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Elderly's Health Shocks and Household's Ex-ante Poverty in India*

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Abstract

Evidence on the association between traditional poverty measures and health is widely available in the literature. However, the traditional ex-post poverty measures neglect many aspects of household welfare by overlooking the risk that a household faces in view of fewer resources available to it. Household's vulnerability to expected poverty is an alternative measure which allows quantification of welfare loss due to poverty as well as due to other sources of uncertainty. Using two waves of independent cross-sectional data collected by National Sample Survey Organization (NSSO) in the years 1995–96 and 2004, the paper aims to estimate household's vulnerability to poverty for Indian households with elderly and examine whether health shocks from the elderly members translated into the risk of household's poverty in the near future. The econometric results accounting for possible endogenous relationship between health and vulnerability suggest that households with higher concentration of aged members with poor health and disability are more vulnerable to poverty. Thus, economic policies, for general population as well as for aged, should be integrated well with the health policies. Sufficient health care facilities and affordable health insurance is needed to be provided to the households with aged — in particular for those living in rural and other poverty prone areas and communities. This is a necessary step to eradicate poverty from poor households and to prevent non-poor households from falling into poverty in the near future.

Keywords: Health shocks, Poverty, Vulnerability to poverty, elderly
JEL classification: J21, J14, I18, C35

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1. Introduction

In developing countries, health shocks are one of the most common shocks faced by households, are unpredictable (Narayan et al., 2000), dominate in frequency, costliness and adversity (Helberg and Lund, 2009, Asfaw and Braun, 2004, Gertler and Gruber, 2002, Lindelow and Wagsaff, 2005). Depending on extent and duration, health shocks may have long and short run impacts on the household's welfare. On one hand, health shocks prevent possible participation of individuals in the labor force, reduce productivity and hours of work, and hence reduce earnings. On the other hand, unhealthy individuals, especially in the old age, become a liability and burden for the household and take away larger part of the household income as their medical expenses. These effects could contract the lifetime budget constraint, significantly reduce consumption or income (Cochrane, 1991; Dercon and Krishnan, 2000; Gertler and Gruber, 2002; Asfaw and Braun, 2004; Wagstaff, 2007; Lindelow and Wagstaff, 2007; Beegle et al., 2008) and might reduce the marginal utility of consumption (Finkelstein, Luttmer et al., 2008). Thus, households have to substitute consumption and production expenditure for health care of individuals. Households behave strategically when coping with an illness related shock so as to minimize its impact on expenditure on necessities. In the aftermath of health shocks, returns from investment in productive activities tend to reduce in the long run (Somi et al., 2009) and if household is not able to mitigate the negative effect of health shocks, it may have to face financial consequences (Baldwin, Zeager and Flacco, 1994; Haveman and Wolfe, 1990; Burkhauser and Daly, 1994, 1995). The household may lose savings, forced to borrow often at relatively high rates of interest; and/or sale of lands, livestocks and physical assets (Wagstaff and Lindelow 2010). There are evidences that suggest that health shocks also have impact on labor supply (Coile, 2004), hours worked (Cai et al., 2008), and on early exit from the labor force (Zucchelli et al., 2010*)*. For a community, given that medical resources are scarce, unhealthy and disabled individuals also take away resources from the others. Studies have shown that financially better and wealthier households are better able to insure against health/illness shocks in particular (Udry, 1990; Rosenzweig and Wolpin, 1993; Besley, 1995; Fafchamps et al., 1998; Jalan and Ravallion, 1999; and Gertler and Gruber, 2002). Thus, from the literature it is evident that health shocks play a significant role in not only determining current state of welfare but may also change household's future course of welfare.

Many studies are attributed to examine adverse effect of health shocks on the economic status of the household. Few of the studies have also looked into this relationship in the context of old age poverty and health and disability. For instance, while Deaton and Paxson (1995) and Pal and Palacious, 2008 had analysed the old age poverty, Dreze and Srinivasan (1997) focused their analysis on widowhood and poverty in the old age. Alam (2008), Balasubramanian (2007), Gupta and Sankar (2001) and Gupta, Dasgupta and Sawhney (2001) tried to examine various factors associated with the health of elderly and economic status is one of those significant factors. Pandey (2009a) established causal relationship between health and poverty among elderly in the rural India. Using full information maximum likelihood estimation technique, Pandey (2009b) found that health shocks had significant implication on the labor force participation decision of elderly in India and vice versa. Applying structural equation modelling approach, Pandey and Jha (2012) tried to examine the role of economic factors in assessing the effect of widowhood on health status of elderly in India and find that the adverse affect of widowhood can be mitigated through improving their economic situation. Pandey (2012) also find that there exists a poverty disability trap among elderly where disability pulls the elderly disabled into poverty and then those aged could not get out of the poverty and become disabled for the life.

Almost all of the existing literature has treated the ex-post poverty measures as indicators of economic aspects. However, these measures neglect many aspects of household welfare by looking at household well-being only through average income or expenditure and ignoring the risk that the household faces in view of fewer resources available to it. As suggested by Chaudhary (2003) and Ligon and Schechter (2003), one of the ex-ante measure of welfare which reflects risks that the household faces is the vulnerability to expected poverty. This measure is seen as a forward looking measure of welfare. Realising the absence of studies examining the association of health shocks with household's future poverty expectations, the present paper contributed to the literature by examining the central question: do poor health conditions and presence of disability among elderly household member — one of the most vulnerable section of the population in India — increase the susceptibility of household's vulnerability?. In other words, the paper tried to answer how health and disability shocks are associated with the household's ex-ante poverty? To the best of our knowledge, none of the study is available which examines this question- particularly in the context of Indian elderly. Following Chaudhary (2003) procedure, household's vulnerability to poverty is estimated for Indian households with elderly and then applying econometric

model of conditional mixed process (CMP) (Roodman, 2011), the effect of health and disability shocks of elderly on the risk of households poverty in the near future is analysed. Two waves of comparable independent cross-sectional data collected by National Sample Survey Organization (NSSO) for the years 1995–96 and 2004 are used for the analysis purpose. The main findings of the paper suggest that increased proportion of elderly members with disability, perceived poor health, and chronic diseases significantly increases the household's vulnerability to poverty. This implies that improvement of health of elderly members in the family is in great interest of the household to prevent incidences of poverty in near future. Therefore, policy makers should focus on strengthening and integrating health care services with the anti-poverty policies in the country-in particular by promoting old age health care facilities in poverty prone areas and communities.

The rest of the paper is outlined as follows. The demographic changes in the past and current and future challenges of Indian ageing population is described in section 2. In section 3, the methodological framework and estimation strategy for the study is detailed. This is followed by section 4 where we discuss data used in the analysis and choices of key variables. In section 5, data statistics is described and econometric results are reported and explained. Finally, we report conclusions, discuss some of the policy implications of the study and some of its limitations in section 6.

2. Population Ageing in India: Past, Present and Future Challenges

With sustained reduction in mortality and fertility rates combined with increased life expectancy due to advancement in the health care system, the base of the population pyramid has continued to shrink due to decline in child birth while the upper section of the population pyramid continues to widen due to increased proportion of old age population. As a direct consequence of this, the process of population ageing[1] has started globally and, like many other countries, is expected to occur in India as well. For example, according to a report by Health Information of India (2005), mortality rate (crude death rate) in India was reduced from 12.5 persons per 1000 population in 1981 to 8.1 persons per 1000 population in 2002 and fertility rates declined from 36.9 in 1971 to 25.0 per 1000 females. Moreover, life expectancy at birth has increased from 24 years in 1901 to 63 years in 2002. As a consequence of this development, the population of persons 60 years and older (hereafter

[1] This is defined as an increase in the proportion of the aged as comparison to that of a reduction in the proportion of the young.

elderly) tripled during 1961–2001 (Population Census of India, 2001) and their share in the total population has risen from 5.6 per cent in 1961 to 7.5 per cent in 2001 (Irudya Rajan, 2006). Also, the growth of the elderly population which was 2.7 per cent during 1981–91 rose to 3.7 per cent during 1991–2001. Further, the ratio of females to males in the aged population increased from 960 females per 1000 males in 1981 to 1029 females per 1000 males in 2001 suggesting the feminisation of elderly population. Census 2001 figures reveal that about 33 per cent of elderly were widowed. Of all persons widowed 71.1 per cent were female and only 28.9 per cent were male (Irudya Rajan, 2006). The increased share of female widowhood may be attributed to the fact that life expectancy of female is higher than that of male and in India; the average age of female spouse is significantly lower than their male partners. Similarly, the old-age dependency ratio, defined as the share of the aged to the working-age population increased to 13.1 per cent in 2001 from 8.9 per cent in 1981. The labor force participation rate for the elderly marginally increased from 39.1 per cent in 1991 (Chakraborti, 2004) to 40.3 per cent in 2001 (Irudya Rajan, 2010).

The rise in the population of the aged 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 programs, better basic education, and successful vaccination programs. But at the same time the steady and sustained growth in the population of older age groups have also posed myriad challenges to policymakers.

On the 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 perceived poor health status beside significant increase in longevity is evident. More than three-fourth of the elderly population lives in rural areas with high prevalence of diseases and unsatisfactory health care system (Alam, 2000). National Sample Survey Organization (NSSO) report, 2004–05 reveals that more than 9% of persons of all age groups and more than 30% of aged persons in India reported one or more ailments in the 15 days prior to the survey. On the supply side, there are few changes are observed over couple of decades. These are (a) increased pressure of urbanization and industrialization (b) increased migration of young people from one place to another (c) 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) (d) a rapid

breakdown in social support networks and (e) continued disintegration of joint family support system to nuclear family system. Moreover, estimates from NHA (2009) suggest that in 2004–05 the share of total health expenditure from all sources in Gross Domestic Product (GDP) was only 4.3 %. The share of public expenditure was less than 1 (about 0.85 percent). Out of pocket expenses in connection with medical treatment or health care amounted to 70 percent of total health expenses in India. This indicates that the country is still not able to provide public health care facilities to the majority of its population. In a study, Chakraborti (2004) noted that old age persons in India do not enjoy any specific government sponsored health care programs. Only retired and working central government employees along with a fraction of state government employees are covered through central government health schemes.

High poverty, low employment rate coupled with relatively high rate of illiteracy create other challenges that India is facing. Also, 85 per cent of total working population in India is employed in unorganized sector (NCEUS, 2008) in which social and health insurance provisions are either very weakly distributed or absent. An Integrated Program for Older Persons (IPOP) was launched by the Government of India in the year 2008 with the objectives of improving the quality of life of older persons by providing basic amenities like shelter, food, medical care and entertainment opportunities and by encouraging productive and active ageing through providing support for capacity building of Government, Non-Governmental Organizations, Panchayati Raj Institutions, local bodies and the Community at large. However, access to this scheme is limited (Irudya Rajan, 2010), provisions are not sufficient and the impact of this program is yet to be felt by the old-age population.[2] Thus, lack of resources combined with expected perceived 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, 2012). Given the importance of aged members in the family and their limited access of household and communities resources, it is interesting to examine how their health status changes the poverty dynamics of the household in the future — a key question of the present paper.

[2] See Ministry of Social Justice and Empowerment, Government of India website http://socialjustice.nic.in/ipop.php?pageid=3 (Last accessed 12 January 2011).

3. Methodological Framework

3.1 Measuring Vulnerability

Following Ligon and Schechter (2003), we assume that $\omega \in \Omega$ denotes the state of the world. We further assume that households have finite population indexed by $h = 1,2,....n$ and consumption expenditure of the h[th] household is $c_h(\omega)$. We also assume that $U_h : \Re \to \Re$ is the h[th] household's objective function (referred as household's welfare or utility) mapping consumption expenditures into real line for each household and is strictly increasing and weakly concave. Suppose that c_h is the goods and services consumed by household h in a given period and z as some certainty equivalent consumption or poverty line such that if household h had certain consumption greater than or equal to this number, we would not regard the household as vulnerable. Finally, we define the vulnerability of the household by the function

$$V_h = U_h(z) - EU_h(c_h) \quad \text{.....(1)}$$

Now, for the empirical computation of household's vulnerability to poverty ideally a panel data could be the most suitable candidate. However, following Jalan and Ravallion (2001), most of the available standard data sources are cross-sectional. To make use of such data, Chaudhary (2003) develops an alternative way to measure vulnerability to poverty by defining vulnerability as expected poverty. In this sense, vulnerability to poverty is the probability that a household's per capita consumption expenditure will lie below the predetermined poverty line in the near future. This method is widely adopted by many recent studies e.g. (Jha and Dang, 2009; Azam and Imai, 2009).

Following Chaudhary (2003) for the framework for Philippines and Indonesia, for a household with at least one elderly (say h), the vulnerability to poverty (V_h) is defined as the probability of its log of per capita consumption expenditure ($\ln c_h$) being below poverty line (z) i.e.

$$V_h = \Pr(\ln c_h < \ln z) \quad \text{.....(2)}$$

Assuming that the stochastic process generating the consumption of a household h is given by:

$$\ln c_h = X_h \beta + \varepsilon_h \quad \text{.....(3)}$$

Where X_h represents a vector of household and community characteristics, β is a vector of unknown parameters and ε_h is a mean-zero disturbance term that captures household's idiosyncratic factors (shocks) contributing to differential level of per capita consumption expenditure for households that share the same characteristics. Further, we assume that c_h follows log-normal distribution and ε_h is normally distributed with mean zero and varying variance

$$V(\varepsilon_h) = \sigma_{\varepsilon,h}{}^2 = X_h\theta \quad \text{.....(4)}$$

Thus, in the presence of heteroskedasticity, a three-step Feasible Generalised Least Squares (FGLS) procedure can be used to estimate the parameters $\beta \& \theta$. For this, first we estimate equation (3) using an ordinary least squares (OLS) procedure. We estimate the residuals from that estimation and save it as $\hat{\varepsilon}^2_{OLS,h}$. Further, we estimate the following equation using OLS:

$$\hat{\varepsilon}^2{}_{OLS,h} = X_h\theta + \eta_h \quad \text{.....(5)}$$

Now, the predictions from equation (5) are used to transform the same equation (5) into the following:

$$\frac{\hat{\varepsilon}^2{}_{OLS,h}}{X_h\hat{\theta}_{OLS,h}} = (\frac{X_h}{X_h\hat{\theta}_{OLS,h}})\theta + \frac{\eta_h}{X_h\hat{\theta}_{OLS,h}} \quad \text{.....(6)}$$

This transformed equation is estimated using OLS to obtain an asymptotically efficient FGLS estimate, $\hat{\theta}_{FGLS,h}$. Note that $X_h\hat{\theta}_{FGLS,h}$ is a consistent estimate of $\sigma^2{}_{e,h}$, the variance of the idiosyncratic component of household consumption. The estimates:

$$\hat{\sigma}_{e,h} = \sqrt{X_h\hat{\theta}_{FGLS,h}} \quad \text{.....(7)}$$

are then used to transform equation (3) as follows:

$$\frac{\ln c_h}{\hat{\sigma}_{e,h}} = (\frac{X_h}{\hat{\sigma}_{e,h}})\beta + \frac{\varepsilon_h}{\hat{\sigma}_{e,h}} \quad \text{.....(8)}$$

Now, OLS estimation of equation (8) yields a consistent and asymptotically efficient estimate of β. The standard error of the estimated coefficients $\hat{\beta}_{FGLS,h}$ can be obtained by dividing the reported standard error by the standard error of the regression.

Using the estimates $\widehat{\beta}_{FGLS,h}$ and $\widehat{\theta}_{FGLS,h}$ for each household h, the expected log consumption is given by

$$\widehat{E}[\ln c_h / X_h] = X_h \widehat{\beta}_{FGLS,h} \quad \text{.....(9)}$$

And the variance of log consumption:

$$\widehat{V}[\ln c_h / X_h] = \widehat{\sigma}_{\varepsilon,h} = X_h \widehat{\theta}_{FGLS,h} \quad \text{.....(10)}$$

Now, as we assume that c_h is log-normally distributed, elderly household h's vulnerability level is given by the probability that a household with characteristics X_h, will be poor i.e.

$$\widehat{\upsilon}_h = \widehat{\Pr}[\ln c_h < \ln z / X_h] = \Phi\left(\frac{\ln z - X_h \widehat{\beta}_{FGLS,h}}{\sqrt{X_h \widehat{\theta}_{FGLS,h}}}\right) \quad \text{.....(11)}$$

3.2 Measuring Health Status

Numerous studies show that self-reported health status (SRHS) is an increasingly common and comprehensive measure of health in empirical research (e.g. Ettner, 1996; Saunders, 1996; Schofield, 1996; Idler and Benyamini, 1997; Deaton and Paxson, 1998; Keneddy et al., 1998; Smith, 1999). Studies suggest that SRHS can be used to predict morbidity and subsequent mortality (Okun et al., 1984; Connelly et al., 1989; McCallum et al., 1994; Idler and Kasl, 1995) and allows examination of how health status varies over the life course (Case and Deaton, 2003). However, some studies have questioned the reliability of self-reported health status (see for example, Lambrinos, 1981; Parsons, 1980a, b; Sen, 2002). Several issues exist with self-reported health status in the empirical analysis (Bound, 1991; Bound et al., 1999). Under-reporting of health status or over-reporting of health problems is one of those issues which accrued to a measurement error. However, this measure of health is quite popular in both developing and developed countries.

3.3. Estimation Strategy

In order to examine health effect on vulnerability, after identifying indicators of health and disability and estimating vulnerability to poverty equation (11), now we will have two separate sets of equations: health production function and vulnerability to poverty function.

To examine the effect of elderly's health on vulnerability of the households, we estimate the following equation:

$$\widehat{\upsilon}_h = H_h\pi + Z_h\gamma + Z_s\lambda + \zeta_{hs} \quad \text{.....(12)}$$

where $\widehat{\upsilon}_h$ is the estimated household vulnerability to poverty from (11), H_h is the proportion of elderly with perceived poor health or disability or chronic diseases. Z_h and Z_s respectively, are vectors of household idiosyncratic and community characteristics. π is a coefficient of health and γ & λ are, respectively, vector of coefficients corresponding to Z_h and Z_s. ζ_{hs} is an error term assumed to be independently and identically distributed.

For the purpose of setting up health production function, we use reduced form of Grossman's (1972) basic human capital model which has been tested in numerous studies (Grossman 2000 and 1972; Nocera and Zweifel 1998; Erbsland et al. 1995; Pohlmeir and Ulrich 1995; Wagstaff 1993 and 1986; Leu and Gerfin 1992; Van Doorslaer 1987; Cropper 1981) related to health and well-being. Following this, our health production function is

$$H_h = \alpha + \beta X_h + \gamma X_s + \psi_{hs} \quad \text{.....(13)}$$

where H_h is proportion of aged with perceived poor health/disabled aged/chronic disease, where X_h and X_s denotes a set of common household and community or state level characteristics, respectively. β represents the coefficients associated with exogenous variables and ϑ is the independently identically distributed (i.i.d) disturbance term.

Now, the error terms in equation (12) and (13) could be correlated through some unobserved factors and there could be some unobserved factors that could be highly correlated with vulnerability to expected poverty and health. This leads to the theoretical possibility of endogenous relationship between vulnerability to poverty and health production functions. In ideal situation, ordinary least squares technique is used to estimate equation (12). Further, because all the three health indicators have very large number of zeros, a tobit model with observations left censored at 0 is an appropriate method of estimation (Greene, 2003) for equation (13). To deal with the potential endogeneity, two-stage approach (Stern (1989)) is the most popular method in the literature. It is an instrumental variable method where all exogenous variables are used as instruments to estimate each equation in the system separately. However, produced estimators are consistent but not efficient and only exogeneity can be tested partially. In this paper, we apply a relatively new technique — conditional mixed process (CMP) model suggested by Roodman (2011). It takes care of the correlation between the error terms in simultaneous equation systems and thus, produces consistent as

well as efficient estimators. Another advantage is that the correlation coefficient between the error terms in equations (12) and (13) can be jointly tested and is therefore, a true test of exogeneity hypothesis. In this model, equation (12) and equation (13) are simultaneously estimated using ordinary least squares method for equation (12) and Tobit method of estimation for equation (13). The final equation looks like

$$\hat{\upsilon}_h = \hat{H}\pi + Z_h\gamma + \psi_h \quad \text{.....(14)}$$

where $\hat{H}$ is the instrumented health variable. After controlling for other household and community level variables, we expect a significant positive relationship between vulnerability and proportion of aged with perceived poor health, disability and chronic diseases. We also expect that the estimation result would be robust in both the periods 1995–96 and 2004.

4. Data Sources and Choice of Variables

4.1 Data: Sources

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 52nd round and 60th round datasets conducted, respectively during July 1995 to June 1996 and January to June 2004. The use of these two data sets is important for three reasons. One, these dataset have been kept as comparable as possible (NSSO, 2006) by 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 the economic front, NSSO 52nd round survey was conducted in July 1995 to June 1996 only after four years of the economic reforms and NSSO 60th round survey was conducted in January to June 2004. Thus, while the former was not much affected by economic reforms, the later survey captures liberalized economic policies and higher economic growth. From a health policy view, NSS 52nd round and NSS 60th round surveys were conducted after twelve and twenty years, respectively, of enactment of the National Health Policy introduced in 1983. These surveys are assumed to register effects of National Health Policy, though attribution to health policy is problematic as the surveys do not have a base line. Thirdly, both these rounds of NSSO survey data provide a wealth of information on elderly's health, health care use, disability, socio-economic and demographic background. It also collected special information on the elderly's past and current economic activity, state of

economic independence, number of dependents, their number of living children, living arrangements and persons supporting them.

These surveys have been conducted by employing a stratified multistage sampling design. While 34084 elderly individuals (17,211 males and 16,873 females) were surveyed in the 52nd round, 34,831 elderly individuals (17,750 males and 17,081 females) were included in the 60th round of the survey. These datasets only collect health information of the people who are 60 years or older living in the household. Apart from these datasets, we also use some state level poverty lines, Gini-coefficients and infrastructure indicators such as road density from different published sources such as Census of India, Centre for Monitoring Indian Economy (CMIE), and Planning Commission of India. Rainfall data is used from India Metrological Department (IMD).

4.2 Choice of Variables

In the above datasets, while information on consumption expenditure is available at the household level, the information on health status, disability and chronic diseases are surveyed at the individual levels. Self-assessed current health status related to whether an individual assesses his/her health as poor, good/fair, very good/excellent. Disability includes whether aged has problems related to visual, hearing, speech, locomotors and amnesia/senility. Chronic diseases include cough, piles, joints pain, high/low blood pressures, heart diseases, urinary problems, diabetes, and cancer. Based on these three indicators, we compute proportion of aged in the households with poor current health status, proportion of aged in the households with at least one disability and proportion of aged in the households with chronic diseases.

According to the objective of the paper, we use following equations: (1) log of per capita monthly expenditure (2) vulnerability to poverty equation and (3) proportion of aged in the household with perceived poor health, disability and chronic disease. While consumption equation is used to predict household's vulnerability to poverty, health equation and vulnerability to poverty equations are estimated simultaneously. Based on previous literature, different set of covariates are used in different set of equations. However, most of the covariates are broadly classified into characteristics related to household, community and to the state where these households belong. A common set of explanatory variables include household characteristics such as age, sex, and marital status of household head, average number of aged members in the family and its square, number of household members not

currently married, proportion of adults in the family, household size and its square, social group such as scheduled castes (hereafter SCs), scheduled tribes (hereafter STs) and other backward castes (hereafter OBCs) and others, location (rural/urban), household facilities of latrine, drainage, and household occupation. Number of household's availing any medical insurance in the community is used in the health equation. We also constructed some state level variables such as normalized rainfall variable,[3] road density[4] and its square, Gini-coefficient.[5] The definition of all the variables used in the analysis is reported in Table 1.

<Table 1 about here>

5. Results

5.1. Data Description and Preliminary Statistics

5.1.1 Gender and Location Differentials in Health and Disability of Elderly Population

In this section, we present how distribution of elderly population with different health status and disability varies by their gender and location preferences (rural/urban) over the period of 1995–96 and 2004.

<Table 2 about here>

Going by different self-assessed health status, we observe that the majority of the elderly perceive their health status as fair or excellent. This pattern exists in both the periods, 1995-96 and 2004. However, the proportion of elderly with perceived poor health status has increased from 20 percent in 1995–96 to 24 percent in 2004 and this trend even persists at the disaggregated level of gender and location. Urban elderly and elderly men enjoy slightly better health as compared to those elderly living in rural areas and those who are women indicating that rural elderly and elderly women are relatively worse-off in terms of their health status. In terms of disability, while the incidences of disability among elderly women and rural elderly is relatively higher as compared to elderly men and urban elderly, respectively; the proportion of disabled elderly across all gender and location has dropped down from 40 percent to 17 percent during 1995–96 and 2004. Percentage elderly suffering

[3] Computed as (actual rainfall for the year 2004–05 — mean rainfall of the year 1970 to 2005)/(standard deviation of rainfall for the year 1970 to 2005)

[4] Road density is the ratio of the length of the country's total road network to the country's land area. The road network includes all roads in the country: motorways, highways, main or national roads, secondary or regional roads, and other urban and rural roads.

[5] It is one of the most popular measure of income inequality and varies between 0 (*complete equality*) and 1 (*complete inequality*; one person has all the income or consumption, all others have none). A detailed computational procedure for it is explained in Deaton (1997).

from at least one chronic diseases is again higher among women and rural elderly and the incidences of chronic diseases in elderly has again dropped sharply from 69 percent in 1995–96 to 47 percent in 2004 with an average reduction of about 2 percent per annum. Thus, we can conclude that while proportion of those suffering from chronic diseases, disability and perceive poor health has reduced for the elderly population, gender and location differential is persistent over a period of 1995–96 to 2004 implying that rural elderly and women elderly are comparatively disadvantageous segment among the elderly.

5.2. Econometric Results

After a few cross-tabulations and descriptive statistics, we report results from econometric exercises in this section.

5.2.1 Determinants of Log of Per Capita Monthly Expenditure and Error Variance

In this section, we analyze the results for households' idiosyncratic characteristics and state level infrastructure and other determinants of log of per capita monthly expenditure (PCME onwards) for the elderly households. Table 3 shows the regression results corresponding to equations (6) and (8). All the models are validated by F-statistics. The sign and significance of majority of the covariates are consistent in both the samples of year 1995–96 and 2004.

<Table 3 about here>

Estimation results suggest that in both the years 1995–96 and 2004, while PCME is not significantly different for male and female headed households, households with relatively older heads and currently married heads tended to have higher PCME. Also, a household with middle and higher education level has significantly higher consumption as compared to households headed by persons with primary or lower level of education. 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). Households with larger family size tended to have lower PCME but the negative effect of family size weakened for larger households. The results is again as per the other findings (e.g. Jalan and Ravallion, 2001; Gaiha and Imai, 2004) in the Indian context. Moreover, PCME decreases significantly with increase in the old age dependency ratio, implying that lower is the proportion of adults to the older age members in the households, lower is the per capita consumption of the household. Our results also confirm for significantly lower income level of STs, and SCs elderly as compared to OBCs and others elderly. As expected, better household facilities including

pucca[6] and semi-pucca[7] structure (as compared to households with kutcha[8] dwellings), availability of a latrine, and drainage system have strong positive association with the higher PCME of the households. As compared to self-employed (whether in agriculture or in nonagricultural sector) household, households involved in agricultural and other labor (whether casual or regular) tended to have significantly lower consumption expenditure. However, while in 2004 other types of households have significantly higher PCME as compared to those with self-employed households, an insignificant difference is found in 1995–96 between these types households. Estimation results also reveal that households in rural areas have significantly lower PCME as compared to those in urban areas.

Now, we turn to some of the state level variables. In recent times the role of rainfall and state level infrastructure has been widely investigated in the literature (see for example, Kaur, Kulkarni, Gaiha, and Pandey, 2011) in relation to the prosperity of the households. Our results show that PCME of elderly households is significantly higher in those states where there is normalized rainfall and better infrastructure in terms of road density. While households in states with higher level of inequality (Gini-coefficients) had higher PCME in 1995–96 but not such significant relation could be established in 2004. One of the possible explanations for positive effect of state level inequality on the household's consumption is that higher inequality provides incentive to work hard, increased competitiveness and more investment and hence more employment opportunities could be possible in the states with higher inequality.

5.2.2 Computation of Vulnerability to Poverty and Exploration of its Association with Health and Disability

We computed estimates of vulnerability to poverty from equation (11) for each of the elderly households using estimates of log of per capita consumption in equation (9) and variance of the disturbance term in equation (10). Once estimated, we assume that a household with a probability to fall in poverty in the next period equals to 0.5 as the threshold for vulnerability to poverty as it is widely recognized as an acceptable threshold (Chaudhuri et al., 2003;

[6] A pucca structure is one whose walls and roofs are made of pucca materials such as cement, concrete, oven burnt bricks, hollow cement / ash bricks, stone, stone blocks, jack boards (cement plastered reeds), iron, zinc or other metal sheets, timber, tiles, slate, corrugated iron, asbestos cement sheet, veneer, plywood, artificial wood of synthetic material and poly vinyl chloride (PVC) material.

[7] A structure which cannot be classified as a pucca or a katcha structure as per definition is a semi-pucca structure. Such a structure will have either the walls or the roof but not both, made of pucca materials.

[8] A structure which has walls and roof made of non-pucca materials such as unburnt bricks, bamboo, mud, grass, leaves, reeds, thatch, etc.

Zhang et al., 2008; Pritchett et al., 2000; Azam and Imai, 2009). With this assumption and using poverty line at the state level (separately for rural and urban areas), we classified households into four broad categories namely chronic poor, transient poor, highly vulnerable non-poor, and total vulnerability to poverty. Chronic poor households are those households for which vulnerability to poverty is beyond the threshold of 0.5, and their absolute as well as expected consumptions fall below poverty line. Transient poor households are those for which though expected consumption is greater than or equal to the given poverty line, current consumption fall short of poverty line. Highly vulnerable non-poor are those whose current consumption is higher or equal than the poverty line but the vulnerability to poverty is greater than the threshold of 0.5. Finally, all those households for which vulnerability to poverty is beyond 0.5 come under total vulnerability to poverty group.

Now, based on these classifications, we explore a pattern between health and disability status of aged and household's various poverty and vulnerability classification of which they belong to.

<Table 4 about here>

As shown in Table 4, a clear pattern exists between health and disability status of aged and household's various poverty and vulnerability classification of which they belong to. Going by self-assessed health status, we observe that higher proportion of aged with lower status of health live in households with chronic poverty and the percentage considerably declines as the perceived health moves from poor health to excellent health status. A similar pattern follows where considerably high proportion of aged (except for those belongs to highly vulnerable non-poor households) with all health categories belong to households with poverty, transient poverty and total vulnerability to poverty. Share of aged with lower health status is higher as compared to relatively higher health status in such households but share dropped down between 1995–96 and 2004.

Now let us examine the distribution of disabled elderly in households with various household categories. We find that as compared to aged without disability, somewhat higher proportion of aged with one or more disabilities tend to live in the households with chronic poverty, transient poverty, poor, highly vulnerable non-poor and households with total vulnerability to poverty. This is true for both the years 1995–96 and 2004. Among disabled aged, majority of the aged belong to household with total vulnerability to poverty.

The distribution of elderly with or without a chronic disease is not consistent with the self-assessed health status and disability indicators. As shown in Table 4, a higher proportion of elderly without a chronic disease belong to households with various poverty categories as compared with those suffering from chronic diseases. And this is true for both the years 1995–96 and 2004. However, the pattern is not surprising and may be contributed to the fact that (a) not all people get diagnosed with the chronic diseases and only relatively non-poor households can afford the cost of medical tests (which is often very high) and that may contribute to the reporting error, and/or (b) majority of the components of chronic diseases included such as high/low blood pressures, heart diseases, urinary problems, diabetes, and cancer are associated with common risk factors such as unhealthy diet preferences, physical inactivity and the use of tobacco WHO(2012). In Indian context, relatively richer section of the population used to intake higher calorie foods high in fat and sugar, live less physically active life in the presence of easy and relaxed work environment, and increasingly stressed with increased urbanization and work styles (Reddy et al., 2005; WHO, 2005, 2010; Mahal, 2010; Ebrahim et al., 2010; Gaiha et al., 2010a and 2010b). Moreover, the difference in the percentages of aged with and without chronic diseases is not very different in households with various poverty classifications.

5.2.3 Health and Disability as a key determinant of Vulnerability to Poverty

In this section, we interpret the results from mixed process regression model with vulnerability and health production function simultaneously.

<Table 5 about here>

We find that in most of the scenarios endogeneity between health/disability and vulnerability is confirmed by the significant correlation between error terms in these equations (reported as atanhrho_12 at the end of the table). As vulnerability estimation is sensitive to the choice of poverty line, we also performed robustness check by adjusting poverty line by $\pm$ 10 percent and find the relationship robust.

Results suggest that after controlling for household, community and state characteristics, increase in the proportion of elderly members with perceived poor health significantly increases household's vulnerability to poverty. Also, the risk of ex-ante poverty increases with increase in share of disabled aged and aged suffering from chronic disease. The same result follows in both the surveys and with all the three indicators we chosen implying that

health shocks of elderly household members is an important determinant of household's probability to fall in poverty in near future.

Now, we will examine other key determinants of vulnerability to poverty. We find that in general, household's vulnerability to poverty is lower for older and male headed households and higher proportion of adults in the household. The risk of expected poverty increases with increase in the size of the household. However, the effect of family size weakens for larger households. Further, households from STs, and SCs social groups are more vulnerable than the OBCs and Others. As compared to self-employed households, while agricultural regular and casual labor type households are more economically vulnerable; households of other occupations are better off. Vulnerability to expected poverty is also significantly lower if the household is from urban areas as compared to the rural areas. State and community level variables also have significant effect on the household's vulnerability to poverty. Estimation result reveals that the risk of falling short of required level of income significantly reduced with increased normalized rainfall in the states. Most of these results are consistent for all the health and disability indicators and across the two periods 1995–96 and 2004.[9]

5.2.4 Determinants of Proportion of Aged in the Households with Poor Health, Disability and Chronic Diseases

After examining the role of health and disability of aged in determining household's vulnerability to poverty, we now examine household and community level correlates of health and disability of aged in the households based on the simultaneous estimation with the vulnerability to poverty.

<Table 6 about here>

We observe that households with relatively older members have higher proportion of aged with perceived poor health, disability or chronic diseases. However, effect of age weakens at the higher ages. Higher proportion of aged with perceived poor health, disability or chronic diseases also exists for households with higher concentration of members without spouses, proportionally less adults in the family. Increase in family size also increases the risk of more aged with perceived poor health (except in year 2004), disability or chronic disease but this effect weakened at larger family (only in 1995–96 sample). The association of social group of household and proportion of aged with perceived poor health, disability or chronic diseases is

[9] The interpretation of these results is similar to that of the previous section so we do not repeat those.

not consistent. SCs households had lower proportion of aged with chronic diseases and higher proportion of aged with perceived poor health. While in 1995–96, SC households had higher proportion of disabled aged but in 2004 a significant difference between SCs and 'Others' is not observed. Similarly, as compared to 'Others' households, ST households have lower proportion of aged with chronic diseases and higher proportion of aged with perceived poor health and disability in 2004. However, in 1995–96, though STs have lower proportion of aged with chronic diseases but STs are significantly different than 'Others' in case of aged with perceived poor health and disability. Also, community with high medical and health insurance coverage have lower proportion of aged with perceived poor health, disability and chronic diseases. However, in 2004 sample, while higher coverage of health insurances in the community does not make effect on the proportion of aged with disability in the household, it in fact increases the probability of aged in households with chronic diseases. This result may be attributed to the people's changed attitude to take insurances after getting diagnosed for one or more chronic diseases. Prices in the states have non-linear effect on the health of elderly in the households and higher prices significantly increases the proportion of elderly with perceived poor health, disability or chronic diseases.

6. Conclusion and Discussion

Despite impressive economic growth in recent years, some sections of Indian population are still poor, living in rural areas, working in unorganized sector and do not get sufficient food, social and health insurance facilities. In addition to this, continuously increasing share of the elderly in Indian population has generated new needs for health care and social security. To ascertain those requirements and to allocate the available resources efficiently and effectively, policymakers require information on the factors influencing economic well-being and health status of the elderly. Theoretically, these two aspects are inter-related. Usual ex-post measure of economic well-being ignores the risk that household faces in view of scarce resources available to it. One of the recent measures that capture the phenomenon of expected poverty in near future is the concept of 'vulnerability to poverty'.

There is growing number of studies that indicate that health shocks have a negative and significant effect on household's welfare. However, there is dearth of evidence on how health shocks from aged individuals would affect household's vulnerability to poverty. To fulfill this gap, the present study attempted to examine the effect of health of the elderly on the household's vulnerability to poverty. Based on econometric exercises using two waves of

independent cross-sectional data collected by NSSO on in the years 1995–96 and 2004, we find that health outcomes of elderly members is one of the key determinants of household vulnerability to poverty and increased proportion of aged with perceived poor health or disability or chronic diseases significantly increases household's risk of falling into poverty in the future. State level infrastructure and other variables also play a significant role in determining household's income and the risk of poverty in future. These results are found consistent in both the time periods 1995–96 and 2004 and for all the three indicators under consideration.

The results of this paper are subjective to some limitations. The measure of vulnerability correctly reflects a households' vulnerability for long panel data. But due to data unavailability, we rely on the latest cross-sectional surveys with very large representative sample and collected over nine years of gap. There are advantages of large sample data. Among large participating households, some experience good times and others suffer from negative shocks (bad times) and thus, the likelihood of getting fair estimates for vulnerability is higher. Another limitation could be the use of self-reported health status (SRHS) in the survey. SRHS may not truly reflect the health of a person given the perception about health is a subjective issue and it is advantageous to use medically tested health indicators.

Despite these caveats the results we found were interesting and if the analysis has any validity, the results imply that improvement of health of elderly members in the family is of great relevance to household vulnerability. Therefore, to lower incidence of poverty in the near future, affordable health care services and health insurance policies are required for poor households with one or more elderly. Thus, to prevent households from falling short of minimum required level of income apart from other poverty alleviation programs, policy makers should also focus on strengthening old age health care facilities in the country-in particular in relatively poor areas and among socially lagging communities. One way of doing that is the targeting of household with aged and integrating health policy with present pension schemes and anti-poverty and employment programs. However, the targeting of such households and economic viability is a major concern. Financial implication and feasibility of any proposed integration requires further careful investigation.

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Table 1 Definition of the Variables Used in the Analysis

Variables	Definitions
Dependent variables	
Log of per capita monthly expenditure	Log of per capita monthly expenditure
Proportion of aged with Poor Health	Ratio of aged with perceived poor health to the total number of aged in hh
Proportion of aged with Disability	Ratio of aged with disability to the total number of aged in hh
Proportion of aged with Chronic Diseases	Ratio of aged with chronic diseases to the total number of aged in hh
Vulnerability to Poverty	Computed from equation 11 in the model section 3
Explanatory variables	
Gender: Head	= 1 if household head is male; 0 if female
Age :HH head	Age of household head (in years)
Square of Age :HH head	Square of Age of household head (in years)
Avg. age of members beyond 60	Average age of the old age members-60
Square of avg age of members beyond 60	Square of avg age of members beyond 60
Married: dummy (reference category)	=1 if married; 0 if single(never married/ widowed/ divorced/separated)
Number of hh members not married	Number of currently not married members (including unmarried, divorced, widowed) in the household
Up to primary: dummy (reference category)	=1 if up to primary including illiterate; 0 otherwise
Middle or secondary: Head	=1 if middle or secondary; 0 otherwise
Higher secondary or above: Head	=1 if higher secondary or above; 0 otherwise
% adults in HH	% of adults(more than 15-59 years old) in the total household size
HH Size	Size of the household
Square of HH Size	Square of households size
Old age dependency ratio	=(number of family members 60 and above years/ number of family members between 15-59 years)*100
Social Group: ST	= 1 if Scheduled Tribe; 0 otherwise
Social Group: SC	= 1 if Scheduled caste; 0 otherwise
Social Group: Others (reference group)	= if Other than ST, and SC; 0 otherwise
HH Structure: Kutcha	=1 if house is Kutcha; 0 otherwise
HH Structure: Pucca	=1 if house is pucca; 0 otherwise
HH Structure: Semi-Pucca	=1 if house is semi-pucca; 0 otherwise
Latrine facility: dummy	=1 if latrine facility is available, 0 otherwise
Drainage system: dummy	= 1 if drainage system available; 0 otherwise
Self-employed hh: dummy(Reference category)	=1 if household is self-employed in agriculture or non-agriculture in rural areas and self-employed in urban areas; 0 otherwise
Ag/regular Labour hh: dummy	=1 if agricultural labour in rural or regular wage in urban areas; 0 otherwise
Others/Casual Labor hh: dummy	=1 if other labour in rural or casual labour in urban areas; 0 otherwise
Others hh: dummy	=1 if other household types; 0 otherwise
No. of hh with accessible medical or health insurance	Number of households with medical or health schemes and insurances in community
Sector: dummy	=1 if Rural; 0 if Urban
Normalised rainfall in the year	(actual rainfall for the year - mean rainfall of the year 1970 to 2005)/(standard deviation of rainfall for the year 1970 to 2005)
State Road Density	State road density
Gini-coefficient for the year	State income Gini
CPIAL or CPIIW: State	State level CPIAL for rural areas and CPIIW for urban areas
Square of CPIAL or CPIIW: State	Square of CPIAL or CPIIW: State

Table 2: % Distribution of Elderly Population by Health and Disability Indicators, Gender and Locations: 1995-96 and 2004

Group	Gender		Location		All Elderly
Health and Disability Indicators	**Male**	**Female**	**Rural**	**Urban**	
Self-Assessed Health Status					
Poor	17.09	21.39	20.78	13.82	19.25
	(21.52)	(25.78)	(24.46)	(21.16)	(23.65)
Good/Fair	72.32	71.11	70.89	74.62	71.71
	(71.71)	(70.35)	(70.66)	(72.16)	(71.03)
Excellent/V. Good	10.59	7.51	8.33	11.56	9.04
	(6.77)	(3.87)	(4.88)	(6.68)	(5.32)
Disability and Chronic Diseases					
Disability	37.50	41.93	40.92	35.52	39.73
	(16.24)	(18.57)	(19.29)	(12.48)	(17.42)
Chronic Disease	68.53	70.20	71.02	64.28	69.36
	(46.42)	(47.19)	(41.43)	(61.03)	(46.81)

Note: All numbers are in percent. Numbers outside parenthesis corresponds to year 1995-96 and numbers within parenthesis corresponds to year 2004. Each column across health and disability indicator categories would add up to 100. Disability includes visual, hearing, speech, locomotors and amnesia/senility. Chronic diseases include cough, piles, joints pain, high/low blood pressures, heart diseases, urinary problems, diabetes, and cancer.

Table3 : Correlates of Log of Consumption and Error Variance

	1995-96		2004	
Dependent Variable	Log of Consumption	Error Variance	Log of Consumption	Error Variance
Explanatory Variables				
Gender: Head	-0.01	0.002	-0.01	-0.09
	(0.011)	(0.067)	(0.011)	(0.063)
Age :HH head	0.01***	0.014*	0.004***	-0.002
	(0.001)	(0.007)	(0.001)	(0.007)
Square of Age :HH head	-2.4e-05**	-0.0001	4.4e-06	3.2e-05
	(9.9e-06)	(6.5e-05)	(1.1e-05)	(6.7e-05)
Marital Status: Married Head	0.02*	-0.14***	0.02***	-0.07
	(0.008)	(0.051)	(0.008)	(0.051)
Middle or secondary: Head	0.16***	0.06	0.15***	0.01
	(0.006)	(0.042)	(0.007)	(0.041)
Higher secondary or above: Head	0.38***	0.35***	0.42***	0.37***
	(0.010)	(0.059)	(0.010)	(0.054)
HH Size	-0.11***	-0.09***	-0.09***	-0.06***
	(0.003)	(0.015)	(0.003)	(0.015)
Square of HH Size	0.003***	0.004***	0.003***	0.003***
	(0.0001)	(0.0007)	(0.0002)	(0.0008)
Old age dependency ratio	-0.001***	0.001*	-0.001***	0.001**
	(8.0e-05)	(0.0005)	(8.4e-05)	(0.0005)
Social Group: ST	-0.17***	0.04	-0.10***	0.11*
	(0.009)	(0.066)	(0.011)	(0.066)
Social Group: SC	-0.12***	-0.02	-0.09***	-0.04
	(0.007)	(0.045)	(0.007)	(0.045)
HH Structure: Pucca	0.13***	0.004	0.13***	-0.02
	(0.007)	(0.049)	(0.009)	(0.056)
HH Structure: Semi-Pucca	0.04***	-0.10**	0.003	-0.05
	(0.007)	(0.049)	(0.009)	(0.056)
Latrine facility: dummy	0.18***	0.17***	0.18***	0.24***
	(0.007)	(0.048)	(0.007)	(0.044)
Drainage system: dummy	0.06***	0.11***	0.08***	0.03
	(0.006)	(0.039)	(0.006)	(0.039)
Ag/regular Labour hh: dummy	-0.09***	-0.11***	-0.05***	-0.07*
	(0.006)	(0.038)	(0.006)	(0.039)
Others/Casual Labor hh: dummy	-0.13***	0.02	-0.13***	0.02
	(0.009)	(0.062)	(0.009)	(0.059)
Others hh: dummy	-0.01	0.10*	0.02**	0.13***
	(0.010)	(0.058)	(0.009)	(0.052)
Sector: dummy	-0.08***	0.03	-0.22***	-0.02
	(0.007)	(0.046)	(0.021)	(0.123)
Normalised rainfall in the year	0.048***	0.003	0.12***	-0.20*
	(0.003)	(0.019)	(0.015)	(0.113)
Gini-coefficient for the year	0.002*	0.03***	0.23	0.49
	(0.001)	(0.008)	(0.205)	(1.205)
State Road Density	3.5e-05***	-2.7e-05	9.8e-06***	2.3e-05**
	(4.8e-06)	(3.1e-05)	(1.7e-06)	(1.0e-05)
Intercept	6.26***	-4.41***	6.51***	-3.64***
	(0.049)	(0.326)	(0.078)	(0.46)
No. of observations	21,595	21,595	22,146	22,146
R-squared	0.466	0.016	0.523	0.017

***p<0.01, **p<0.05, *p<0.1. Standard errors are in the parentheses. All the equations above are also controlled for state level dummies. However, in order to save spaces coefficients corresponding to those have not been reported. These estimates correspond to FGLS estimates of equation 8 and error variances equation 6 in section 3.

Table 4: Distribution of Aged by their Health and Disability Status and their Poverty and Vulnerability Classification: 1995-96 and 2004

Health and Disability Indicators	1995-96					2004				
	CP	TP	P	HVNP	TVP	CP	TP	P	HVNP	TVP
Self-assessed Health Status										
Poor	13.38	22.87	35.64	6.27	42.51	11.5	19.1	28.62	6.61	37.21
Good/Fair	10.4	18.12	26.85	5.74	34.26	9.1	15.84	22.82	5.48	30.42
V.Good/Excellent	9.34	14.76	22.49	7.75	31.84	8.1	14.86	19.34	6.49	29.45
Disability (D)										
Without D	10.75	18.03	26.97	5.50	34.27	6.90	15.33	20.47	4.75	26.98
With D	11.09	19.78	29.92	6.68	37.55	14.03	17.81	29.37	7.75	39.6
Chronic Diseases										
Without CD	10.03	16.42	24.59	4.77	31.22	11.03	17.53	26.63	6.74	35.30
With CD	9.92	18.27	27.01	6.2	34.39	4.85	13.78	16.78	3.61	22.24

Note: CP: Chronic Poor, TP: Transient Poor, P: Poor, HVNP: Highly Vulnerable Non-poor, TVP: Total Vulnerability to Poverty.

Table 5: Correlates of Vulnerability to Poverty: 1995-96 and 2004

Dependent Variable	1995-96: Vulnerability to Poverty			2004: Vulnerability to Poverty		
Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Proportion of aged with poor health	0.17***			0.05***		
	(0.017)			(0.018)		
Proportion of aged with poor health		0.15***			0.04*	
Proportion of aged with disability		(0.020)			(0.0258)	
Proportion of aged with disability			0.37***			0.32***
Proportion of aged with chronic diseases			(0.010)			(0.006)
Proportion of aged with chronic diseases				-0.003***	-0.003***	-0.002***
Age :HH head				(9.9e-05)	(9.9e-05)	(9.6e-05)
Gender: HH head	0.03***			-0.01**	-0.01***	-0.02***
	(0.005)			(0.005)	(0.005)	(0.005)
Social Group: ST	0.29***	0.33***	0.35***	0.27***	0.27***	0.30***
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
Social Group: SC		0.18***	0.20***	0.14***	0.14***	0.16***
		(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
% Adults in HH	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***	-0.003***
	(8.9e-05)	(8.9e-05)	(0.0001)	(9.2e-05)	(9.2e-05)	(9.7e-05)
HH Size	0.07***	0.04***	0.04***	0.06***	0.06***	0.06***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Square of HH Size	-0.002***	-0.004***	-0.005***	-0.001***	-0.001***	-0.001***
	(7.0e-05)	(0.0004)	(0.0002)	(8.6e-05)	(8.6e-05)	(7.7e-05)
Ag/regular Labour hh: dummy	0.17***	0.13***	0.13***	0.09***	0.09***	0.07***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)
Other/Casual Labour hh: dummy	0.23***	0.19***	0.19***	0.19***	0.19***	0.18***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Others hh: Dummy	-0.003	-0.02***	-0.01**	-0.03***	-0.03***	-0.02***
	(0.005)	(0.005)	-0.005	(0.005)	(0.005)	(0.005)
Sector: dummy	0.13***	0.11***	0.10***	0.03***	0.03***	0.05***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
Normalised rainfall in the year	-0.03***	-0.03***	-0.03***	-0.05***	-0.05***	-0.04***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.002)
Intercept	-0.41***	-0.29***	-0.43***	0.06***	0.07***	0.003
	(0.011)	(0.013)	(0.011)	(0.012)	(0.011)	(0.011)
lnsig_1	-1.57***	-1.59***	-1.32***	-1.57***	-1.57***	-1.39***
	(0.010)	(0.016)	(0.013)	(0.005)	(0.005)	(0.007)
lnsig_2	0.23***	-0.10***	-0.25***	0.17***	0.48***	0.24***
	(0.012)	(0.008)	(0.007)	(0.011)	(0.020)	(0.012)
atanhrho_12	-0.44***	-0.40***	-0.96***	-0.09*	-0.02	-1.06***
	(0.047)	(0.055)	(0.021)	(0.048)	(0.057)	(0.016)
Number of observations	23,669	23,674	23,674	27,141	27,141	27,141

***p<0.01, **p<0.05, *p<0.1. Standard errors are in the parentheses. Model 1, Model2 and Model3 corresponds respectively to the vulnerability equation with proportion of aged with perceived poor health, proportion of aged with disability and proportion of aged with chronic diseases as the key explanatory variable. All the models are jointly estimated with respective health equations reported in Table 6 below and all the models are validated by likelihood ratio (follows Chi-square) test.

Table 6: Correlates of % of Household Aged with Poor Health, Disability and Chronic Diseases: 1995-96 and 2004

Dependent Variable	1995-96: Proportion of hh aged with			2004: Proportion of hh aged with		
	Poor health	Disability	Chronic Disease	Poor health	Disability	Chronic Disease
Explanatory Variables						
Social Group: ST	-0.04	0.04	-0.15***	-0.13***	0.19***	-0.74***
	(0.046)	(0.027)	(0.022)	(0.041)	(0.071)	(0.049)
Social Group: SC	0.47***	0.063***	-0.07***	0.16***	0.04	-0.31***
	(0.037)	(0.02)	(0.014)	(0.024)	(0.048)	(0.027)
% Adults in HH	-0.002***	-0.002***	-0.0004	-0.001*	-0.004***	0.004***
	(0.0006)	(0.0003)	(0.0003)	(0.0004)	(0.001)	(0.001)
HH Size	0.04***	0.08***	0.08***	-0.01	0.02***	-0.04***
	(0.009)	(0.008)	(0.004)	(0.003)	(0.006)	(0.003)
Square of HH Size	-0.002***	-0.004***	-0.005***	-	-	-
	(0.001)	(0.0004)	(0.0002)			
Avg. age of members beyond 60	0.08***	0.05***	0.01***	0.08***	0.08***	0.03***
	(0.005)	(0.003)	(0.002)	(0.004)	(0.007)	(0.003)
Square of avg age of members beyond 60	-0.002***	-0.001***	-0.0003***	-0.001***	-0.001***	-0.001***
	(0.0002)	(9.5e-05)	(5.9e-05)	(0.0001)	(0.0002)	(0.0001)
Number of hh members not married	0.19***	0.14***	0.06***	0.10***	0.06*	-0.10***
	(0.020)	(0.012)	(0.008)	(0.019)	(0.035)	(0.017)
No. of hh with accessible medical or health insurance	-0.17***	-0.11***	-0.06***	-0.13*	0.03	0.09*
	(0.020)	(0.012)	(0.007)	(0.079)	(0.144)	(0.053)
CPIAL or CPIIW: State	0.005***	-0.004***	-0.001***	-0.03***	-0.03***	-0.05***
	(0.001)	(0.001)	(0.001)	(0.005)	(0.009)	(0.002)
Square of CPIAL or CPIIW: State	-2.42e-06***	1.55e-06***	5.37e-07**	2.9e-05***	3.2e-05***	6.0e-05***
	(6.0e-07)	(3.5e-07)	(2.2e-07)	(6.1e-06)	(1.1e-05)	(2.8e-06)
Intercept	-4.60***	2.13***	1.02***	4.2***	3.24*	9.20***
	(0.857)	(0.497)	(0.304)	(1.088)	(1.917)	(0.503)
Number of observations	23,669	23,674	23,674	27,141	27,141	27,141

*** p<0.01, ** p<0.05, * p<0.1. Standard errors are in the parentheses.

All the equations are jointly estimated with respective vulnerability to poverty equations reported in Table 5 above and all the models are validated by likelihood ratio (follows Chi-square) test.