

# On Ageing, Health and Poverty in Rural India

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## Abstract

In this paper, the trend and determinants of health and poverty among the elderly in rural India is analysed. Two rounds of National Sample Survey (NSS) data for the year 1995-96 and 2004 are employed. The analysis has been done with independent and pooled datasets. Our analysis shows that levels of consumption poverty have declined marginally between 1995-96 and 2004 while increased proportion of elderly with poor health status is continued. Results suggest that poverty is one of the key determinants of health among elderly in rural India.

Keywords: health, poverty, elderly  
JEL classification: I32, J14, I12

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### 1. Introduction

With sustained reduction in mortality and fertility rates combined with increased life longevity, the size of the young cohort has reduced while the size of old cohort has increased. As a direct consequence the process of population ageing<sup>2</sup> has started globally and can be visualised in India too. According to Population Census of India, the population of persons with age 60 years and above (elderly hereafter) was only 24 million in 1961 which increased more than thrice in next four decades. Their share in the total population has also risen from 5.6 percent in 1961 to 7.5 percent in 2001 (Irudya Rajan, 2008). This rise in ageing population depicts the success story of development process in India on different fronts like advancement in the medical sciences and technology, continuous improvement in living standards, increase in the accessibility of healthcare services, introduction of maternal welfare and childcare programmes, better basic education, and successful vaccination programmes. But at the same time the steady and sustained growth in the population of this stratum have also posed myriad of challenges to the policy makers.

On demand side, research suggests that old age people suffer from a range of problems, among which health care demands are at the top (Ory and Bond, 1989). However, growing prevalence of morbidity and poor health status beside significant increase in longevity is evident (Alam, 2000) and about four-fifth (80 percent) of the elderly population in India are living with high prevalence of diseases and non-satisfactory conditions of health care system. On the supply side, because of the increased pressure of urbanization and industrialization, increased migration of young generation, shift in employment pattern among the non-aged and moreover, increase in female employment opportunities (who are supposed to be the main caregivers for the aged), a rapid breakdown in social support networks and continued disintegration of joint family support system to nuclear family system has been noticed in the last few years. These recent changes in the size and structure of the families have caused the re-arrangement of the roles and functions of the family members and finally, left the aged to cope with all the anomalies and to face increased social isolation. Poverty and poor health among elderly is a matter of grave concern, especially in rural areas where a significant proportion of rural aged live their life without enough income, functional autonomy and with chronic ailments and disability (Alam, 2008; Pandey, 2009).

Though some studies are aimed at the issues related to old age poverty<sup>3</sup> and health;<sup>4</sup> the issue of poverty and health trends, their determinants and inter-relationship is still under research in India and in particular for rural elderly. The aim of this paper is, therefore, to analyse temporal changes in the poverty and health status of the rural elderly in India using National Sample Survey (NSS) data on morbidity and health for the year 1995-96 and 2004. We also try to find out the determinants of poverty and self-reported health status after considering possible endogenous relationship between poverty and health.

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<sup>2</sup> defined as an increase in the proportion of the aged as comparison to that of a reduction in the proportion of the young

<sup>3</sup> Deaton and Paxson, 1995; Pal and Palacios, 2008; Dreze and Srinivasan, 1997; Alam, 2008; Pandey, 2009 are some of the studies on rural poverty among elderly

<sup>4</sup> see Chanana and Talwar, 1987; Nandal et al., 1987; Darshan et al., 1987; Gupta and Vohra, 1987; Joseph, 1991; Shah, 1993; Reddy, 1996; Kumar, 1999; Chakraborty, 2005; Balasubramanian, 2007; Alam, 2008; Gupta and Sankar, 2001; Gupta, Dasgupta and Sawney, 2001

The rest of the paper is outlined as follows. Section 2 details the data used in the analysis. Methodological strategies are discussed in section 3 and section 4 deals with description and trend analysis of poverty and health. Estimation results are described in section 5 and finally, paper is concluded in section 6.

## 2. Data

This paper is based on the two independent rounds of micro-level data collected by National Sample Survey Organization (NSSO) through standard sampling techniques. These are 52<sup>nd</sup> round and 60<sup>th</sup> round datasets conducted, respectively during July 1995-June 1996 and January to June 2004. We will use these datasets independently as well by pooling them. The importance of using these two datasets is in the following. One, these dataset have been kept as comparable as possible (NSSO, 2006) through maintaining similarity in sample designs, definitions and nature of schedules employed to conduct the survey. Secondly, these two datasets are important from both economic and health policy points of view. On economic front, NSSO 52<sup>nd</sup> round survey was conducted in July 1995-June 1996 only after four years of economic reforms and NSSO 60<sup>th</sup> round survey was conducted in January-June 2004. Thus, while former was not much affected by economic reforms, later survey captures liberalised economic policies and sustained economic growth. From health policy view, NSS 52<sup>nd</sup> round and NSS 60<sup>th</sup> round surveys were conducted after twelve and twenty years of enactment of the National Health Policy introduced in 1983. Hence, these surveys are assumed to register effects of National Health Policy.

The NSSO 52<sup>nd</sup> round surveyed a total of 33, 981 households out of which 20, 949 were rural and 13, 032 were urban spread over all the Indian States and Union Territories, except Andaman and Nicobar Island, Dadra and Nagar Haveli, Lakshadweep, and certain remote areas of Arunachal Pradesh and Nagaland. The NSSO 60<sup>th</sup> round covers 73, 868 households out of which 47, 302 were from rural and 26,566 households from urban India and covers the whole of the Indian Union Territories, except Leh (Ladakh) and Kargil districts of Jammu & Kashmir, interior villages of Nagaland situated beyond five kilometers of the bus route and villages in Andaman and Nicobar Island which remain inaccessible throughout the year.

Both the rounds of NSSO survey data provide a wealth of information on elderly's health (self reported health status, diseases etc), health care, disability, deaths and causes of death in last 365 days, use of medical facility, hospitalization and health expenses on medical treatment, socio-economic and demographic background, their past and current economic activity, state of economic independence (whether not dependent on others, or partially or fully dependent on others), number of dependents, their number of living children, living arrangements (living alone as an inmate of old age home, living alone, living with spouse only, living with spouse and other members, living without spouse but with children/other relations/non-relations), supporting person/s (whether spouse, own children, grand children, or others), their roles in the household and family integration and participation in social and religious activities. These rounds also collect information on usual activity, retirement benefits derived, provisions for regular income, amount of loans, management of financial assets belonging to them etc. of the aged residing in India. The final analysis is done on the truncated sample for individuals with age more than 60 years and reduced sample size of 21,028, 22,265 and 43,263, respectively, for the 52<sup>nd</sup> round, 60<sup>th</sup> round and pooled data sets.

### 3. Methodology

In this section we delineate the detailed discussion on measurement of poverty, health and estimation procedure to examine the determinants of poverty and self-reported health status for rural elderly.

We will use per capita monthly consumption expenditure (PCMCE hereafter) as a measure of poverty. This measure is used in many studies<sup>5</sup> and gives an idea about the economic environment of the individuals. Though some studies have criticised PCMCE as a true indicator of poverty, in particular in the context of its inability to capture age-specific poverty level<sup>6</sup>, it is still the best available measure of standard of living. In fact, Deaton (1997) and Blundell (1995) have shown that household monthly consumption expenditure could be used as a proxy variable for income. We compute PCMCE<sup>7</sup> of the households with elderly co-residents for the year 1995-96 and 2004. Here, it is worth to note that PCMCE for year 2004 is adjusted by using consumer price index for agricultural labourers (CPIAL) and 1995-96 as a base period to facilitate overtime comparisons. Further, using individual level household data, FGT measures of head count ratio<sup>8</sup> (HCR hereafter) will be calculated.

We will use self-reported current health status as a measure of health. This is increasingly common and comprehensive measure of health used in much empirical research<sup>9</sup> because it is assumed to predict morbidity and subsequent mortality<sup>10</sup> and allows examination of how health status varies over the life course (Case and Deaton, 2003). Moreover, a close correlation has been observed between self-reported health status (SRHS hereafter) and actual physical measures of health (Rahman and Barsky, 2003). Deaton and Paxson (1998) argued that SRHS is itself an independent determinant of longevity as individuals with healthier self images live longer and this captures information about health of an individual which is unobserved by others including physicians. SRHS is also a good summary of overall health and is known to be sensitive to the socio-cultural factors (Jylha et al., 1998). Furthermore, a continuous health measure constructed from a categorical response by the method of Wagstaff and Van Doorslaer (1994) is found highly correlated with other continuous measures of health (Gredtham et al., 1999).

We estimate poverty equation separately for period 1995-96 and 2004 as follows:

$$LnPCMCE_{hit} = \alpha_{hit} + X_{hit}\beta + \varepsilon_{hit} \dots\dots\dots(1)$$

where  $LnPCMCE_{it}$  is the natural logarithm of per capita monthly consumption expenditure for  $i^{th}$  elderly co-resident of household  $h$  at year  $t$ .  $LnPCMCE_{it}$  is assumed to be log-normally distributed.  $X$  is a set of individual, household and other characteristics.  $\alpha$  and  $\beta$ 's the intercept and vector parameters respectively.  $\varepsilon_{hit}$  is independently and identically distributed

<sup>5</sup> see Deaton and Paxson, 1995; Deaton, 1997; Pal and Palacios, 2008; Dreze and Srinivasan, 1997; Alam, 2008

<sup>6</sup> Alam (2008) raised question on the determination of old age poverty on the basis of the calorific norms generalized across all ages

<sup>7</sup> defined as household monthly consumption expenditure (in Rs.) divided by number of household members. Consumption expenditure is the expenditure on food and non-food items such as clothing, housing, health, education, transport and communication, recreation and entertainment

<sup>8</sup> Foster et al., 1984

<sup>9</sup> e.g. Ettner, 1996; Saunders, 1996; Schofield, 1996; Idler and Benyamini, 1997; Deaton and Paxson, 1998; Kennedy et al., 1998; Smith, 1999

<sup>10</sup> Okun et al., 1984; Connelly et al., 1989; McCallum et al., 1994; Idler and Kasl, 1995

(i.i.d) disturbance term, follows normal distribution with mean zero and represents household's idiosyncratic factors contributing to differential level of per capita consumption expenditure for individuals that share same households and households with same characteristics.

For pooled data, equation (1) becomes

$$LnPCMCE_{hi} = \delta_{hi} + X_{hi}\gamma + \rho t + \xi_{hi} \dots\dots\dots(2)$$

where  $LnPMCE_{hi}$  is again log-normally distributed natural logarithm of per capita monthly consumption expenditure for  $i^{th}$  elderly co-resident of household h.  $X$  is a set of individual, household and other characteristics.  $\delta$  and  $\gamma$ 's are the intercept and vector parameters respectively.  $\xi_{hi}$  is independently and identically distributed (i.i.d) disturbance term following normal distribution with mean zero. The additional term  $t$  is the time dummy for year 1995-96 and 2004.

Equation (1) and (2) will be estimated using robust regression procedure<sup>11</sup> and expected per capita consumption expenditure will be calculated. This will be then used to estimate health production function. Under this setting, our empirical model of health<sup>12</sup> for time t can be written as follows:

$$SRHS_{it} = \eta_t + \theta X_{it} + \phi_{it} \dots\dots\dots(3)$$

where  $SRHS_{it}$  is a self-reported current health status for  $i^{th}$  elderly at time t. Again,  $X$  is a set of individual, household and other characteristics.  $\eta$  and  $\theta$ 's are as usual intercept and vector parameters respectively.  $\phi_{it}$  is error term assumed to be distributed independently and identically (i.i.d) with zero mean.

Again for the pooled data, we modify equation (3) as follows:

$$SRHS_i = \lambda_i + \varphi X_i + \vartheta t + \psi_i \dots\dots\dots(4)$$

where additional term t is the year dummy. As SRHS is an ordered health outcome, ordered probit estimation procedure will be the best suitable technique (Greene, 2003; Long, 1997) to estimate equations (3) and (4).

Here it is worth to note that while selecting explanatory variables, we include only those explanatory variables in the equations which are common in both the surveys in terms of their definitions. Also, we do not include variables which could cause endogeneity problem at the estimation stage. In the poverty equation, we include individual characteristics such as age, education and marital status and household characteristics such as number of adult male, household size, household type, social group, facilities of latrine, drainage and drinking water source. In addition to these, normalised rainfall<sup>13</sup> is used as an explanatory variable. In health equations (3) and (4) we use individual characteristics such as gender, age, education, marital

<sup>11</sup> See Greene, 2003  
<sup>12</sup> in fact it is reduced form Grossman (1972, 2000) model  
<sup>13</sup> The monthly data on rainfall for year 1970-2005 is given for different metrological regions in India. A metrological region includes one or more states. Annual average and standard deviations were calculated and we converted the actual data into normalised form by subtracting average from each annual value and divide it by respective standard deviations. Statistically speaking, the converted series follows normal distribution with zero-mean and unit variance. Finally, values of state-wise normalised rainfall was picked up for the year 1995 and 2004 and used in the analysis.

status and objective health measures such as sickness, disability and chronic diseases and household characteristics such as expected per capita consumption estimated through equations (1) and (2), number of children, household social composition, household type and facilities of latrine, drainage and drinking water source.

#### 4. Understanding trend in elderly population, poverty level and health status

##### 4.1 Population and socio-demographic characteristics: 1995-96 and 2004

Table 1 documents percentage distribution of elderly in rural population in 1995-96 and 2004 from where we can draw following four observations. First, in terms of percentage distribution of the rural elderly, Kerala is on the top position in both the years, followed by Himachal Pradesh. Secondly, feminisation of rural elderly is visible in most of the major states as in both the time points the percentage share of female aged is higher than that of their male counterparts. Thirdly, during the period, population of rural elderly has gone up by 1.3% at national level, spread over a range of 0.1% in Uttar Pradesh to by 2.8% in Tamil Nadu. Finally, we can observe that in most of the states the proportion of both male and female aged have increased between year 1995-96 and 2004. Here we notice that the percentage of male has increased in all the states, except in UP where the figure has gone down from 6.3% in 1995-96 to 6.0% in 2004. Similarly, proportion of female rural aged is reduced marginally only in major three states, Jammu and Kashmir by 0.3%, Karnataka by 0.2% and UP by 0.1% during 1995-96 and 2004.

Table 1: % Share of rural elderly: 1995-96 and 2004

States	Male			Female			All		
	1995-96	2004	%Change	1995-96	2004	%Change	1995-96	2004	%Change
Andhra Pradesh	4.7	7.3	2.6	5.0	7.7	2.7	4.8	7.5	2.7
Assam	4.5	5.3	0.8	4.0	4.3	0.3	4.3	4.8	0.5
Bihar	4.7	5.9	1.2	4.6	5.2	0.6	4.6	5.5	0.9
Gujarat	4.7	6.7	2	6.4	6.8	0.4	5.5	6.8	1.3
Haryana	6.1	7.2	1.1	6.9	8.4	1.5	6.5	7.8	1.3
Himachal Pradesh	8.2	9.2	1.0	7.7	9.5	1.8	8	9.4	1.4
Jammu & Kashmir	6.0	7.3	1.3	5.7	5.4	-0.3	5.9	6.4	0.5
Karnataka	4.8	7.1	2.3	6.8	6.6	-0.2	5.8	6.9	1.1
Kerala	9.0	10.6	1.6	10.2	12.3	2.1	9.6	11.5	1.9
Madhya Pradesh	4.5	6.3	1.8	5.2	6.8	1.6	4.9	6.5	1.6
Maharashtra	7.1	8.3	1.2	7.4	8.8	1.4	7.2	8.6	1.4
Orissa	6.6	9	2.4	6.1	8	1.9	6.4	8.5	2.1
Punjab	5.8	8.5	2.7	6.4	8.8	2.4	6.1	8.6	2.5
Rajasthan	3.8	5.9	2.1	5.5	6.7	1.2	4.6	6.3	1.7
Tamil Nadu	6.3	8.7	2.4	5.3	8.5	3.2	5.8	8.6	2.8
Uttar Pradesh	6.3	6.0	-0.3	6.8	6.7	-0.1	6.5	6.6	0.1
West Bengal	4.5	6.4	1.9	4.4	6.4	2	4.4	6.3	1.9
All India	5.5	6.2	0.7	5.9	7.1	1.2	5.7	7	1.3

Source: NSSO (1998, 2006)

Further, Table 2 describes distributional changes in some of the socio-demographic characteristics of the rural aged. It can be noticed from the table that the sex ratio, which was 101.7 (per 1000 male) in 1995-96 has gone down to 98.5 in 2004. Also, share of female elderly in the population has been reduced by 1.1% during the same period. This indicates that in rural India, the share of female elderly has declined over the time but the absolute numbers are still increasing. The trend in the old age dependency ratio, proportion of elderly living alone, economically fully dependent on others, out of labour force is alarming as all these indicators have increased during 1995-96 to 2004. Further, average household size has reduced from 6 to 5.6 in the duration of nine years.

Table 2: Distributional change in some characteristics: 1995-96 and 2004

Characteristics	1995-96	2004	%Change
Age group: 60-70	77.69	79.48	1.79
Age group: 70-80	17.87	16.18	-1.69
Age group: 80+	4.53	4.31	-0.22
Sex ratio	101.7	98.5	-3.2
Female (%)	50.7	49.6	-1.1
Old-age dependency ratio	10.8	12.5	1.7
Living alone (%)	4.4	5.5	1.1
Fully dependent (%)	52.4	52.7	0.3
Not in labour force (%)	61.3	61.9	0.6
Average household size	6.0	5.6	-0.4
Widows (%)	39.9	39.4	-0.5
SC (%)	18.7	19.1	0.4
ST (%)	7.7	8.1	0.4
Physically Immobile (%)	11.1	8.1	-3

The social composition of elderly has also changed during the period as the proportion of both scheduled castes (SCs) and Scheduled Tribes (STs) has increased by 0.4% in each. Besides these challenging outcomes, atleast from the policy points of view, there are some positive indications too. The percentage of widow and physically immobile elderly has reduced by 0.5 (from 39.9% to 39.4%) and 3 (from 11.1% to 8.1%) percentage points, respectively. However, these figures are still higher than many countries in the world.

#### 4.2 Average PCMCE: 1995-96 and 2004

Temporal changes in the PCMCE and health conditions of rural elderly are documented in Table 3 to Table 6. Table 3 presents the descriptive statistics of PCMCE for year 1995-96 and 2004 separately for male and female. As our data is spread over a large range and hence mean per capita monthly expenditure is more likely to get effected from extreme values and may mislead the comparison.

And therefore, we use median per capita monthly expenditure for all the comparison purposes. It can be noticed from the table that during the said period, median PCMCE of the elderly households has increased from Rs. 305 to Rs. 328. Also, median PCMCE of households with male co-residents is higher as compared to households with female co-residents. For example, while for the former households, the median PCMCE was 308 in

1995-96; it was about Rs. 5 less for the households with female elderly co-residents. Similarly, the figures were 331 and 326 respectively for these two types of households in the year 2004. Average PCMCE for the households with elderly co-residents in bottom 10%, 25%, 75%, 90% and 99% (see Table 3) which indicates that at lower level, the change in the income level over the period is not substantial and most of the elderly are still in the bottom side of the income level. Further, we notice from the Table 4 that poverty has declined during 1995-96 and 2004.

Table 3: Gender wise average PCMCE\*: 1995-96 and 2004

Statistics	Male elderly		Female elderly		All elderly	
	1995	2004	1995	2004	1995	2004
Mean	345.55	381.91	337.42	383.09	341.44	382.49
Median	308.25	331.38	303.17	326.65	305.33	328.42
CV	0.52	0.63	0.51	0.74	0.51	0.69
p10	192.71	197.25	186.50	193.30	189.43	195.28
p25	240.80	250.31	236.13	248.53	239.00	248.53
p75	401.67	443.81	397.00	443.81	399.44	443.81
p90	528.80	605.95	515.67	613.73	522.50	610.68
p99	943.00	1171.66	905.50	1183.50	919.00	1183.50
Minimum	79.38	0.00	12.20	0.00	12.20	0.00
Maximum	7370.00	8041.87	3369.00	16687.32	7370.00	16687.32

Note: Poverty cut-off points for 1993-94 has been adopted from ([www.indiastat.com](http://www.indiastat.com)) and for the year 2004-05 from (Himanshu, 2007). It was found 205.03 in year 1993 and 358.03 in the year 2004. After inflating 1993-94 figure using CPIAL, we estimated 254.17 as adjusted poverty cut-off point in the year 1995-96.

Table 4: Gender-wise Head Count Ratio (HCR): 1995-96 and 2004

Elderly	1995-96	2004	% change
Male	27.9 (0.004)	23.1 (0.004)	-4.8
Female	29.9 (0.005)	24.4 (0.004)	-5.5
Difference (Female-Male)	2.0	1.3	

Note: figures in the parenthesis are the standard deviations.

For male elderly it has declined from 27.9% to 23.1% whereas for female elderly it reduced from 29.9% to 24.1% in the same period. However, male and female elderly living below the poverty line have declined by 0.5 to 0.6 percentages point per year during the period, which is certainly not impressive. Again, this table support the earlier finding that more female elderly are below poverty line than their male counterparts, though the gap has reduced from 2.0% to 1.3% with a rate of little below 0.1 percentage points per year.

#### 4.3 SRHS: 1995-96 and 2004

Table 5 presents distribution of elderly according to their age and self-reported health status for the years 1995-96 and 2004. It reveals that while in 1995-96, the proportion of elderly living with poor health status was about 21%, the figure increased to about 25% in 2004. Further, during the same period, the share of elderly with good or fair health declines marginally by 0.39% (from 70.78% to 70.48%).

Table 5: % distribution of self-assessed current health status according to age and sex

	Self-assessed current health status								
	Poor			Good/fair			Excellent/very good		
	1995-96	2004	%change	1995-96	2004	%change	1995-96	2004	%change
Elderly with sickness									
Older	33.25	38.42	5.17	61.55	60.13	-1.42	5.2	1.92	-3.28
Older-Old	47.82	45.24	-2.58	49.32	52.6	3.28	2.85	2.17	-0.68
Oldest	55.57	52.65	-2.92	42.3	46.29	3.99	2.13	1.06	-1.07
All	37.98	40.48	2.5	57.55	57.49	-0.06	4.47	1.91	-2.56
Elderly without sickness									
Older	14.22	15.24	1.02	76.07	78.42	2.35	9.95	6.53	-3.42
Older-Old	28.58	28.07	-0.51	65.45	68.17	2.72	5.96	3.76	-2.2
Oldest	33.93	41.99	8.06	62.63	54.57	-8.06	3.44	3.43	-0.01
All	17.43	18.02	0.59	73.65	75.81	2.16	9.01	6.02	-2.99
All elderly									
Older	17.14	21.5	4.36	73.38	73.11	-0.27	9.19	5.26	-3.93
Older-Old	32.67	34.52	1.85	62.03	62.31	0.28	5.29	3.16	-2.13
Oldest	39.41	46.25	6.84	57.49	51.26	-6.23	3.1	2.49	-0.61
All	20.94	24.74	3.8	70.87	70.48	-0.39	8.23	4.81	-3.42

Note: older adults: 60-70 years, older-old adults: 70-80 years, oldest adults: 80+ years and all elderly: 60+ years

The proportion of elderly in the excellent/very good health category has also declined drastically between 1995-96 and 2004 and reduction is recorded by 3.42 percentage points (8.23% to 4.81%). This means while the proportion of elderly with poor health status has gone up, the reduction in the proportion elderly with good and very good health shows decline in the health level of elderly over time.

Again, the same table gives percentage distribution of elderly with and without sickness.<sup>14</sup> The same trend emerges for all the health levels with sickness and for the poor and excellent health status without sickness. However, the health trend for elderly without sickness and with good and fair health status is encouraging where percentage of elderly with good health increased by 2.16% during 1995-96 to 2004.

Now, if we compare the trend across the age groups, we find that for both the time points the proportion of elderly with poor health status increases from older old to oldest age group and the changes in percentage shares are highest in the uppermost age group, followed by older and older old age group. Among the good and fair health category, the change is found to be negative, except for the older-old elderly where the proportion has gone up by 0.28 percentages. The percentage of elderly with excellent health status declines with increase in age and over the period of 1995-96 to 2004 the change in all age group is found to be negative. Summarising the trend, we find that the health situation of elderly has not improved during 1995-96 and 2004.

<sup>14</sup> In NSS survey schedule it has been asked from the respondents, whether they had suffered from any ailment during the last 15 days. This enabled the aged to be classified as 'with sickness' or 'without sickness'.

#### 4.4 SRHS and poverty status: 1995-96 and 2004

Table 6 reports head count ratio (HCR) for male and female elderly according to their self-reported health status for the years 1995-96 and 2004.

Table 6: Gender-wise Head count ratio (HCR) and SRHS: 1995-96 and 2004

Health Status	1995-96	2004	%Change
Male elderly			
Poor	32.1 (0.011)	27.7 (0.009)	-4.4
Good/fair	27.3 (0.005)	21.8 (0.005)	-5.5
Excellent/v.good	24.1 (0.013)	17.3 (0.015)	-6.8
All	27.9 (0.004)	23.1 (0.004)	-4.8
Female elderly			
Poor	33.4 (0.010)	27.5 (0.008)	-5.9
Good/fair	29.1 (0.005)	22.9 (0.005)	-6.2
Excellent/v.good	25.8 (0.016)	19.7 (0.021)	-6.1
All elderly	29.9 (0.005)	24.4 (0.004)	-5.5

We can observe from Table 6 that (1) proportion living below the poverty line declines as the level of health increases from poor to excellent in both male and female elderly, (2) percentage decline in poverty level is more for those with higher health level, (3) in general, the percentage change among female elderly is little higher than male elderly (5.5% among female elderly as compared to 4.8% for male).

#### 5. Estimation results

After the descriptive trend analysis, in this section, we will examine the determinants of poverty and health for all the three samples. The definition of variables used in the analysis is presented in Table 7. The determinants of poverty and self-reported health status are reported in Table 8 and Table 9.

##### 5.1 Determinants of poverty

Robust regression results in Table 8 for 1995-96, 2004 and pooled samples show that number of adults, education, marital status, household size, social composition, rainfall and household types and facilities are the important determinants of income or poverty in rural households with elderly co-residents.

The average per capita monthly expenditure increases with increase in number of male elderly in the household in all the samples (see table 8). Age beyond 60 years and its square are not significant in determining income, except in the pooled sample where age is positive and significant. However, insignificant square of age beyond 60 years does not show any indication of non-linear relationship with the PCMCE. PCMCE is also significantly determined by higher educational status of elderly in all the samples and here we find strong positive influence of middle and higher education status as compared to below primary. This result is in accordance with the earlier findings that education has a strong causal effect on household's poverty status (McCulloch and Baluch, 1999; Gaiha, 1988). Further, while being married is positively associated with the increased income in the households with elderly co-

residents, its significance disappeared in the 2004 and pooled sample. Also, with increased household size the income level reduced significantly and this is true for all the three samples. It is again as per expectations (Jalan and Ravallion, 2000; Gaiha and Imai, 2004).

Table 7: Definitions of the variables used in the analysis

Variable	Definitions
<b>Dependent variable</b>	
Log of PCMCE	Natural Logarithm of household monthly per capita consumption expenditure
Current Health Status: ordered	Assessment of own current health status on a three-point scale (1=poor; 2=good/fair; 3= Excellent/very good)
<b>Explanatory variables</b>	
Gender	1 if male
Age beyond 60 years	Actual age-60
Age square	Square of age beyond 60 years
Below primary education (Reference category)	1 if education below primary including illiterate and primary education
Middle and secondary education	1 if middle and secondary education
Higher education	1 if higher education
Currently married	1 if currently married
Sickness	1 if ailed in last 15 days
Disability	1 if suffer from any disability
Chronic disease	1 if suffer from any one or more chronic diseases
No. of elderly male	Number of male elderly in household
No. of Children	No. of surviving children
Size of household	Size of household
Expected PCMCE	Estimated per capita consumption expenditure
Social group	1 if Scheduled Tribes or Scheduled castes
Latrine facility	1 if latrine facility is available
Drainage system	1 if drainage system is available
Quality of drinking water	1 if drinking water is of good quality
Household: Self-employed in non-agriculture	1 if household type is self-employed in non-agriculture
Household: agriculture labour	1 if household type is agriculture labour
Household: other labour	1 if household type is other labour
Household: self-employed in agriculture	1 if household type is self-employed in agriculture
Household: others (reference category)	1 if household type is other than above categories
Normal rainfall	Normalised rainfall
Year	1 if year is 2004

Our results also confirm reduced income level of ST and SC as compared to elderly of other castes in the rural society. All the household facilities including having a latrine, drainage system and drinking water sources have strong positive association with the increased level of PCMCE. As in recent times, the role of rainfall has been widely investigated in the literature. It was hypothesised that in rural areas where most of the households are either self-employed in agriculture or work as agricultural labourers, normal rainfall certainly increase the income level of households. Our analysis confirms this hypothesis. Finally, year variable does not turn up significant in the pooled data suggesting that there is no significant change in the income level of households with elderly co-residents during 1995-96 and 2004.

Table 8: Determinants of poverty among rural elderly: robust regression result

Dependent variable	Log of adjusted PCMCE		
	1995-96	2004	Pooled
Explanatory variables	Coefficient (Standard error)	Coefficient (Standard error)	Coefficient (Standard error)
No. of elderly male	0.038*** (0.007)	0.023*** (0.008)	0.032*** (0.005)
Age beyond 60 years	0.002 (0.001)	0.001 (0.001)	0.001** (0.001)
Age square	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Middle and secondary education	0.148*** (0.013)	0.152*** (0.011)	0.149*** (0.008)
Higher education	0.224*** (0.034)	0.276*** (0.022)	0.260*** (0.018)
Size of household	-0.036*** (0.001)	-0.034*** (0.001)	-0.035*** (0.001)
Social group	-0.126*** (0.006)	-0.095*** (0.007)	-0.109*** (0.005)
Latrine facility	0.227*** (0.007)	0.253*** (0.006)	0.240*** (0.005)
Drainage system	0.042*** (0.006)	0.116*** (0.006)	0.086*** (0.004)
Quality of drinking water	0.037*** (0.011)	-0.001 (0.014)	0.019** (0.009)
Normal rainfall	0.026*** (0.003)	0.087*** (0.005)	0.071*** (0.004)
Household: Self-employed in non-agriculture	-0.068*** (0.012)	-0.067*** (0.011)	-0.066*** (0.008)
Household: agriculture labour	-0.233*** (0.010)	-0.198*** (0.010)	-0.218*** (0.007)
Household: other labour	-0.112*** (0.014)	-0.108*** (0.013)	-0.118*** (0.010)
Household: self-employed in agriculture	-0.034*** (0.009)	-0.016* (0.009)	-0.025*** (0.006)
Currently married	0.018** (0.007)	-0.007 (0.008)	0.004 (0.005)
Year	-	-	0.004 (0.004)
constant	5.940*** (0.015)	5.983*** (0.017)	5.970*** (0.011)
F statistics <sup>^</sup>	369.78***	441.86***	781.34***
Number of observations	18966	19362	38328

<sup>^</sup>the degrees of freedom are (16, 18949), (16, 19345) and (17, 38310) respectively for 1995-96, 2004 and pooled samples  
\*\*\*p<0.01, \*\*p<0.05 and \*p<0.10

## 5.2 Determinants of health status

As discussed in the methodology section, rather than using log of PCMCE in the health production function to estimate the effect of income on self-reported health we use estimated natural logarithm of PCMCE as an explanatory variable in the health production equations for all the three samples. Our ordered probit results presented in Table 9 show that predicted income has statistically strong association with self-reported health status. This finding suggests that lower income level is an important determinant of poor health among elderly. The same positive strong relationship was found for 1995-96, 2004 and pooled samples separately.

Another important determinant of self-reported health is gender. As compared to female elderly the health status of elderly is at the higher level (see table 9) which again confirms for the gender inequality in health. In support of the descriptive data, we notice that in the health equation both age and age square variables are significant with opposite sign of their coefficients. Age has negative and its square has positive coefficients in all the three equations which indicates that increased age is associated with lower level of health status and the association between health and age is non-linear. Education variable has mixed effect in the health production equation as while it is significant and positive in 1995-96 and pooled

samples, its association with health is found positive but not significant in 2004. Number of children is also positively associated with the higher health category, however significant only for the 1995-96 and pooled sample.

Table 9: Determinants of self-reported health status: ordered probit regression

Dependent variable	Self-reported health status		
	1995-96	2004	Pooled
Explanatory variables	Coefficient (Standard error)	Coefficient (Standard error)	Coefficient (Standard error)
Expected PCMCE	0.129** (0.060)	0.359*** (0.052)	0.291*** (0.039)
Gender	0.129*** (0.020)	0.184*** (0.021)	0.154*** (0.014)
Age beyond 60 years	-0.035*** (0.003)	-0.046*** (0.004)	-0.041*** (0.002)
Age square	0.000*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Middle and secondary education	0.148*** (0.044)	0.125*** (0.038)	0.130*** (0.029)
Higher education	0.216* (0.121)	0.046 (0.075)	0.099 (0.063)
No. of Children	0.010** (0.004)	0.001 (0.004)	0.006** (0.003)
Sickness	-0.410*** (0.026)	-0.537*** (0.022)	-0.482*** (0.016)
Disability	-0.539*** (0.021)	-0.540*** (0.039)	-0.541*** (0.018)
Chronic disease	-0.382*** (0.019)	-0.352*** (0.030)	-0.377*** (0.016)
Currently married	0.055*** (0.021)	-0.032 (0.021)	0.012 (0.015)
Social group	-0.067*** (0.022)	0.025 (0.022)	-0.012 (0.016)
Household: Self-employed in non-agriculture	0.116*** (0.041)	0.128*** (0.035)	0.126*** (0.027)
Household: agriculture labour	0.093*** (0.039)	0.135*** (0.036)	0.129*** (0.027)
Household: other labour	-0.068 (0.049)	0.083* (0.043)	0.023 (0.032)
Household: self-employed in agriculture	0.144** (0.031)	0.184*** (0.028)	0.172*** (0.021)
Year	-	-	-0.536*** (0.015)
Cut point 1	-0.627 (0.355)	1.163 (0.313)	0.279 (0.234)
Cut point 2	1.819 (0.356)	3.632 (0.315)	2.735 (0.235)
Wald chi <sup>2</sup> (16)	2583.84***	2027.25***	4994.67***
Log pseudolikelihood	-13028.8	-12839.3	-25888.9
Pseudo R <sup>2</sup>	0.1023	0.0829	0.0973
Number of observations	18626	18350	36976

\*\*\*p<0.01, \*\*p<0.05 and \*p<0.10

Turning to objective measures of health; it can be observed that in all the samples, being sick during last 15 days, being disabled and suffering from chronic diseases all have strong negative effect on the self-reported health. This result is particularly important in the view that self-reported health often does not follow with the objective measures of health. Further, though being married has been found positively associated with health in 1995-96, the relationship for 2004 and pooled sample is not convincing. Another important factor is the social composition of elderly where being SC/ST is negatively associated in 1995-96; it disappeared in other two samples. Finally, household types are found to be one of the significant determinants of self-reported health among elderly in rural India.

Now, to test for equality of coefficients of expected PCMCE and joint significance in samples 1995-96 and 2004, we use Wald test.

Table 10: Wald test results

Null hypothesis	Alternative hypothesis	Chi-square statistics
coefficient of expected PCMCE in 1995-96 = coefficient of expected PCMCE in 2004	coefficient of expected PCMCE in 1995-96 $\neq$ coefficient of expected PCMCE in 2004	chi2(1) = 60.99***
coefficient of expected PCMCE in 1995-96 = 0 and coefficient of expected PCMCE in 2004 = 0	coefficient of expected PCMCE in 1995-96 $\neq$ 0 and coefficient of expected PCMCE in 2004 $\neq$ 0	chi2(2) = 111.07***

\*\*\*p<0.01

The test result reported in the Table 10 suggests that (1) there is significant difference between coefficients of expected PCMCE in health production equation and effect in terms of magnitude of coefficient has declined over 1995-96 to 2004, (2) these two coefficients are jointly significant and differ from zero.

## 6. Concluding observations

Continuously increasing number of elderly in rural India has generated new needs for health care and social security as well as a rise in the consumption of other resources already in place. To ascertain those requirements and to allocate the available resources efficiently and effectively, the policy makers require information on the factors influencing poverty and health status of elderly. Keeping this in mind, In this paper the trend and determinants of health and poverty has been examined for the rural elderly in India. These determinants along with the trend in the temporal changes in the characteristics of rural aged, their poverty level and health status will provide a clear picture of demand for health and economic security.

Main findings of this paper are following:

- Kerala's status of the most ageing states is continued over 1995-96 and 2004.
- Feminisation of rural elderly is visible in most of the states.
- The share of aged in the total population has increased by 1.3 percentage points over the period of 1995-96 and 2004.
- The trend in the old age dependency ratio, proportion of elderly living alone, economically fully dependent on others, out of labour force is increasing while average household size has reduced during 1995-96 and 2004. The elderly's share in ST and SC has increased. However, the percentages of widow and physically immobile elderly have been reduced by 0.5 and 3 percentage points, respectively.
- Median PCMCE has increased marginally and consequently, percentage below poverty line has declined.
- Proportion of elderly with poor health status has increased while with good/fair and excellent/very good health has decline.

- Head count ratio declines with increased level of health status and more reduction is observed in female elderly with same levels of health.
- In all the three samples, the number of adults, education, marital status, household size, social composition, rainfall and household types and facilities are the important determinants of poverty in rural households with elderly co-residents.
- Poverty, gender, age, education, number of children, objective measures such as being sick during last 15 days, being disabled and suffering from chronic diseases, marital status (married), social group and household type are the important determinants of health.
- The effect of poverty on health has declined in terms of magnitude of coefficients during 1995-96 and 2004.

Our analysis suggests that in view of the increased demand for health, immediate intervention is required in improvement of rural infrastructure, provision of more sustained anti-poverty programmes and strong social safety net for rural elderly. In conclusion, the paper provides some insights to the policy makers to think seriously on the supply side, for example, hospitals equipped with expert gerontologists etc. and implementation of proper and cost effective programmes for the elderly in rural India is imperative.

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