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Upcoming Need of Geriatric Healthcare: An investigation in India

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Abstract

Purpose: With the background of surging greying population India has emerging pressure on the healthcare system because aged people are more susceptible to health problems. Therefore, present study aims: firstly to explore how the health complains among the elders are distributed across the rural-urban sectors; and secondly, what is the nexus between socioeconomic status and health complains.

Research Design: The study has analysed unit-level data for the elderly (60 years and above).The analysis has two parts: firstly, the study explored the distribution of health complains using the descriptive statistics and econometric analysis explored the relationship between socioeconomic status and health complains across the sectors.

Findings: The study finds that health situation of the elderly has deteriorated and the rural-urban sectorial gap has widened during over time. Findings suggest that socioeconomic status has close congruence with the self-reported health status but the relationship largely varies due to sectorial residency.

Implications: Firstly, the study identified the trend of the elderly population's perception of their health over a decade, which can help to understand the future healthcare demand. Secondly, the study conducted an in-depth analysis to comprehend how socioeconomic characteristics influence perceptions of health in a rural-urban framework, which can shed light on the sources of emerging healthcare needs.

Originality: To the best of my knowledge, this is the first study to make an effort to pinpoint the sectorial geriatric health trajectory, the health gap, and related contributing socioeconomic determinants of the aged over a decade, specifically in the context of India.

Keywords: *Sectorial geriatric health; Health trajectory; Reported Health; Aging; India.*

1: Introduction

According to projections, the number of individuals over the age of 60 in India is expected to rise by 61.99 percent between 2015 and 2030, reaching 189 million, and by 2050, it would be three times as large as it was in 2015 (WHO, 2015). With a 7.7% elderly population, India is classified

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as a "ageing nation" (Ingle & Nath, 2008). The demographic transition is marked by a significant increase in the elderly population, which poses a serious challenge to the current healthcare system because the elderly are more susceptible to health issues (Abdulraheem, 2017; Kaur et al., 2017). The healthcare system needs to be adjusted now to accommodate the growing older population.

It is indispensable to understand population health characteristics to design any health policy (Sen, Östlin, & George, 2007). According to the World Health Organisation (WHO) health is a "state of complete physical, mental and social well-being…" (WHO, 2006) – it indicates that the optimal measurement of health is multifactorial. Self-reported Health (SRH) serves a multidimensional and "nuanced indicator of underlying health status" (Rahman & Barksy, 2003). As a measure of geriatric health, SRH becomes popular over time due to its construct validity (Wallace & Herzog, 1995), forecasting power (Idler & Benyamini, 1997), integrity with disability (Idler & Kasl, 1995), congruence with morbidity (Beckett et al., 2000; Rahman & Barksy, 2003), and absence of readily available alternative measure of health. SRH is associated with various socioeconomic and individual characteristics like *per capita household income* (Husain & Ghosh, 2011), *social identity* (Alam, 2009; Husain & Ghosh, 2011), *age* (Cotten, & Gupta, 2004), *gender* (Husain & Ghosh, 2017), *education level* (Gupta & Sankar, 2003; Husain & Ghosh, 2011), and *marital status* (Shields & Shooshtari, 2001).

The impact socioeconomic status on health condition in late life is, however, conflicting. Studies suggest that health inequalities among socioeconomic groups, can increase (Ferraro & Farmer, 1996; Mirowsky, & Ross, 2005) or decrease (Marmot & Shipley, 1996; Liang, et al., 2002) with age. Distinctive findings of the studies can be attributed to the contextual differences. For example, elders from lower occupational class loose health functionality faster than the higher grades (Chandola, et al., 2007). Thus, convergence and divergence of health inequality are important to understand the health problems of aging (Yang, 2007).

The contextual disparity in rural-urban context is widespread in India particularly, in terms income (Pradhan, et al., 2000; Tiwari, Shahbaz & Islam, 2013), occupation choice (Das, & Pathak, 2012; Hnatkovska & Lahiri, 2013), and education (Hnatkovska & Lahiri, 2013; Agrawal, 2014). Furthermore, healthcare service related disparity also exists between the sectors (Das & Pathak, 2012; Nagaraja & Veerabhadrappa, 2018). Almost 75% of health infrastructure and health resources hovers in the urban locality, where only 25% of the population lives (Ingle & Nath, 2008). Quality of the neighborhood is, in fact, closely linked with human development outcomes (Kawachi & Berkman, 2003). People from poor neighborhoods, for example, remote villages, often face systematic disadvantages of health, due to isolation from structural opportunities (Wilson, 1987). The skewed distribution of healthcare resources, together with social hierarchy, can adversely affect the health condition and treatment seeking behavior of the relatively disadvantageous people in the late life, and if the trend continues, can create greater health burden for the society. However, the impact of sectorial divergence on old age health trajectory remained unexplored in the literature. Additionally, studies have used 'caste

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dimension' to analyze social and political power relation from village perspectives but do not explore their linkages with the transition in health outcome.

2: Objectives

To address the gap area, discussed in the previous section, the study sets four research questions. ***Firstly,*** what is the health trajectory of elders in India? ***Secondly,*** whether the health trajectory is contingent on sectorial residence? ***Thirdly,*** how the household and demographic characteristics intervene in the health trajectory of elders across the sectors? ***Finally,*** what is the extent of each of the characteristics in explaining the variation in health?

3: Data and Methodologies

3.1: Data

The present study uses secondary data, collected by the National Sample Survey Organisation (NSSO). It has used the latest two (60^{th} and 71^{st}) rounds of health, conducted in the year of 2004-05 and 2014. NSSO uses multi-stage stratified sampling, where, census villages in rural areas (except Kerala) and urban blocks in Urban Frame Survey (UFS) form as the First Stage Units (FSU). In the second stage, households are selected as Ultimate Stage Units (USU), and ten households from each FSUs are surveyed randomly. The detail of the survey is given elsewhere[1]. Originally, a total of 3,83,338 and 3,33,104 individuals from 73,868 and 65,932 households were surveyed in 60^{th} and 71^{st} rounds, respectively – from where the data present has extracted the information on 34,831 and 27,245 elderly individuals in the respective rounds.

3.2: Dependent Variable (DV)

The DV of our analysis is Current Self-Reported Health (CSRH). NSS has recorded CSRH in a three-point Likert-scale: Excellent/Very good-1, Good-2, Poor-3. However, due to low frequency in the first category, Excellent/Very good and Good are merged together. So, in present study CSRH is a dichotomous variable with two categories: *Good=0 and Poor=1*.

3.3: Independent variables

Table-1 shows the adopted independent variables that are selected based on literature, logical understandings and availability of data.

Table-1: List of independent variables

Variable	Measurement
Gender	Male=0 (reference category); female=1.
Sector	Rural=0 (reference category); urban=1
Region	All Indian states and union territories are divided into six geographical regions: *North (includes Jammu & Kashmir, Himachal Pradesh, Punjab,*

[1] http://www.icssrdataservice.in/NSS.php

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Variable	Measurement
	Chandigarh, Uttaranchal, Haryana, Delhi, Uttaranchal and Rajasthan)=1 (reference category); *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.
Log of Living Environment (LLE)	It is an index [formulation is given in Annexure-1] that shows the living condition of the household.
Socio-religious identity	The study combines information on social and religious groups to compute a single variable, called Socio-Religious Identity (SRI). SRI has the following levels: *Upper Caste Hindu (HUC)=0* (reference category), *Hindu Schedule Caste (HSC)=1, Hindu Schedule Tribe (HST)=2, Hindu Other Backward Classes (HOBC)=3, Upper Caste Muslims (MUC)=4, Lower Caste Muslims (MLC)=5, and Other Minorities (Others)=6.*
Economic Status (ES)	NSS collects Monthly Household Expenditure (MHE), based on the consumption of durables and non-durables. The present study uses MHE as the proxy for the income of a household. To identify the economic status, the first calculates the Per Capita Monthly Household Expenditure (MPCE), dividing the MHE by the household size and then computes income quantiles of MPCE for rural and urban areas, separately. *Poorest=0 (reference category); Poor=1; Middle=2; Rich=3; and Richest=4*.
Household size (Hsize)	It calculates the total number of members reside in a house.
Education level	*Illiterate=0 (reference category); Literate without formal school (it combines "Literate without any schooling", "Literate without formal schooling: through NFEC", "Literate through TLC/AEC" 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*.
Age	The number of completed years.
Marital status	*Currently married =1; No spouse (reference category) =0*.

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3.4: Analytical strategy

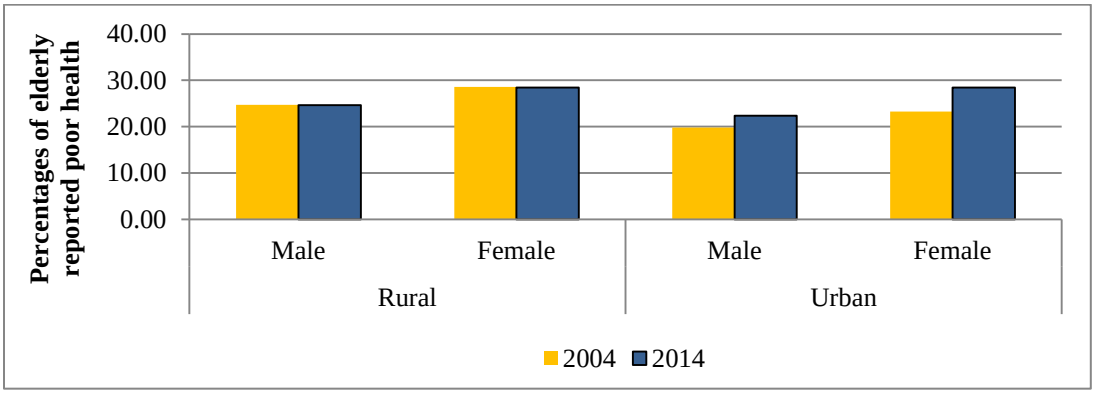
The study adopts three stages of analysis. Initial data profiling involves the calculation of the percentages and sectorial percentage gap (% of urban - % of rural) among the elderly in reporting poor health. Due to the dichotomous nature of DV, the study uses logistic regressions to estimate the role of determinants in explaining poor health conditions the elderly across the sectors and time. Four multivariate models are estimated: Model-I (for rural areas and 60th round); Model-II (for urban areas and 60th round); Model-III (for rural areas and 71st round); Model-IV (for urban areas and 71st round). Additionally, four pooled models like Model-V (rural areas and combined rounds); Model-VI (urban areas and combined rounds), Model-VII (60th round and combined sectors), and Model-VIII (71st and combined sectors) are also estimated to assess the change in the likelihood of reporting poor health over time and the effect of the sector on SRH, respectively. However, the estimated results from Model-I to IV are reported in the result section, although, results of combined models are available on request. Furthermore, the study has adopted the bootstrap method (Annexure-2) to check the robustness of the estimated coefficients and found them consistent with the original models. Finally, the 'shapely' decomposition method is adopted for the first four models to compare the relative importance of determinants on the DV (Sharrocks, 2013). Entire analysis has been done in STATA 13.

4: Findings

4.1 Trajectory of health complains over time and sectorial gap

Percentage distribution of reporting poor health across sectors (Figure-1) shows that health status has declined in the urban areas but substantial change is not visible among rural elderly. However, as the controls are considered in the econometric models, the results show that the likelihood of reporting poor health has significantly increased in both rural (β =0.20; S.E. =0.6) and urban (β =0.26; S.E. =0.4) areas. From the coefficient, is evident that the likelihood of health complains has increased over time more in urban areas than the rural sector. There is no significant sectorial difference in 2004-05 (coefficient of urban= 0.04; S.E. =0.65), but compared to rural sector people in urban (β= 0.12; S.E. =0.05) area have a significantly higher likelihood of reporting poor health in 2014.

Figure-1: Percentages of aged reporting poor health – by gender and sector



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4.2 Social and individual characteristics in rural-urban health difference

The percentage share of elderly, who report poor health, is widely varied across the household and individual characteristics (Table-2). In most of the cases, the sectorial health difference, the percentage share of elderly reporting of poor health in urban sector minus the percentage share of elderly reporting of poor health in the rural sector, is negative – it indicates that greater percentage of urban elderly have reported poor health than their rural counterpart. Over time, the sectorial health difference has increased among the poorest households but declined for males, females, all socio-religious groups, poor, middle, rich and richest income groups, all regions; middle-old and young-old age groups. However, in 2014, for most of the education levels, a greater percentage share of rural-elderly has reported poor health than their urban counterpart.

Table-2: Percentage of aged reporting poor health – by sector and time

	60th round			71st round		
Indicators	**Rural**	**Urban**	**Difference**	**Rural**	**Urban**	**Difference**
Gender						
Male	0.25	0.20	-0.05	0.25	0.22	-0.02
Female	0.29	0.23	-0.05	0.28	0.28	0.00
Socio-religious identity						
HUC	0.24	0.21	-0.04	0.26	0.22	-0.04
HST	0.21	0.20	-0.01	0.26	0.23	-0.02
HSC	0.30	0.25	-0.05	0.27	0.29	0.02
HOBC	0.27	0.20	-0.07	0.25	0.26	0.00
Muslims	0.33	0.28	-0.06	0.36	0.34	-0.02
Other minorities	0.22	0.19	-0.03	0.22	0.22	-0.01
Economic status						
Poorest	0.31	0.28	-0.03	0.27	0.32	0.05
Poor	0.29	0.24	-0.05	0.27	0.25	-0.02
Middle	0.26	0.20	-0.06	0.26	0.27	0.01
Rich	0.25	0.20	-0.05	0.27	0.23	-0.04
Richest	0.24	0.18	-0.06	0.25	0.22	-0.03
Household size	5.75	5.63	-0.12	5.81	5.70	-0.11
Regions						
North	0.23	0.19	-0.04	0.23	0.23	0.01
Central	0.28	0.26	-0.02	0.28	0.28	-0.01
East	0.33	0.27	-0.06	0.34	0.32	-0.02
North-East	0.22	0.20	-0.03	0.26	0.25	-0.01
West	0.20	0.19	-0.01	0.18	0.17	-0.01
South	0.27	0.18	-0.08	0.26	0.26	0.00
Age group						

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Indicators	60th round			71st round		
	Rural	Urban	Difference	Rural	Urban	Difference
Young-old	0.20	0.16	-0.04	0.20	0.20	0.00
Middle-old	0.35	0.27	-0.08	0.34	0.31	-0.02
Oldest-old	0.50	0.43	-0.06	0.51	0.45	-0.06
Marital status						
No spouse	0.31	0.26	-0.05	0.34	0.33	-0.01
Currently married	0.24	0.18	-0.05	0.23	0.22	-0.01
Education level						
Illiterate	0.28	0.26	-0.02	0.29	0.32	0.03
Literate without formal education	0.29	0.22	-0.07	0.32	0.30	-0.02
Below primary	0.24	0.22	-0.02	0.25	0.30	0.05
Primary	0.24	0.20	-0.04	0.22	0.27	0.05
Middle	0.20	0.20	0.00	0.20	0.22	0.01
Secondary	0.16	0.16	0.00	0.19	0.19	0.00
Higher secondary	0.17	0.14	-0.03	0.21	0.16	-0.05
Graduate & above	0.19	0.13	-0.06	0.15	0.15	0.00

The descriptive statistics, discussed above, neither consider the extent of the impact of the indicators nor identify how an indicator influences reported health status by controlling the effects of other correlates. To overcome these problems, I consider the econometric analysis in the next paragraph. The χ^2 values (Table-3) of all estimated models suggest that the independent variables, together, have a significant impact on SRH of the elders.

Table-3: Regression results of CSRH – by place of residence

Correlates	Model-I		Model-II		Model-III		Model-IV	
	β	S. E.	β	S. E.	β	S. E.	β	S. E.
Time								
Gender	0.31**	0.11	0.05	0.07	0.07	0.08	0.11	0.06
Socio-religious identity								
HST	-0.48	0.43	-0.54	0.29	0.10	0.22	-0.16	0.22
HSC	-0.21	0.20	0.02	0.12	0.05	0.13	0.13	0.10
HOBC	-0.07	0.12	-0.15*	0.08	-0.01	0.09	0.04	0.07

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Correlates	Model-I		Model-II		Model-III		Model-IV	
	β	S. E.	β	S. E.	β	S. E.	β	S. E.
Muslims	0.15	0.17	0.31**	0.09	0.72**	0.12	0.46**	0.08
Other Minorities	-0.11	0.15	0.00	0.10	-0.02	0.13	-0.11	0.10
Log of living environment	-0.12	0.07	-0.21**	0.05	-0.06	0.05	-0.14**	0.05
Economic status								
Poor	-0.28	0.26	-0.08	0.10	0.21	0.16	-0.12	0.09
Middle	-0.19	0.24	-0.27**	0.10	0.03	0.15	0.05	0.09
Rich	-0.31	0.24	-0.28**	0.10	0.17	0.15	-0.10	0.10
Richest	-0.24	0.22	-0.28**	0.11	0.06	0.15	0.05	0.10
Household size	-0.01	0.01	-0.03**	0.01	-0.02	0.01	-0.02**	0.01
Regions								
Central	0.49**	0.16	0.26**	0.10	0.60**	0.12	0.17	0.09
East	0.44**	0.17	0.35**	0.10	0.74**	0.14	0.43**	0.09
North-East	0.01	0.17	0.06	0.13	0.25*	0.13	0.12	0.11
West	-0.09	0.17	-0.13	0.10	-0.19	0.12	-0.45**	0.09
South	0.10	0.15	-0.27**	0.10	0.00	0.11	-0.13	0.09
Age	0.06**	0.01	0.07**	0.00	0.07**	0.00	0.06**	0.00
Education level								
Literate without formal education	0.17	0.30	-0.16	0.19	0.07	0.27	-0.10	0.19
Below primary	-0.19	0.16	-0.10	0.10	-0.13	0.11	-0.09	0.09
Primary	-0.05	0.15	-0.03	0.09	-0.27*	0.12	-0.22**	0.09

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Correlates	Model-I		Model-II		Model-III		Model-IV	
	β	S. E.	β	S. E.	β	S. E.	β	S. E.
Middle	-0.24	0.18	-0.05	0.10	-0.22	0.15	-0.43**	0.10
Secondary	-0.21	0.21	-0.24*	0.11	-0.33*	0.15	-0.44**	0.09
Higher secondary	-0.87*	0.39	-0.35*	0.15	-0.14	0.20	-0.70**	0.12
Graduate & above	0.19	0.32	-0.54**	0.13	-0.53*	0.24	-0.83**	0.10
Marital status	-0.19	0.10	-0.10	0.07	-0.17*	0.08	-0.05	0.06
Model summary								
Constant	-5.42**	0.55	-5.38**	0.31	-5.96**	0.41	-4.95**	0.29
LR χ^2 (df=26)	595.98**		438.98**		771.21**		611.78**	
Observations	8974		5252		9862		8364	

Notes: ** and * stand for 1% and 5% level of significance, respectively.

No significant gender gap is visible except, in rural areas in 2004 (β =0.20; S.E. =0.6), where female-elderly are significantly more likely to report poor health. Another individual characteristic like marital status (β =-0.17; S.E. =0.08) has a significant impact on health perception in rural areas, particularly in 2014. It shows that elderly, who live without a spouse, have a greater tendency of perceiving poor health than the currently married individuals. Age is significantly positively associated with reporting of poor health status. Level of education is found to be an important indicator of health perception. In comparison to illiterate, rural-elderly with education level of higher secondary (β =0.87; S.E. =0.39) in 2004; and primary (β =-0.27; S.E. =0.12), secondary (β =-0.33; S.E. =0.15), and graduate and above (β =-0.53; S.E. =0.24) in 2014 have significantly lower likelihood of reporting poor health. Similarly in the urban areas, a higher level of education has a significantly negative association with the probability of reporting poor health. In fact, more categories of education level like primary and middle, which do not show any significant difference in likelihood of poor health compared to the illiterate elderly in 2004-05 (coefficient of primary =-0.03; S.E. =0.09; coefficient of middle =-0.05; S.E. =0.10), become significant in later round (coefficient of primary =-0.22; S.E. =0.09; coefficient of middle =-0.43; S.E. =0.10).

Compared to the HUC, perceived health status of Muslims have significantly deteriorated over time in rural (β =0.15; S.E. =0.17 in the 60th round; β =0.31; S.E. =0.09 in the 71st round) and urban (β =0.72; S.E. =0.12 in the 60th round; β =0.46; S.E. =0.08 in the 71st round) areas.

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Unlike rural areas, living environment and household size significantly influence the health perception in the urban-elderly – the probability of reporting poor health declines with improvement in the living environment and household size. Taking poorest households as the reference category, no significant difference in reporting poor health can be observed among other income categories, except middle (β =-0.27; S.E. =0.10), rich (β =-0.28; S.E. =0.10), and richest (β =-0.28; S.E. =0.11) classes in urban areas in 2014. In comparison to the north, health perception among elderly varies significantly across the geographical regions. Elderly people in central (rural areas in 60th round, β =0.49, S.E. =0.16; rural areas in 71st round, β =0.60, S.E. =0.12; urban areas in 60th round, β =0.26, S.E. =0.10), north-east (rural areas in 71st round, β =0.25, S.E. =0.13), and east (rural areas in 60th round, β =0.44, S.E. =0.17; rural areas in 71st round, β =0.74, S.E. =0.14; urban areas in 60th round, β =0.35, S.E. =0.10; urban areas in 71st round, β =0.43, S.E. =0.09) regions have significantly higher tendency to perceive poor health than northern India. On contrary, people from south (urban areas in the 60th round, β =-0.27, S.E. =0.10) and west (urban areas in the 71st round, β =-0.45, S.E. =0.09) regions have shown significantly lower health complains in late life.

4.3 Comparisons of the impact of determinants on CSRH by sector and time

The decomposition analysis estimates the relative contribution (i.e., the percentage share) of each determinant in explaining the variation of the DV. Larger the value of percentage, greater is the importance of the attribute in explaining the outcome. Based on the attributability analysis (Figure-2), age is the most and household size is the least important factor to health perception of the aged, irrespective of time and sectors. However, education level is the second most important factor in the urban areas, followed by marital status and living environment; but in rural India, marital status has a relatively greater contribution to old age health than the educational attainment. Considering the overtime change in relative contributions to determine health in late life, I found gender and marital status have expanded importance in rural areas whereas the same trend can be attributed for living environment, income quantiles, and regions in the urban sectors. However, Socio-religious identity contributes less than 2% in variation of CSRH in both sectors and time.

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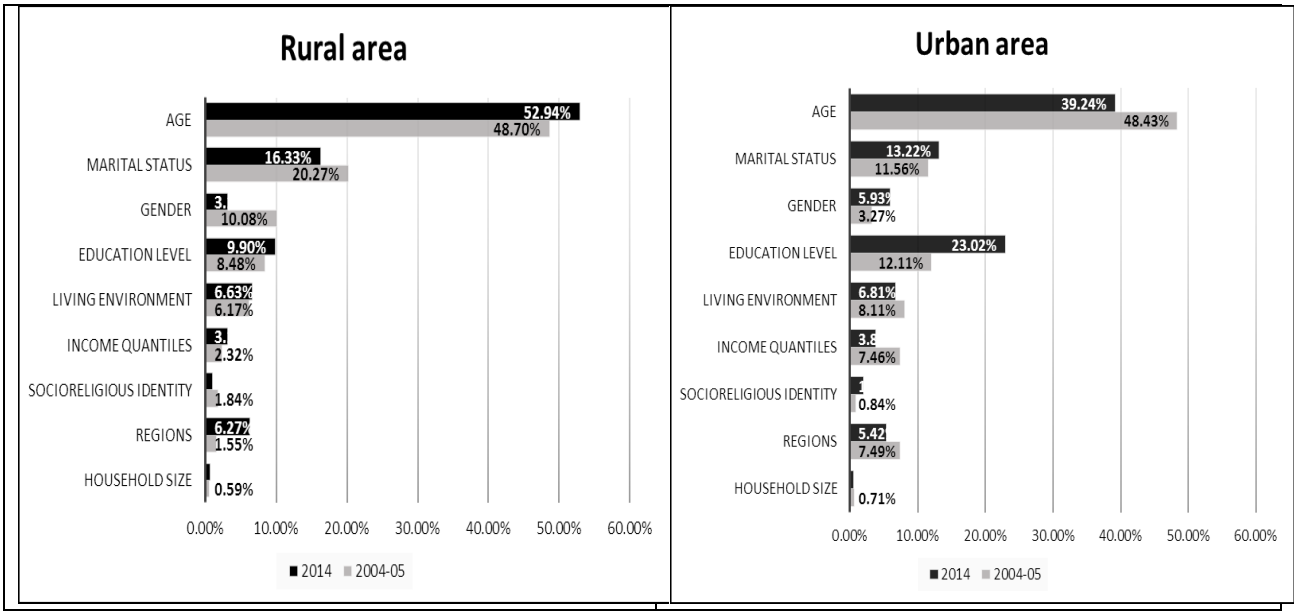
Figure-2: Decomposition analysis – by sector and time



Note: The left and the right side images show the decomposed percentages of the determinants for rural and urban areas, respectively.

5: Discussions

This study makes a distinctive contribution to the literature on the determinants of SRH as well as the debate on change in health situations for the elderly population in India. Present examination demonstrates the health trajectory of the elderly population over a period of the decade from 2004 to 2014, and the role of the household and individual characteristics on in determining the perceived health status of the same. Corroborating the finding of Husain & Ghosh (2011) for the period of 1995-96 and 2004, the study also has witnessed a decline in perceived health status among the elderly in both rural and urban areas. Although, Government put various efforts during 2010-11, to improve health situations of elderly in India by introducing multiple welfare schemes – like, National Policy for Senior Citizens (NPSC) for improving geriatric healthcare facilities or Ministry of Rural Development and National Programme for Health Care of the Elderly (NPHCE) for "Free, Specialized health care facilities exclusively for the elderly people through the State health delivery system"[2] – the results of the analysis are surprising and needs further investigations. Furthermore, it is observed that the health gap has among the rural-urban sectors have significantly increased over time and the situation became worse in urban areas. Instead of redundant availability of healthcare facilities in urban areas, health of the elderly people probably remains neglected. The possible reasons might be inadequate public health facilities, high private Out-Of-Pocket (OOP) health expenditure (Duggal, 2007), and sky rocketing inflation of healthcare cost (Yip & Mahal, 2008). Furthermore, old-age health insurance from employer is limited only to a small occupational

[2] https://mohfw.gov.in/major-programmes/other-national-health-programmes/national-programme-health-care-elderlynphce

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group (Ellis, Alam & Gupta, 2000; Kumar et al., 2011), and private insurance companies cover only in-patient costs (Shahrawat and Rao, 2011). As a result, majority of the elderly population reveals high financial risk if they sought for healthcare facilities (Yip & Mahal, 2008, Pal, 2010). In fact, "37.6 percent of low-income urban residents" revealed that they did not seek healthcare due to financial hardship as the prime reason (Yip & Mahal, 2008).

Gender difference contrasts the findings of existing literature that states females are more (Gupta & Sankar, 2003; Mini, 2009) or less (Husain & Ghosh, 2011) likely to complain about their health. The findings might indicate that both the genders are equally vulnerable to the health problems in late life and contextual influence on gender that has been argued by Sen (2006) might disappear at the advanced ages (Manton, 1997).

Taking the most privileged social class i.e., the upper-class Hindus, unlike others (Husain & Ghosh, 2011), no significant reported health difference can be observed among different social classes in the recent round, except the Muslims. The findings can have two arguments: firstly, lower health expectations of backward social class (discussed in Sen, 2006), nullifies the possibility of significant reported-health difference with the upper caste individuals; secondly, the heterogeneity within the caste might have influence that has been ignored by the explicitly recognized classes, based on historical relevance (Saberwal, 2010) . Moreover, I found Muslims consistently have significantly greater tendency to report poor health in the late life, irrespective of the sectors – it might because their strong perception of deprivation regarding fairness in obtaining social opportunities (Singh et al, 2010), negatively affect the health perceptions too.

The living environment has a significantly negative association with reporting poor health especially, in the urban areas. The constituents of living environment (drinking water, toilet, and cooking energy facilities) might have more importance in the urban area as the basic resources like drinking water is relatively scarce and the houses are congested. Moreover, inter-regional variation is quite evident particularly for central India, where the elderly are more tending to report poor health than the north region. It indicates the regional diversity, in terms of, healthcare infrastructure (Nagaraja & Veerabhadrappa, 2018).

The study uses relative economic position, assuming individual compares with the condition of identical economic peers during health perception and identified that the indicator has lost its significance over time in urban areas and for rural elderly, it does not have any significance, at all. However, previous studies, where per capita household expenditure is taken as the proxy for household economic status, have found significant association with perceived health (Gupta & Sankar, 2003; Alam, 2009; Mini, 2009) – it suggests that absolute economic condition is rather more influential in determining reported health than relative financial position in the society – however, this requires further investigation to study.

The present study also found that larger the household size significantly decreases the likelihood of poor health perception (Minkler & Fuller-Thomson, 1999). Large household size increases, the family support, which is the major source of support in the old age in India (Yadav, 2006), as well as, the chance of getting companion for the elderly within the households, which otherwise is limited in a constrained social bonding of urban areas (Sørensen, 2016).

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Present findings suggest that marital status has a substantial contribution to reported-health and its significance has increased over time. Existence of spouse improves perceived health, probably because, it might reduce old-age depression (Shields & Shooshtari, 2001; Hosseinpoor et al., 2012), and consequently, positively influence the health behavior (Joung, et al., 1995). Similar to previous studies, our results also suggest a negative association of self-reported health with age (Alam, 2008; Mini, 2009). In addition, it is observed that age has the highest relative importance among all indicators and significant impact on health perception during old age. It, however, opens the discourse of debate on "health-related quality of life" during old age i.e., whether we have gained only the life expectancy or there is an improvement in the quality of extended life as well!

As expected, health perception significantly improves with an increase in the level of education. However, compared to the rural areas and the initial round, education becomes more important in urban areas for the recent round. Better educated individuals have higher control over their life in selecting beneficial options for a healthy life and enjoy cumulative health benefits (Mirowsky & Ross, 2005).

6: Concluding remarks

The study concludes that the trajectory of the perceived health status of the elderly in India has experienced a declining trend in the last decade when the inter-sectorial divergence has cropped up with an urban biasedness. Old age health diversity is still a cause for grave concern for India, particularly because the health-related deprivation is evident among the elderly, even after multiple health policies. It emerges the discourse of debate that whether the poor health perception is an outcome of systematic disadvantage that has been cumulated over the life-span (Crystal, S., & Shea, 1990) or it is a lacuna within the system itself that fails to address the needy elderly correctly. The present study contributes in two aspects firstly, it identified the changes in the perceived health status of elderly in the last decade; secondly, involves an in-depth analysis to understand how various social and individual characteristics play role in determining health perception in the rural-urban framework. Based on the findings, it suggests more customized health policies than a holistic alternative and for implementation perspectives, it suggests to design a more effective instrument that can mitigate the health-education related wellbeing divergence among the elderly.

Conflict of interest: The study declares no conflict of interest.

Availability of data used in the manuscript: The data is publicly available and can be downloaded after registering in the following website http://www.icssrdataservice.in/NSS.php. Kindly note that author does not have the right to share the data.

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Annexure-1: Formulation of *'living environment'* index

To represent the household living condition, NSSO collects information on the type of latrine, type of drainage, major sources of drinking water and primary source of energy for cooking during the last 30 days. For analysis, firstly, codes of the original categories are arranged in ascending order of quality of living condition, such as: type of latrine is coded as no latrine=1, at least some latrine arrangements (it combines "Service latrine", "pit" and 'others')=2, and septic tank/flush system=3; type of drainage is coded as no drainage=1, and drainage available (it combines "Open katcha", "open pucca", "covered pucca" and "underground")=2; cooking energy is as 'carbon-based fuel' (it combines "coke, coal", "firewood and chips", "gobar gas", "dung cake", 'charcoal', 'kerosene' and 'others')=1, and 'safe fuel' (it combines 'LPG', 'electricity' and "no cooking arrangement")=2; source of drinking water is coded as bottled water/tap (it combines "tankers", "pucca well", "tank/pond reserved for drinking", "river/canal/lake" and 'others')=1, tube well/hand-pump=2, and others (it combines "bottled water" and 'tap')=3. Secondly, Principal Component Analysis (PCA) is followed to prepare an index to represent the living environment of a household. We first undertake tests to check whether PCA is permitted under the data structure. The Kaiser-Meyer-Olkin (KMO) statistic (0.709) and Bartlett test of sphericity (i.e. χ^2=51389.802 and significant at 1% level) suggest that factor analysis is possible for the observed variables of living condition. The Kaiser criterion suggests that we should take as many factors as there are eigenvalues greater than unity. Since there is only one eigenvalue greater than unity (1.49779), a single factor solution is used to create the index. Using 'predict' command, we have 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. The index is named as 'living environment' — greater the value of the index, better the quality of living condition.

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Annexure-2: Results of bootstrap method