and health, and wealth and health. Results show that inclusion of wealth along with the education in the regression models (Model1 vs. Model2) adds significantly to the model fit for all the health indicators except IADL, asthma and depression. The chi-square values are highly significant (p-value<0.01)for poor self-rated health, under-nutrition and low vision. Also, the inclusion of background characteristics (Model2 vs. Model3) improves model fit considerably as depicted by very high likelihood ratio test statistics (significant at less than 1% level of significance). The addition of behavioural factors along with the SES and background characteristics (Model3 vs. Model4) shows further improvement in the model fit (p-value<0.01) for all health indicators.

Results further reveal that education displays a statistically significant positive association with most of the health indicators, even after adjusting for household wealth, respondents' background characteristics and behavioural risk factors. However, Model 4,

which included the full set of predictors, show significant gradient of education for measured hypertension prevalence while education gradient was insignificant for measured COPD prevalence. In Model2, household wealth quintile depicted a mixed pattern across different health indicators. For example, household wealth showed significant gradients for most health indicators: self-reportedpoor SRH, ADL limitations, arthritis, angina, and lung disease, and measured hypertension, COPD and low vision, but showed insignificant gradient for IADLs, asthma and depression.

[Table3 around here]

The regression model estimates summarized in Table3 used years of schooling and household wealth quintile as continuous variables. Following this, we further explored the SES-health relationship with the SES variables being categorical (four categories of years of schooling and five quintiles of household wealth scores). The purpose was to ascertain the SES-health association at different levels of SES. Adopting the aforementioned four model specification analytical approach, the results of full model (Model 4) are presented in Table4. This table provides the adjusted odd ratios for poor health outcomes based on the education and wealth categories. Additional results for all regression models are given in the Appendix-C (online material). Results showed anoverall positive and significant SES gradient for all health indicators except COPD. Also, importantly, compared with no schooling, 1-5 years of schooling showed no significant impact on health indicators of Indian adults, while for adults with 6-9 years of schooling completed, health indicators showed notable improvement. Education showed less consistent gradients for under-nutrition given this is a more widespread problem in India. Overall, education showed a positive and statistically significant gradient for all the health indicators except COPD. Household wealth quintiles was associated negatively with negative health outcome indicators; vice-versa, wealth quintile demonstrated an overall positive gradient on the health of Indian adults.

[Table4 around here]

SES-health relationship across age groups

In this section, we explore the SES-health relationship across broad age groups: 18-49, 50-59, 60-69 and 70+. There are two approaches to examine the SES-health relationship across ages: the first is to estimate separate regression models for all age groups and the second is to use interaction between age groups and SES groups in the models. The first approach is more flexible as it allows all the control variables to affect health differently in different age group. The second approach of using interactions in the regression models is more restrictive as it assumes that the impact of control variable do-not change with age. Also, the interpretation of interaction terms is difficult in the non-linear models (like logit or probit) when dealing withthe magnitude and statistical significance of the coefficients (Ai and Norton, 2003). Therefore, in this paper, we opt for the flexible approach of estimating separate regression model for each age group.

Table5 presents the results of odds ratios of education and wealth quintiles on health estimated from logit models for each age group and each of the health indicators. Compared to those with no schooling, the odds ratios for younger adults aged 18-49 years with 1-5 years of schooling are insignificant for all health indicators except angina, under-nutrition and low vision. Overall, education of 1-5years showed insignificant effect on the health of young adults (aged 18-49) contrasted by significant effect on the health of older adults in age 50-59 and 60-69. However, this pattern of relationship is not consistently established for all health indicators. Interestingly, those adults with 1-5 years schooling were more likely to have low vision (OR=1.34) and arthritis (OR=1.45) in the50-59 year age group. Such inconsistent pattern of results (higher odds among adults with higher education) was also observed in the analysis for full sample and there is no apparent explanation for such unlikely results.

Nevertheless, 1-5 years of education had significant positive effects for a larger number of health indicators in the 70+ age group.

Younger adults with 6-9 years of schooling were significantly less likely than those with no schooling to have: ADL (OR=0.64), arthritis (OR=0.66), lung diseases (OR=0.60), asthma (OR=0.44), measured hypertension (OR=0.70) and low vision (OR=0.45). Second, older adults in age 50-59 with6-9 years of schooling were significantly less likely than those with no schooling to have; IADL (OR=0.65), arthritis (OR=0.6) and under-nutrition (OR=0.77). Third, older adults in ages of 60-69 with 6-9 years of schooling were significantly less likely than those with no schooling to have:poor self-rated health (OR=0.43), ADL limitation (OR=0.53), IADL limitation (OR=0.54) and angina (OR=0.59). Lastly, adults aged 70+ with 6-9 years of schooling were significantly less likely than those with no schooling to have:poor self-rated health (OR=0.6), arthritis (OR=0.58), asthma (OR=0.26), under-nutrition (OR=0.26) and low vision (OR=0.48).

The highest education category, 10+ years of schooling showed consistently the clearest and largest effecton health indicators across all age groups. Importantly, unlike other categories, the odds ratios on 10+ years of schooling -compared with no schooling-depicted a negative association with the prevalence of all the diseases and poor health conditions across all the age groups. For the youngeradults, 10+ years of schooling was significantly and negatively associated with poor self-rated health, ADLs, IADLs, arthritis, angina, depression and low vision. For older adults aged50-59,10+ years of schooling was significantly and negatively associated with poor self-rated health, ADLs, IADLs, arthritis, angina, lung disease, depression and under-nutrition. Among older ages of 60-69, the 10+ years of schooling was significantly and negatively associated with poor self-rated health, ADLs, IADLs, angina, lung diseases, asthma, depression, under-nutrition and low vision.

In sum, the results indicate that education was overall negatively associated with poor health across all age-groups. Though, these estimates are generated from separate regression models by each age category and therefore are not comparable, the lowest odds ratios for 10+ years of schooling points to the highest educational differentials in health for the oldest age-group (70+).

[Table5 around here]

Table 5 also shows the odds ratio estimates of wealth quintiles on health indicators. Household wealth was negatively associated with the prevalence of negative health outcome indicators across both younger and older age-groups. However, the level of significance of the odds ratios presented in the model suggests that the effect of household wealth is relatively moderate compared to education, except its influence in determining the prevalence of under-nutrition. Household wealth was negatively and significantly associated with the prevalence of under-nutrition across all ages with the largest impact on the 70+ age group. Household wealth quintile showed significant and positive association with hypertension among Indian adults except in the 50-59 age group. On the whole, these results suggest that the influence of household wealth varied somewhat on different indicators of health and across adult ages.

We further estimated predicted probabilities from the multivariate logit models by years of schooling and wealth quintiles to examine socioeconomic disparities in the prevalence of various health outcomes across age groups. Figure1 displays the predicted probabilities of various health outcomes by years of schooling and Figure2 depicts the predicted probabilities of health indicators by wealth quintiles across different age groups. We also tested the differences in the predicted probabilities between levels of SES across age groups. The detailed results are provided in Appendix-D (online material). Figure 1 showed how the difference in the predicted probabilities between lowest and highest education

groupings for the three self-reported health measures increased with age demonstrating a diverging age pattern of SES disparities in health. The age patterns of SES disparities (difference in the predicted probabilities between no schooling and 10+ years of schooling) also diverged notably for all the symptom-based disease prevalence, except asthma. For the objective health measures, age patterns of SES disparities for hypertension and COPD showed inconsistent patterns. Under-nutrition and low vision also depicted diverging age patterns of SES disparities. The predicted probabilities of various health outcomes by household wealth quintile across age groups presented in Figure2 revealed similar inconsistencies as seen with education. Measured prevalence of hypertension and COPD showed inconsistent and often inverse SES disparities in health across age groups.

[Figure1 around here]

[Figure2 around here]

Discussion

In this study, the effect of socioeconomic status (SES) on health of Indian adults using four different groups of health measures was explored using WHO-SAGE Wave1 data. Further analysis examined SES gradients across four broad age groups. We estimated gradients for two SES measures, namely years of schooling (education) and household wealth, on four health measures, including (i) self-rated overall general health; (ii) self-reported functional health consisting of ADLs and IADLs; (iii) self-reported chronic conditions, including arthritis, angina, lung diseases, asthma and depression based on validated symptom-report with diagnostic algorithm; and, (iv) measured hypertension, lung function classified as COPD, low BMI (under-nutrition) and low vision.

This analysis provided a number of fresh insights and contributed to a better understanding of the SES-health relationship using multiple health measures in the Indian context. In a comparative perspective, previous studies largely focused on the SES

differentials in self-reported prevalence of chronic diseases and consequently reported inconclusive results of SES-health relationship in the Indian context (Dilip, 2002; Satayshekhar, 1997). As commonly known, self-reported morbidity data is known to be affected by several biases as result of widespread illiteracy and poor access to health care (Sen, 2002). Therefore, many of these studies in general reported a negative relationship between SES-health implying positive association between SES-poor health and prevalence of diseases (Reddy, 2002; Reddy et al., 2007; Vellakkal et al., 2013). Other studies have documented contrary results of positive association between SES and health in India (Gupta et al., 2010). Amidst such unsettled conclusions, the findings from this study reinforce the hypothesis of overall positive relationship between socioeconomic status and health in the Indian context; a hypothesis that has been widely demonstrated in high (House, 2002) as well middle-income countries (Zimmer and Amornsirisomboon, 2001). Results of this study reveal that each ordinal increase in the socioeconomic status resulted in declining probability of poor health outcomes for the subjective and objective health outcome measures used in this study.

The education and household wealth had significant individual influence on the selected health indicators. But, when adjusted for education, the effect of household wealth quintile is attenuated for IADLs, asthma and depression. Notably, education emerged as a more consistent indicator of socioeconomic status in determining health of Indian adults than household wealth; except that household wealth is a more important SES determinant of under-nutrition. The conclusion of greater influence of education on the health of Indian adults is contrasted with the findings of household wealth as the most significant SES determinant of health from other low to middle income countries. In the developed countries, education has been found to be the strongest measure of SES in relation to health influencing it through multiple pathways, including health behaviours and access to healthcare (Fuchs

1979). Results further reveal that behavioural health risk factors in the regression models add significantly to the model fit to distinguish the effect of education versus household wealth quintile. The effect of education on all health indicators, except hypertension and COPD, remained very significant after successive adjustment for demographic and behavioural characteristics. In contrast, the effect of wealth after adjustment for the same set of characteristics turns out to be insignificant for arthritis, asthma, hypertension, COPD and low vision. The varying strength of the relationship of education and household wealth with health points to other mechanisms that mediate socioeconomic differences in health. The theory of fundamental causes of health by Link and Phelan (1995) may provide a useful link for further investigation in the Indian context.

Investigation of SES-health relationship by broad adult age groups suggests an overall positive association of SES-health, alternatively a negative association with poor health outcomes across all age groups; however, the magnitude of SES-health association varied across age-groups and by different health measures. Also, unexpected inconsistencies observed in SES-health relationships may warrant alternative explanations. A comparative assessment of SES differentials in the probability of poor health outcomes reveals a mixed picture of diverging patterns of socioeconomic gradients of health with age. For example, results point to diverging age patterns of SES gradients for health indicators: self rated health and activity limitations and chronic diseases such as lung disease, asthma and depression. However, for physical performance based measures namely hypertension and COPD, results revealed no clear pattern. Admittedly, these results are consistent with the findings from other studies in developing countries (Lowry and Xi, 2009).

The notable incongruous finding is the relationship between SES gradient and the performance based health measures: hypertension and COPD showed inconsistent pattern compared with the other subjective health measures. A plausible reason for the variance

could be related to the considerable levels of illiteracy and lack of access to health care in this context. The more objective health measures are likely to uncover large burden of undiagnosed negative health outcomes. Such findings have also been reported in other studies from developing countries (Rosero-Bixby and Dow, 2009; Zimmer and Amornsirisomboon, 2001).

Although, this study provides evidences of overall positive gradients of healthwith diverging patterns of SES gradients with age in the Indian context, results should be viewed with caution for the following limitations. First, given the vast state variations in socioeconomic, demographic and cultural profiles, the WHO-SAGE India data from the six selected states may not adequately capture all the sub-national SES-healthvariations. Second, cross-sectionaldata limits the scope of disentangling the effects of aging from cohort effects in theexamination of age-pattern of SES gradients.Third, cross-sectional data constrains anycausal inferences.Lastly, due to smaller sample size at the older ages, SES-health gradients could not be examined among oldest old ages.

In sum, these results confirm the hypothesis of positive SES-health gradients for Indian adults. Results also point to the diverging pattern of SES-health gradients with age among the Indian adults. The key strength of this study lies in the wide range of health indicators used representing the multidimensional nature of adult health. Secondly, this is a maiden study that explored the age pattern of SES gradients of health in the Indian context. Lastly, these findings provide a basis for further studies of SES-health relationship across adult age groups with broad array of health and socioeconomic indicators in India. A potential exists in future for more robust analysis to test SES gradients of health with age with the availability of detailed longitudinal data from this large nationally representative sample on adult health.

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References

Adler, N. E., Boyce, T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., & Syme, S. L. (1994). Socioeconomic status and health. The challenge of the gradient. The American Psychologist, 49(1), 15-24. http://dx.doi.org/10.1037/0003-066X.49.1.15

Adler, N. E., & Newman, K. (2002). Socioeconomic disparities in health: pathways and policies. Health Affairs (Millwood), 21(2), 60-76. http://dx.doi.org/10.1377/hlthaff.21.2.60

Adler, N. E., & Ostrove, J. M. (1999). Socioeconomic status and health: what we know and what we don't. Annals of the New York Academy of Sciences, 896, 3-15. http://dx.doi.org/10.1111/j.1749-6632.1999.tb08101.x

Ai, Chunrong, & Norton, E. C. (2003). Interaction terms in logit and probit models. Economics Letters, 80(1), 123-129. http://dx.doi.org/10.1016/S0165-1765(03)00032-6

Beckett, M. (2000). Converging health inequalities in later life--an artifact of mortality selection. Journal of Health and Social Behaviour, 41(1), 106-119. http://dx.doi.org/10.2307/2676363

Brunner, E. (1997). Stress and the biology of inequality. BMJ, 314(7092), 1472-1476. http://dx.doi.org/10.1136/bmj.314.7092.1472

Chadha, S. L., Radhakrishnan, S., Ramachandran, K., Kaul, U., & Gopinath, N. (1990). Epidemiological study of coronary heart disease in urban population of Delhi. Indian Journal of Medical Research, 92, 424-430.

Crimmins, Eileen M., & Seeman, Teresa E. (2004). Integrating Biology into the Study of Health Disparities. Population and Development Review, 30, 89-107. doi: 10.2307/3401464

CSDH. (2008). Closing the Gap in a Generation: Health Equity through Action on the Social Determinants of Health. Final report of the commission on social determinants of health. Geneva: World Health Organization.

Cutler, D. M., & Lleras-Muney, A. (2010). Understanding differences in health behaviors by education. Journal of Health Economics, 29(1), 1-28. http://dx.doi.org/10.1016/j.jhealeco.2009.10.003

Cutler, D.M., & Lleras-Muney, A. (2008). Education and health: evaluating theories and evidence. In S.H James, R. F. Schoeni, G. A. Kaplan & H. Pollack (Eds.), Making Americans Healthier: Social and Economic Policy as Health Policy. New York: Russell Sage Foundation.

Dannefer, Dale. (1987). Aging as Intracohort Differentiation: Accentuation, the Matthew Effect, and the Life Course. Sociological Forum, 2(2), 211-236. doi: 10.2307/684472

Dannefer, D. (2003). Cumulative advantage/disadvantage and the life course: cross-fertilizing age and social science theory. Journal of Gerontology. Series B, Psychological Sciences & Social Sciences, 58(6), S327-337. http://dx.doi.org/10.1093/geronb/58.6.S327

Dilip, T. R. (2002). Understanding levels of morbidity and hospitalization in Kerala, India. Bulletin of the World Health Organization, 80(9), 746-751.

Dupre, M. E. (2008). Educational differences in health risks and illness over the life course: a test of cumulative disadvantage theory. Social Science Research, 37(4), 1253-1266. http://dx.doi.org/10.1016/j.ssresearch.2008.05.007

Elo, I. T., & Preston, S. H. (1996). Educational differentials in mortality: United States, 1979-85. Social Science & Medicine, 42(1), 47-57. http://dx.doi.org/10.1016/0277-9536(95)00062-3

Fuchs, V. R. (1979). Economics, health, and post-industrial society. The Milbank Memorial Fund Quarterly. Health & Society, 57(2), 153-182. http://dx.doi.org/10.2307/3349761

Galobardes, B., Shaw, M., Lawlor, D. A., Lynch, J. W., & Davey Smith, G. (2006). Indicators of socioeconomic position (part 1). Journal of Epidemiology & Community Health, 60(1), 7-12. http://dx.doi.org/10.1136/jech.2004.023531

Goldman, Dana P., & Smith, James P. (2002). Can Patient Self-Management Help Explain the SES Health Gradient? Proceedings of the National Academy of Sciences of the United States of America, 99(16), 10929-10934. doi: 10.2307/3059493

Gupta, R., Kaul, V., Agrawal, A., Guptha, S., & Gupta, V. P. (2010). Cardiovascular risk according to educational status in India. Preventive Medicine, 51(5), 408-411. http://dx.doi.org/10.1016/j.ypmed.2010.08.014

Hemingway, H., Nicholson, A., Stafford, M., Roberts, R., & Marmot, M. (1997). The impact of socioeconomic status on health functioning as assessed by the SF-36 questionnaire: the Whitehall II Study. American Journal of Public Health, 87(9), 1484-1490. http://dx.doi.org/10.2105/AJPH.87.9.1484

House, J. S. (2002). Understanding social factors and inequalities in health: 20th century progress and 21st century prospects. Journal of Health and Social Behavior, 43(2), 125-142. http://dx.doi.org/10.2307/3090192

House, James S., Kessler, Ronald C., & Herzog, A. Regula. (1990). Age, Socioeconomic Status, and Health. The Milbank Quarterly, 68(3), 383-411. http://dx.doi.org/10.2307/3350111

House, J. S., Lantz, P. M., & Herd, P. (2005). Continuity and change in the social stratification of aging and health over the life course: evidence from a nationally representative longitudinal study from 1986 to 2001/2002 (Americans' Changing Lives Study). Journals of Gerontology, Series B, Psychological Sciences & Social Sciences, 60 Spec No 2, 15-26. http://dx.doi.org/10.1093/geronb/60.Special_Issue_2.S15

House, J. S., Lepkowski, J. M., Kinney, A. M., Mero, R. P., Kessler, R. C., & Herzog, A. R. (1994). The social stratification of aging and health. Journal of Health Social Behavior, 35(3), 213-234. http://dx.doi.org/10.2307/2137277

Hurt, L. S., Ronsmans, C., & Saha, S. (2004). Effects of education and other socioeconomic factors on middle age mortality in rural Bangladesh. Journal of Epidemiology & Community Health, 58(4), 315-320. http://dx.doi.org/10.1136/jech.2003.007351

Katagawa, E, & Hauser, P. (1973). Differential Mortality in the United States: A Study in Socioeconomic Epidemiology. Cambridge: Harvard University Press.

Lantz, P. M., House, J. S., Mero, R. P., & Williams, D. R. (2005). Stress, life events, and socioeconomic disparities in health: results from the Americans' Changing Lives Study. Journal of Health and Social Behavior, 46(3), 274-288. http://dx.doi.org/10.1177/002214650504600305

Lantz, P. M., Lynch, J. W., House, J. S., Lepkowski, J. M., Mero, R. P., Musick, M. A., & Williams, D. R. (2001). Socioeconomic disparities in health change in a longitudinal study of US adults: the role of health-risk behaviors. Social Science & Medicine, 53(1), 29-40. http://dx.doi.org/10.1016/S0277-9536(00)00319-1

Link, Bruce G., & Phelan, Jo. (1995). Social Conditions As Fundamental Causes of Disease. Journal of Health and Social Behavior, 35, 80-94. http://dx.doi.org/10.2307/2626958

Lowry, D., & Xi, Y. (2009). Socioeconomic Status and Health Differentials in China: Convergence or Divergence at Older Ages: Population Studies Centre, Institute of social research, University of Michigan.

Lynch, J. W., Kaplan, G. A., & Shema, S. J. (1997). Cumulative impact of sustained economic hardship on physical, cognitive, psychological, and social functioning. New England Journal of Medicine, 337(26), 1889-1895. http://dx.doi.org/10.1056/NEJM199712253372606

Lynch, J., & Kaplan, G. (2000). Socioeconomic Position. In I. Kawachi & L. Berkman (Eds.), Social Epidemiology. New York: Oxford University Press.

Marmot, M. (1999). Epidemiology of socioeconomic status and health: are determinants within countries the same as between countries? Annals of the New York Academy of Sciences, 896, 16-29. http://dx.doi.org/10.1111/j.1749-6632.1999.tb08102.x

Marmot, M. G., Smith, G. D., Stansfeld, S., Patel, C., North, F., Head, J., . . . Feeney, A. (1991). Health inequalities among British civil servants: the Whitehall II study. Lancet, 337(8754), 1387-1393. http://dx.doi.org/10.1016/0140-6736(91)93068-K

Mirowsky, John, & Ross, Catherine E. (1998). Education, Personal Control, Lifestyle and Health: A Human Capital Hypothesis. Research on Aging, 20(4), 415-449. http://dx.doi.org/10.1177/0164027598204003

Ostrove, J. M., Feldman, P., & Adler, N. E. (1999). Relations among Socioeconomic Status Indicators and Health for African-Americans and Whites. Journal of Health Psychology, 4(4), 451-463. http://dx.doi.org/10.1177/135910539900400401

Palloni, A., & McEniry, M. (2007). Aging and health status of elderly in Latin America and the Caribbean: preliminary findings. Journal of Cross Cultural Gerontology, 22(3), 263-285. http://dx.doi.org/10.1007/s10823-006-9001-7

Pollack, C. E., Chideya, S., Cubbin, C., Williams, B., Dekker, M., & Braveman, P. (2007). Should health studies measure wealth? A systematic review. American Journal of Preventive Medicine, 33(3), 250-264. http://dx.doi.org/10.1016/j.amepre.2007.04.033

Reddy, K. S. (2002). Cardiovascular diseases in the developing countries: dimensions, determinants, dynamics and directions for public health action. Public Health Nutrition, 5(1A), 231-237. http://dx.doi.org/10.1079/PHN2001298

Reddy, K. S., Prabhakaran, D., Jeemon, P., Thankappan, K. R., Joshi, P., Chaturvedi, V., . . . Ahmed, F. (2007). Educational status and cardiovascular risk profile in Indians. Proceedings of the National Academy of Sciences of the United States of America, 104(41), 16263-16268. http://dx.doi.org/10.1073/pnas.0700933104

Rosero-Bixby, L., & Dow, W. H. (2009). Surprising SES Gradients in mortality, health, and biomarkers in a Latin American population of adults. Journals of Gerontolrontology: Series B, Psychological Sciences & Social Sciences, 64(1), 105-117. http://dx.doi.org/10.1093/geronb/gbn004

Ross, Catherine E., & Wu, Chia-ling. (1995). The Links Between Education and Health. American Sociological Review, 60(5), 719-745. http://dx.doi.org/10.2307/2096319

Ross, Catherine E., & Wu, Chia-Ling. (1996). Education, Age, and the Cumulative Advantage in Health. Journal of Health and Social Behavior, 37(1), 104-120. http://dx.doi.org/10.2307/2137234

Sekhar, P Satya. (1997). Levels of Morbidity in Andhra Pradesh. Economic and Political Weekly, 32(13), 663-672.

Sen, A. (2002). Health: perception versus observation. BMJ, 324(7342), 860-861. http://dx.doi.org/10.1136/bmj.324.7342.860

Smith, K. V., & Goldman, N. (2007). Socioeconomic differences in health among older adults in Mexico. Social Science & Medicine, 65(7), 1372-1385. http://dx.doi.org/10.1016/j.socscimed.2007.05.023

Vellakkal, S., Subramanian, S. V., Millett, C., Basu, S., Stuckler, D., & Ebrahim, S. (2013). Socioeconomic inequalities in non-communicable diseases prevalence in India: disparities between self-reported diagnoses and standardized measures. PLoS One, 8(7), e68219. doi: 10.1371/journal.pone.0068219

Zimmer, Z., & Amornsirisomboon, P. (2001). Socioeconomic status and health among older adults in Thailand: an examination using multiple indicators. Social Science & Medicine, 52(8), 1297-1311. http://dx.doi.org/10.1016/S0277-9536(00)00232-X

Zimmer, Z., Martin, L. G., & Chang, M. C. (2002). Changes in functional limitation and survival among older Taiwanese, 1993, 1996, and 1999. Population Studies , 56(3), 265-276. http://dx.doi.org/10.1080/00324720215931

Figure captions:

Figure1: Predicted Probabilities for various health outcomes by age and education, WHO-SAGE India, 2007.

Figure2: Predicted Probabilities for various health outcomes by age and wealth quintiles, WHO-SAGE India, 2007.

Table1: Sample characteristics of data used in the analysis, WHO-SAGE India, 2007

Variables	Cases	Un-weighted %	Weighted %
Age groups (Missing cases=0)			
18- 49	4,670	41.6	75.2
50-59	2,939	26.2	12.0
60-69	2,235	19.9	7.7
70+	1,386	12.3	5.1
Years of schooling (missing cases=31)			
No-schooling	5,099	45.4	36.2
1-5 years	2,108	18.8	17.6
6-9 years	1,824	16.2	19.4
10+ years	2,168	19.3	26.8
Wealth quintiles (Missing cases=0)			
Poorest	2,271	20.2	21.9
Poor	2,245	20.0	21.5
Middle	2,248	20.0	20.2
Higher	2,245	20.0	17.5
Highest	2,221	19.8	18.9
State (Missing cases=0)			
Assam	1,194	10.6	5.9
Karnataka	1,553	13.8	11.8
Maharashtra	1,983	17.7	20.4
Rajasthan	2,225	19.8	12.1
Uttar Pradesh	2,201	19.6	32.8
West Bengal	2,074	18.5	17.0
Residence (Missing cases=0)			
Urban	2,845	25.3	25.5
Rural	8,385	74.7	74.5
Religion (Missing cases=0)			
Hindu	9,439	84.1	84.2
Muslim	1,384	12.3	12.3
Others	407	3.6	3.5
Caste (Missing cases=0)			
ST/SC	2,752	24.5	25.5
Others	8,478	75.5	74.5
Sex (Missing cases=0)			
Male	4,357	38.8	50.9
Female	6,873	61.2	49.1
Marital status (Missing cases=1)			
currently married	8,715	77.6	81.9
Otherwise	2,514	22.4	18.1
Total sample	11,230	100.0	100.0

Notes: Weighted percentages are obtained using sampling weights provided in the dataset and excluding the missing cases

Table2: Prevalence (%) of chronic health condition and self rated health by education and wealth quintiles, WHO-SAGE India, 2007

Health Indicators	All	Education (years of schooling)				Household wealth quintile				
		No schooling	1-5 years	6-9 years	10+ years	Lowest	Lower	Middle	Higher	Highest
Prevalence of self rated bad health and ADL and IADL limitations										
Self rated bad health	11.3	15.3	14.8	9.8	4.6	16	14.4	11.7	7.3	5.6
1+ ADL limitation	27.4	39.5	32.2	21.2	12.3	33.3	32.7	25.2	24.3	19.6
1+ IADL limitation	13.8	20.6	16.5	11.3	4.6	17.6	17	13.4	11.3	8.6
Prevalence of chronic diseases (algorithm based)										
Arthritis	12.9	17	16.7	9.7	7.2	14.8	14.2	12.5	12	10.3
Angina	12.1	16.5	13.4	10.6	6.7	15.6	13.6	12.9	10.9	6.8
Lung Disease	8.9	11.2	10.8	5.3	7	11.4	9.3	9.8	7.3	5.8
Asthma	5.9	7.1	7.1	4	4.8	7.1	6.3	5.6	5.3	4.8
Depression	11.9	15.9	11.5	10.6	7.6	13.5	13.9	11.8	11.9	7.7
Prevalence of performance based measures (biomarkers)										
Hypertension	19.9	21.6	21.4	18	18.1	18.8	19.7	19.5	19.7	22.1
COPD	43.9	45.6	47.3	42.5	40.5	46.1	46.7	43	42.1	40.8
Low Vision	24.4	33.8	27.6	18.2	13.7	25.7	25.9	25.8	25.1	18.9
Under-nutrition (BMI<18.5)	35.2	40.1	40.8	36.3	24.1	50.6	39.8	34.7	27.2	19.9
Sample	**11230**	**5099**	**2108**	**1824**	**2168**	**2271**	**2245**	**2248**	**2245**	**2221**

Notes: percentages are weighted using sampling weights provided in the dataset and excluding the missing cases.

Table: 3 Summary of likelihood ratio tests for successive addition of different set of covariates in the regression models and the level of significance of SES measures in various models.

	Likelihood Ratio Test[a] (Chi-square)			**Is education significant?[a]**				**Is household wealth significant?[a]**		
Health Indicators	**Model1 vs. Model2**	**Model2 vs. Model3**	**Model 3 vs. Model4**	**Model1**	**Model2**	**Model3**	**Model4**	**Model2**	**Model3**	**Model4**
Poor self rated health	23.9***	492.4***	22.8***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***
1+ ADL	6.4**	1039.1***	15.5***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(-)***	Sig(+)***	Sig(+)***
1+ IADL	0.4	408.9***	32.9***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	No	Sig(+)***	Sig(+)***
Arthritis	4.9**	327.5***	34.2***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(-)**	No	No
Angina	6.4**	252.7***	9.1	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)**	Sig(+)***	Sig(+)***
Lung disease	3.0*	204.7***	5.4	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)*	Sig(+)**	Sig(+)**
Asthma	0.1	144.5***	21.5***	Sig(+)***	Sig(+)***	Sig(+)**	Sig(+)**	No	No	No
Depression	0.0	419.3***	31.4***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	No	Sig(+)***	Sig(+)***
Hypertension	11.0***	347.7***	144.6***	Sig(+)***	Sig(+)***	Sig(+)*	No.	Sig(-)***	No	No
COPD	3.2*	234.3***	17.3***	Sig(+)***	Sig(+)***	Sig(+)**	No	Sig(+)*	No	No.
Under Nutrition	277.4***	184.6***	230.2***	Sig(+)***	Sig(+)***	Sig(+)***	Sig.(+)*	Sig(+)***	Sig(+)***	Sig(+)***
Low vision	55.3***	941.8***	20.8***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(+)***	Sig(-)***	No	No
Degree of freedom	**1**	**14**	**5**							

* p<.1, ** p<.05, *** p<.01; Notes: The positive (+) sign in the parentheses shows positive relationship between SES and health, that is, the regression coefficient is negative. Whereas, the negative (-) sign depict negative relationship, that is, regression coefficient is positive. [a]In the regression models, years of schooling and household wealth are entered as continuous predictors. Model1 includes years of schooling; Model2 includes: years of schooling and wealth score; model3 includes age, sex, marital status, state, rural residence, caste and religion along with predictors of model3; Model4 includes tobacco consumption, alcohol consumption, physical activity and the waist-hip ratio along with factors used in model3.

Table4: Logit model estimates (odd ratios) for the overall effects of age and socioeconomic status on various indicators of health, WHO-SAGE India, 2007

Predictors	Self rated poor health	ADL	IADL	Arthritis	Angina	Asthma	Lung	Depression	Hypertension	COPD	Under-nutrition	Vision
Years of Schooling												
No Schooling	1	1	1	1	1	1	1	1	1	1	1	1
1-5 Years	1.12	0.94	1.02	1.2	0.81**	0.97	0.92	0.98	0.91	1.10	1.28***	0.85**
	(0.11)	(0.07)	(0.09)	(0.10)	(0.08)	(0.13)	(0.10)	(0.10)	(0.07)	(0.07)	(0.09)	(0.06)
6-9 Years	0.89	0.66***	0.88	0.67***	0.77**	0.64***	0.50***	1.04	0.78***	0.99	1.3***	0.56***
	(0.1)	(0.05)	(0.09)	(0.07)	(0.09)	(0.10)	(0.07)	(0.11)	(0.07)	(0.07)	(0.09)	(0.05)
10+ Years	0.56***	0.44***	0.38***	0.61***	0.54***	0.94	0.88	0.68***	0.83**	0.97	0.83**	0.47***
	(0.076)	(0.04)	(0.05)	(0.07)	(0.07)	(0.14)	(0.11)	(0.08)	(0.07)	(0.07)	(0.06)	(0.04)
Wealth												
Lowest	1	1	1	1	1	1	1	1	1	1	1	1
Lower	1.10	1.13	1.14	1.05	0.91	0.92	0.89	0.99	1.09	1.05	0.72***	1.12
	(0.11)	(0.08)	(0.10)	(0.10)	(0.09)	(0.12)	(0.10)	(0.10)	(0.09)	(0.07)	(0.05)	(0.09)
Middle	1.14	0.92	0.94	1.01	0.87	0.85	1.06	0.94	1.07	1.00	0.61***	1.25***
	(0.12)	(0.08)	(0.10)	(0.10)	(0.10)	(0.12)	(0.12)	(0.10)	(0.09)	(0.07)	(0.04)	(0.11)
Higher	0.65***	0.94	0.81*	0.95	0.72***	0.80	0.69***	0.87	1.02	0.91	0.44***	1.13
	(0.09)	(0.08)	(0.10)	(0.10)	(0.09)	(0.12)	(0.09)	(0.10)	(0.10)	(0.07)	(0.03)	(0.10)
Highest	0.61***	0.79**	0.76**	0.88	0.53***	0.77	0.68***	0.58***	1.30***	0.90	0.36***	0.87
	(0.1)	(0.08)	(0.10)	(0.11)	(0.08)	(0.13)	(0.10)	(0.08)	(0.13)	(0.07)	(0.03)	(0.09)
Age												
18-49	1	1	1	1	1	1	1	1	1	1	1	1
50-59	2.30***	3.13***	2.06***	2.62***	1.67***	1.98***	2.02***	2.06***	1.58***	1.30***	1.05	4.13***
	(0.23)	(0.23)	(0.19)	(0.22)	(0.18)	(0.25)	(0.2)	(0.19)	(0.12)	(0.09)	(0.08)	(0.29)
60-69	3.0***	4.74***	3.2***	2.73***	2.40***	2.87***	2.81***	2.30***	1.93***	1.42***	1.24**	5.43***
	(0.35)	(0.43)	(0.34)	(0.29)	(0.30)	(0.41)	(0.34)	(0.27)	(0.19)	(0.12)	(0.11)	(0.487)
70+	5.17***	7.38***	5.08***	3.12***	2.81***	3.86***	3.52***	3.02***	1.80***	1.36**	1.82***	6.95***
	(0.72)	(0.91)	(0.66)	(0.43)	(0.44)	(0.68)	(0.54)	(0.44)	(0.23)	(0.17)	(0.21)	(0.832)
N	9598	9599	9599	9597	7925	9596	9598	9594	9575	8755	9575	9488
Log likelihood	-2737	-4628.6	-3186.1	-3342.9	-2688.7	-1982.4	-2587	-3113.8	-4425.3	-5859.7	-5721.5	-4464.4

* p<.1, ** p<.05, *** p<.01; Figures in the parentheses are standard errors. Estimates are adjusted for the control variables.

Table5: Logit model estimates (odd ratios) for the effects of socioeconomic status on various indicators of health across broad age groups , India, 2007

	Poor self rated health	1+ ADL	1+ IADL	Arthritis	Angina	Lung	Asthma	Depression	Hypertension	COPD	Under-nutrition	Low vision
Age-group 18-49												
Years Of Schooling												
No Schooling	1	1	1	1	1	1	1	1	1	1	1	1
1-5 Years	1.21 (0.20)	0.99 (0.11)	1.12 (0.17)	1.25 (0.18)	0.69** (0.12)	0.99 (0.22)	1.00 (0.18)	0.90 (0.15)	0.90 (0.12)	1.07 (0.11)	1.51*** (0.16)	0.72*** (0.09)
6-9 Years	0.93 (0.17)	0.64*** (0.079)	0.97 (0.16)	0.66** (0.11)	0.78 (0.13)	0.60* (0.16)	0.44*** (0.10)	1.01 (0.16)	0.70*** (0.09)	0.94 (0.10)	1.47*** (0.15)	0.45*** (0.06)
10+ Years	0.62** (0.14)	0.39*** (0.06)	0.41*** (0.08)	0.57*** (0.11)	0.60*** (0.12)	1.25 (0.29)	1.00 (0.20)	0.63** (0.12)	0.79* (0.11)	0.99 (0.11)	0.95 (0.11)	0.37*** (0.06)
Wealth												
Lowest	1	1	1	1	1	1	1	1	1	1	1	1
Lower	1.26 (0.21)	1.32** (0.16)	1.31* (0.2)	0.97 (0.15)	1.03 (0.17)	0.91 (0.21)	1.00 (0.19)	0.93 (0.15)	1.01 (0.14)	1.05 (0.11)	0.72*** (0.07)	1.20 (0.16)
Middle	1.46** (0.27)	0.93 (0.13)	0.82 (0.15)	1.22 (0.20)	0.84 (0.15)	0.91 (0.23)	1.31 (0.25)	1.06 (0.18)	0.10 (0.14)	0.99 (0.11)	0.58*** (0.06)	1.49*** (0.21)
Higher	0.69 (0.17)	0.98 (0.14)	0.72 (0.15)	0.83 (0.16)	0.73 (0.15)	0.78 (0.21)	0.76 (0.18)	1.00 (0.19)	0.10 (0.15)	0.89 (0.10)	0.44*** (0.053)	1.20 (0.19)
Highest	0.67 (0.18)	0.84 (0.14)	0.65* (0.15)	0.89 (0.19)	0.45*** (0.11)	1.00 (0.29)	0.66 (0.17)	0.68* (0.15)	1.27 (0.20)	0.86 (0.11)	0.36*** (0.05)	0.97 (0.17)
N	4216	4217	4217	4216	3568	4216	4216	4213	4206	3926	4205	4172
Log-likelihood	-979	-1816.9	-1155.9	-1230.3	-1077.2	-714.9	-954.8	-1222	-1786.3	-2614.9	-2509.1	-1693.3
Age-group 50-59												
Years Of Schooling												
No Schooling	1	1	1	1	1	1	1	1	1	1	1	1
1-5 Years	1.09 (0.18)	0.78** (0.01)	0.88 (0.13)	0.85 (0.12)	0.94 (0.17)	1.04 (0.22)	0.84 (0.15)	0.91 (0.15)	1.11 (0.15)	1.08 (0.14)	0.73** (0.10)	1.36** (0.16)
6-9 Years	1.41* (0.26)	0.65*** (0.09)	0.82 (0.15)	0.6*** (0.10)	1.07 (0.21)	0.98 (0.23)	0.83 (0.17)	0.85 (0.16)	1.18 (0.18)	1.08 (0.15)	0.77* (0.12)	1.07 (0.15)
10+ Years	0.82 (0.18)	0.78* (0.11)	0.38*** (0.08)	0.59*** (0.10)	0.47*** (0.11)	0.53** (0.15)	0.73 (0.16)	0.66** (0.13)	0.82 (0.13)	0.96 (0.14)	0.47*** (0.08)	1.05 (0.15)
Wealth												
Lowest	1	1	1	1	1	1	1	1	1	1	1	1
Lower	0.98 (0.15)	0.96 (0.13)	0.92 (0.15)	1.21 (0.18)	0.75 (0.14)	1.1 (0.24)	0.97 (0.18)	1.47** (0.25)	1.46** (0.23)	1.20 (0.16)	0.74** (0.10)	0.89 (0.11)
Middle	0.53*** (0.09)	0.83 (0.12)	0.9 (0.15)	0.79 (0.13)	0.81 (0.16)	0.87 (0.20)	0.81 (0.16)	0.74 (0.14)	1.55*** (0.24)	1.22 (0.17)	0.57*** (0.08)	0.61*** (0.08)
Higher	0.41*** (0.09)	0.81 (0.12)	0.62** (0.17)	1.14 (0.19)	0.56*** (0.12)	0.80 (0.20)	0.73 (0.16)	0.75 (0.15)	1.09 (0.19)	0.84 (0.13)	0.35*** (0.06)	0.91 (0.13)
Highest	0.59** (0.13)	0.75* (0.12)	0.92 (0.18)	0.93 (0.17)	0.71 (0.17)	0.63 (0.18)	1.28 (0.29)	0.46*** (0.10)	1.92*** (0.34)	0.94 (0.15)	0.46*** (0.08)	0.50*** (0.08)
N	2604	2604	2604	2603	2107	2603	2604	2604	2599	2403	2599	2588
Log-likelihood	-1040.6	-1631	-1128.5	-1358.2	-877.8	-701.2	-923.2	-1051	-1414.8	-1597.6	-1453.5	-1711.1
Age-group 60-69												
Years Of Schooling												
No Schooling	1	1	1	1	1	1	1	1	1	1	1	1
1-5 Years	0.91 (0.16)	0.97 (0.14)	1.03 (0.16)	1.45** (0.23)	1.29 (0.24)	1.11 (0.24)	0.96 (0.17)	1.24 (0.23)	0.91 (0.14)	0.98 (0.15)	0.94 (0.14)	1.08 (0.16)
6-9 Years	0.43*** (0.12)	0.53*** (0.09)	0.54*** (0.19)	0.82 (0.18)	0.59* (0.16)	0.84 (0.24)	0.73 (0.19)	1.18 (0.28)	0.92 (0.18)	0.88 (0.17)	1.18 (0.23)	0.83 (0.15)
10+ Years	0.34*** (0.11)	0.33*** (0.07)	0.28*** (0.08)	1.13 (0.27)	0.44*** (0.14)	0.61 (0.20)	0.57* (0.17)	0.67 (0.19)	1.44* (0.31)	0.60** (0.12)	0.45*** (0.1)	0.52*** (0.10)
Wealth												
Lowest	1	1	1	1	1	1	1	1	1	1	1	1
Lower	0.73* (0.13)	0.57*** (0.09)	0.77 (0.13)	1.40** (0.23)	0.64** (0.13)	0.96 (0.20)	0.61*** (0.11)	0.67** (0.12)	1.19 (0.19)	0.86 (0.14)	0.65*** (0.10)	1.17 (0.17)
Middle	1.11 (0.20)	0.91 (0.15)	1.4** (0.23)	0.68** (0.13)	0.95 (0.19)	0.53** (0.13)	0.52*** (0.10)	0.77 (0.15)	0.82 (0.14)	0.83 (0.14)	0.76* (0.12)	1.45** (0.23)
Higher	0.82 (0.17)	0.87 (0.15)	1.12 (0.21)	1.20 (0.23)	0.75 (0.17)	0.80 (0.20)	0.43*** (0.10)	0.42*** (0.10)	0.80 (0.15)	1.10 (0.2)	0.63*** (0.11)	1.18 (0.2)

	0.48***	0.65**	0.93	0.53***	0.53**	0.66	0.36***	0.46***	0.83	1.23	0.32***	0.95
Highest	(0.12)	(0.16)	(0.19)	(0.12)	(0.13)	(0.18)	(0.10)	(0.11)	(0.16)	(0.23)	(0.06)	(0.17)
N	1838	1838	1838	1838	1481	1838	1838	1837	1831	1629	1832	1816
Log-likelihood	-807.4	-1152.2	-991.9	-935.2	-700.5	-617.4	-776.7	-802.3	-1054.5	-1040	-1060.5	-1180.1
						Age-group 70+						
Years Of Schooling												
No Schooling	1	1	1	1	1	1	1	1	1	1	1	1
	0.65**	0.860	0.65**	1.44*	1.00	0.95	0.51**	1.38	1.08	1.81***	0.51***	0.96
1-5 Years	(0.14)	(0.172)	(0.13)	(0.31)	(0.25)	(0.26)	(0.13)	(0.33)	(0.23)	(0.39)	(0.11)	(0.20)
	0.60*	1.518	0.79	0.58*	0.74	0.71	0.26***	1.62	1.19	1.82**	0.26***	0.48***
6-9 Years	(0.17)	(0.424)	(0.21)	(0.19)	(0.25)	(0.27)	(0.10)	(0.55)	(0.33)	(0.53)	(0.08)	(0.13)
	0.16***	0.388***	0.38***	0.74	0.38**	0.26**	0.49*	0.40**	1.13	0.77	0.26***	0.57*
10+ Years	(0.07)	(0.114)	(0.12)	(0.26)	(0.16)	(0.15)	(0.18)	(0.17)	(0.36)	(0.25)	(0.09)	(0.17)
Wealth												
Lowest	1	1	1	1	1	1	1	1	1	1	1	1
	0.77	0.572***	0.66*	1.03	0.59**	0.74	0.74	1.51	0.93	0.85	0.54***	0.76
Lower	(0.17)	(0.121)	(0.14)	(0.24)	(0.16)	(0.20)	(0.19)	(0.38)	(0.21)	(0.20)	(0.12)	(0.16)
	1.04	0.930	0.92	0.59*	0.74	0.76	1.27	0.80	1.12	0.68	0.89	1.69**
Middle	(0.26)	(0.224)	(0.22)	(0.17)	(0.22)	(0.24)	(0.34)	(0.24)	(0.28)	(0.18)	(0.21)	(0.41)
	0.80	0.905	1.14	0.93	0.72	0.7	0.62	1.06	1.06	1.05	0.30***	1.10
Higher	(0.21)	(0.225)	(0.27)	(0.25)	(0.21)	(0.22)	(0.19)	(0.30)	(0.27)	(0.27)	(0.08)	(0.27)
	0.62*	0.637*	0.72	1.38	0.69	0.30***	0.78	0.54*	1.41	1.17	0.20***	1.18
Highest	(0.18)	(0.161)	(0.19)	(0.38)	(0.22)	(0.13)	(0.24)	(0.17)	(0.37)	(0.32)	(0.06)	(0.30)
N	940	940	940	940	769	939	940	940	939	797	939	912
Log-likelihood	-515.5	-581.3	-570.9	-487.4	-387.4	-340.5	-418.8	-412.2	-543.5	-490.7	-543	-573.4

* p<.1, ** p<.05, *** p<.01; Figures in the parentheses are standard errors. Estimates are adjusted for control variables.