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## **Health shocks and coping strategies**

State health insurance scheme of Andhra Pradesh, India

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**Abstract:** The objectives of the study are three-fold: to investigate who are vulnerable to welfare loss from health shocks, what are the household responses to cope with the economic burden of health shocks and if policy responses like state health insurance schemes are effective in reducing the economic vulnerability. Existing literature have investigated the impact of state health insurance schemes in reducing the vulnerability to financial risks of medical care using catastrophic health expenditure (CHE) measure. This has several limitations like setting arbitrary threshold levels, exclusion of those that did not seek medical care due to inability to pay and non-accounting for risks posed by different sources of financing. So we use self-reported measure of reduction in economic wellbeing of households due to serious illness or death of one or more members from the recent Young Lives longitudinal study in Andhra Pradesh, India. Three-level random intercept logistic regression analysis that accounts for role of contextual or environmental factors like access to healthcare is used to determine the characteristics of vulnerable population and effectiveness of the state insurance scheme.

**Keywords:** health shocks, coping strategies, state health insurance scheme, three-level random intercept model

**JEL classification:** I100, I130, O150

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## 1 Introduction

The impact of income shocks on households in low- and middle-income countries has received much attention in development economics literature. This is because income shocks, like weather and price variability, are important factors associated with movements of households in and out of poverty (Morduch 1994). They also affect the health and nutrition status of household members (Foster 1995), alter households' investments in human capital (Jacoby and Skoufias 1997), influence their livelihood strategies and welfare trajectories (Ellis 1998), etc. Some of these shocks are covariate in nature—common to all households in a community—like drought and flood while others are idiosyncratic in nature-specific to individual households, such as job loss and illness. This study deals with understanding the factors that lead to household welfare loss from a particular type of idiosyncratic shock, namely health shock.

Health shock is the most common idiosyncratic shock and the most important reason for descent of households into poverty in developing countries (Krishna 2007). A household is said to face a health shock when an illness or injury weakens the health status of its member and generates a welfare loss for the household<sup>1</sup> (Khan 2010). Such shocks involve direct and indirect costs. Direct costs are expenditures incurred on those goods and services during medical care like hospitalization and outpatient treatment, drugs and medical supplies. Indirect costs refer to the loss of productive labour time and thus labour earnings of patients as well as caregivers. Due to non-existent or imperfect credit and insurance markets in developing countries, households rely on different informal mechanisms like transfers from family and friends, sale of assets and borrowing from moneylenders to cope with the economic costs of health shocks. Despite these coping mechanisms, households remain vulnerable to welfare disruptions and impoverishment (Dercon 2002).

In their seminal work, Gertler and Gruber (2002) find that Indonesian households are not able to insure consumption during severe health crises. The ability of the households to smooth consumption against health shocks depends on severity of the health shocks (Cochrane 1991), employment status of members facing health shocks (Kochar 1995), household resources like human and physical capital (Gertler and Gruber 2002), access to financial markets (Islam and Maitra 2012) etc. Health shocks are also found to have an adverse impact on education attainment and nutritional status of household members (Dercon and Krishnan 2000; Sun and Yao 2010). Thus, the knowledge of who are vulnerable to welfare loss from health shocks and coping strategies is very important from policy perspectives.

This study focuses on the southern state of Andhra Pradesh<sup>2</sup> which launched the *Rajiv Arogyasri* (RAS) public health insurance scheme in 2007. We use longitudinal data of the Young Lives

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<sup>1</sup> Though health shocks affect individuals, the unit of analysis is household. This is because decisions regarding medical expenditure and coping strategies are based on negotiations within the household and the burden of medical costs falls on the household budget (Russell 2004).

<sup>2</sup> Andhra Pradesh (AP) is the fifth largest state in India by population (84.7 millions) with around two-thirds (66.5 per cent) living in the rural areas. The literacy rate of AP (for persons aged 7 years and above) is 67.66 per cent with male literacy at 75.56 per cent and female literacy at 59.74 per cent (Census 2011). The life expectancy at birth for males and females in AP (India) are 62.9 (62.6) and 65.5 (64.2) years. The infant mortality rate and maternal mortality rate of AP (India) are 46 (47) and 134 (212), against the MDG target of 28 and 109 respectively (SRS, 2010). The percentage of live births where mothers received medical attention at delivery has gone up from 55 per cent (34 per cent) in 2005 to 88 per cent (60 per cent) in 2010 for this southern state (India). Despite these, access to affordable healthcare remains poor. The number of beds per 1000 population is 0.67 for AP against 0.7 for India and it faces severe shortage of health professionals like lab technicians (22 per cent), radiographers (58 per cent),

project that studies childhood poverty in four countries and has information on whether households faced reduction in economic welfare (self-perceived) due to serious illness or death of one or more members. We empirically investigate the following questions:

- 1) What are the factors that lead to welfare loss (as self-perceived by households) from health shocks?
- 2) What is the likelihood of adopting risk-coping strategies—such as borrowing, selling assets and reducing consumption—when households face health shocks?
- 3) How effective is the state health insurance scheme of Andhra Pradesh in reducing the welfare loss from health shocks?

We find that economic vulnerability to health shocks and coping strategies is high among poorer households, those with elderly, chronically ill or disabled members, Scheduled Castes (SC) and Muslim households. The state insurance scheme does not provide adequate protection from economic losses of health shocks and we further explore the reasons behind this.

This study is organized as follows. Section 2 gives the background of central and state government health insurance schemes in Andhra Pradesh. Section 3 provides a review of literature on factors leading to welfare loss from health shocks and coping strategies adopted against them. It also summarizes the gaps in the literature. Section 4 describes the conceptual framework used in the study. Section 5 briefs the longitudinal dataset used in this study. Section 6 explains the methodology used in this study. Results of the analysis are presented in Section 7; and the final section concludes.

## 2 Public health insurance schemes in India

In India, financial burden of health shocks increases the number of people living below the poverty line by as much as 3.3 per cent (GoI 2005). Mitchell et al. (2011) elucidate the reasons behind this:

- 1) Public health expenditure to GDP ratio has been abysmally low (around one percent) for many years. This has led to poor quality of health services, shortage of professionals, drugs, etc., provided at public facilities.
- 2) The inadequate public healthcare infrastructure has resulted in the dominance of high-cost private sector in which even the poor seek care 80 per cent of the times (Peters 2002).
- 3) In addition to these, around 90 per cent of the India's workforce is employed in the informal sector which neither provides health insurance coverage nor gives protection against income loss due to illness episodes.
- 4) Private health insurance in India contributes to only 3.3 per cent of total health expenditure while out-of-pocket (OOP) payments accounted for more than 60 per cent in 2010.<sup>3</sup>

In order to provide financial security against health shocks for vulnerable sections of the population, the central and the state governments in India have launched various social insurance schemes. The *RashtriyaSwasthyaBimaYojana* (RSBY) scheme, launched by the Ministry of Labour

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surgeons, physicians and paediatricians (63 per cent) in the primary and secondary public health centers of rural areas (MoHFW 2012). This in turn leads to people seeking medical care from high-cost private sector in a majority of the cases.

<sup>3</sup> Source: National Health Accounts, World Health Organization

and Employment, provides health insurance for below poverty line (BPL)<sup>4</sup> families upto a sum of INR30,000. The insurance premiums are subsidized by central and state governments in the ratio of 75:25. Few states like Kerala and Himachal Pradesh have extended the RSBY scheme by covering more beneficiaries or increasing the benefitpackage (Selvaraj and Karan 2012). On the other hand, state governments of Andhra Pradesh and Tamil Nadu launched their own public health insurance schemes which are solely funded by state revenues. The RSBY scheme is virtually non-existent in the states of Andhra Pradesh<sup>5</sup> and Tamil Nadu.

In Andhra Pradesh, the dysfunctional public health system led to a majority of households to seek medical care at high-cost private facilities. Those households that could not afford hospitalization expenses approached the government for financial assistance under the Chief Minister's relief fund.<sup>6</sup> Hence the state decided to institutionalize the assistance and launched RAS scheme in 2007 that gives insurance coverage to around 68 million people (more than 80 per cent of the population)<sup>7</sup> for 938 identified therapies through an identified network of private and public hospitals (Table 1). The scheme aims to improve economic access to healthcare among poor households and provide financial protection against high cost illnesses. Households that have valid BPL ration cards are covered under the scheme and can avail of free tertiary healthcare services (for serious ailments requiring hospitalization and surgery) up to a sum of INR 200,000. This scheme is considered to be more comprehensive than RSBY scheme in terms of benefit-package, number of therapies and beneficiaries covered as a percentage of population (Selvaraj and Karan 2012).

Table 1: RAS scheme in Andhra Pradesh

|                                    | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
|------------------------------------|---------|---------|---------|---------|---------|
| Districts covered                  | 8       | 23      | 23      | 23      | 23      |
| Beneficiaries covered (lakhs)      | 137.21  | 570.43  | 682.82  | 683.17  | 683.97  |
| Therapies done (lakhs)             | 0.23    | 2.24    | 3.26    | 4.03    | 4.34    |
| RAS total expenditure (Rs. crores) | 140.8   | 606.4   | 1014.3  | 1131.4  | 1026.0  |

Source: Data extracted from [www.aarogyasri.gov.in/ASRI/index.jsp](http://www.aarogyasri.gov.in/ASRI/index.jsp), on 16.09.2013

### 3 Literature review

Literature addressing the above-mentioned questions is reviewed under two separate sub-sections (3.1 and 3.2). The first section summarizes the results of studies that empirically investigate the factors determining vulnerability to financial risks of medical expenditure. The second section details on the coping strategies used by households to cope with high medical expenditure.

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<sup>4</sup> The central government sets the poverty line and estimates the number of poor in different states of India for distribution of funds to the states under various schemes. The state governments set the criteria for identification of poor people and are responsible for issuing BPL ration cards.

<sup>5</sup> Only 2,184 families in the Rangareddi district of Andhra Pradesh were covered under the RSBY scheme since November 2012. Data accessed from [www.rsby.gov.in](http://www.rsby.gov.in) on 16.09.2013.

<sup>6</sup> A sum of Rs.168.5 crores was provided between 14.05.2004 to 26.06.2007 to meet hospitalization expenses in 55361 cases. Source: [www.aponline.gov.in/apportal/HomePageLinks/aarogyasri.html](http://www.aponline.gov.in/apportal/HomePageLinks/aarogyasri.html), accessed on 16.09.13.

<sup>7</sup> Though the central government estimates of BPL population in Andhra Pradesh is 15.8 per cent in 2004-05, the state government follows broad targeting and has more than 80 per cent of the population under the BPL category.

### 3.1 Vulnerability to welfare loss from health shocks

A vast amount of empirical literature has examined the characteristics of households that face financial catastrophe due to unexpected medical expenditure. A household is said to have incurred catastrophic health expenditure (CHE) if the proportion of OOP health expenditure in household income or total expenditure crosses some threshold level, say, 5, 10, or 20 per cent (Equation 1). The idea is that if health expenditure forms a large share of household resources, then it endangers the family's ability to maintain the customary standard of living (Berki1986; Wyszewianski 1986).

$$I_c = 1 \text{ if } \frac{h_i}{x_i} \geq t^*$$
$$I_c = 0 \text{ otherwise} \tag{1}$$

where  $I_c$  is an indicator variable,  $x_i$  is the total expenditure/income and  $h_i$  is the health expenditure of household  $i$ ,  $t^*$  is the threshold level. In order to determine the characteristics of households that face catastrophic health expenditure, logit or probit regression analysis is used. The key factors identified from the literature are described below.

Health status of the individuals in the household is an important determinant of catastrophic health expenditure incurred by households. For example, studies report that higher illness episodes among household adults and presence of member with chronic illness increased the probability of facing financial catastrophe due to high medical expenditures (Su et al. 2006). In case, where health status is not known, demographic characteristics like age and gender of the members are used as proxies to identify who are vulnerable to health shocks (Pradhan and Prescott 2002). For instance, households with elderly and disabled members are more likely to face higher incidence of CHE. Household size also affects the vulnerability to financial risks of health shocks. Larger household size leads to greater budget devoted for health care since the probability of one of the members falling sick is higher and also economies of scale for medical care is limited (O'Donnell et al. 2005).<sup>8</sup>

Income level of the household is a major determinant of households incurring catastrophic OOP health expenditure. Households belonging to higher income groups are less likely to face financial risks due to their higher capacity to pay. For instance, Pal (2012) found that land possession and wealth index, usage of safe cooking and electricity reduced the probability of catastrophic spending in rural India. Similarly, households whose heads are self-employed or wage labourer are highly vulnerable to financial risks of health shock as they are less likely to have formal health insurance and also have little protection against income loss (Lara and Gomez 2011).

Education level of the individuals is likely to affect the OOP health expenditure through two important channels. (1) Educated members are more likely to allocate resources efficiently to obtain better health (efficiency mechanism). (2) Education raises future income and hence opportunity costs of engaging in unhealthy behaviour are high (Cowell 2006). Thus, having an educated household head is likely to reduce the incidence of CHE.

Type of health services (self-treatment, out-patient or in-patient treatments) and type of service provider (public or private) used by the households for medical care are key determinants of

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<sup>8</sup> On the contrary, studies like Shi et al. (2011) and Hazijadeh and Nghiem (2011) found that larger households are more likely to escape financial catastrophe due to medical expenditure.

households incurring CHE. Illness episodes involving in-patient treatment and use of private hospitals are found to increase the incidence of CHE among households<sup>9</sup>.

The effect of insurance on probability of a household incurring CHE has also been explored in the literature but the results are mixed. Few studies (Hazijadeh and Nghiem 2011; Kumar et al. 2012) conclude that insured households are less likely to have high levels of catastrophic spending on healthcare. On the other hand, Wagstaff and Lindelow (2008) report that the insured faced higher risk of catastrophic medical expenditure in China due to insurance encouraging increase in demand for care from higher-level providers. Few studies in the Indian context have assessed the impacts of state insurance schemes in India. Mitchell et al. (2011) found that RAS scheme reduced inpatient expenditures significantly but did not have any effect on CHE. While studies like Fan et al. (2012), and Selvaraj and Karan (2012) found that state insurance schemes are not effective in reducing the welfare impacts of OOP medical expenditure.

The impact of distance to public hospitals, average living standards of a community, percentage of poor households, average literacy levels, village infrastructure etc. on incidence of CHE has also been analysed in the literature (Shi et al. 2011; Wagstaff and Lindelow 2008) and found to be significant predictors of catastrophic health payments incurred by households.

#### *Research gaps*

Empirical studies that draw policy implications based on the factors leading to catastrophic OOP health expenditure incurred by households have several limitations. CHE measure does not take into account those households that do not treat ailments due to their inability to pay for healthcare. Such households may experience greater welfare loss in the long-term through further deterioration of health (Kawabata et al. 2002). The threshold level or cut-off point used to measure CHE in the literature is arbitrary. The most common threshold level used is 10 per cent or 40 per cent, when total expenditure or income net of subsistence expenditure is used as denominator respectively (O'Donnell et al. 2008). The findings of empirical studies are sensitive to the measure of CHE used and using only one of the threshold levels may lead to misrepresentation of important factors (Pal 2012; Su et al. 2006).

Most of the empirical studies examining financial catastrophe due to illness/injury focus only on direct costs. This is due to lack of data and methodological challenges in estimating indirect costs like income loss due to absence from work, mortality and disability. Few studies that have estimated indirect costs report that income loss and not medical expenditure had a major contribution to economic costs of illnesses and most households lack full insurance against such losses (Gertler and Gruber 2002; Sauerborn et al. 1996). CHE measure does not take into account sources of financing medical expenditure i.e., whether household pays medical expenditure by dissaving, transfers, borrowing, sale of assets etc. Households vary in their capacity to cope with financial risks associated with these coping strategies which in turn have implications for household welfare in both the short and long term (Flores et al. 2008).

This study overcomes the above-mentioned limitations to some extent by using self-reported disruptions in economic wellbeing of the households due to serious illness or death of one or more members. Also, we evaluate the performance of state health insurance scheme of Andhra Pradesh in reducing the economic burden of health shocks using longitudinal data.

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<sup>9</sup> Lara and Gomez (2011); Shi et al. (2011); Somkotra and Lagrada (2009).

### 3.2 Coping with economic costs of health shocks

Coping with an income shock can occur at two stages (Morduch 1995). First, households protect themselves from shocks before they occur (risk-management strategies). Second, households may use different strategies to reduce the impact of shocks after they occur (risk-coping strategies).

Risk-management strategies are needed to protect households against direct as well as indirect costs of health shocks. While private health insurance reduces the risks of incurring very high medical expenditure (direct costs), formal sector jobs provide relative protection against loss of wage income (indirect costs) through paid sick-leave. However, private medical insurance is mostly unaffordable for poor households while those earning wage income in the informal sector like daily wage labourers are exposed to risks of income loss in developing countries (Sparrow et al. 2012). Thus poor households who mostly work in the informal sector face the double burden of OOP health expenditure as well as reduction in labour income.

Due to limited options of risk-management, households use risk-coping strategies after health shocks occur. Households can finance healthcare expenses from their current income or past savings. Since poor households barely meet their minimum needs, they resort to borrowing, selling assets or reducing expenditure on education by taking children out of school. These households trade future welfare of its members to meet current medical expenditure that is perceived to be essential for survival (van Damme et al. 2004). Around 25 per cent of households in developing countries borrowed or sold assets to pay for healthcare (Kruk et al. 2009). Coping strategies also involve sending children or other members of the household to work in order to cope with the increase in medical expenditure and decrease in wage income due to health shocks. Households also tend to rely on informal networks like friends, neighbours and relatives to manage the economic costs of health shocks.

Very few empirical studies have explored the factors that lead to greater likelihood of borrowing or selling assets to finance healthcare.<sup>10</sup> Borrowing or selling assets to fund for healthcare referred to as distress or hardship financing is believed to increase the economic vulnerability of the households in the long run (Kruk et al. 2009). Distress financing is higher among lower income groups as they do not have sufficient income or savings to absorb the economic costs of health shocks. Use of private hospitals and in-patient treatment also increase the likelihood of borrowing or selling assets for financing medical expenditure.

#### *Research gaps*

Studies on coping strategies adopted for health shocks have only examined factors leading to distress financing for medical expenditure. Health shocks are more likely to prompt households to seek assistance or transfers from friends, extended family etc. (De Weerd and Dercon 2006; Wagstaff and Lindelow 2010). There are also households that do not have access to either informal support networks or formal credit and insurance markets. Such households resort to reduction of current consumption or sending children or other members of the family to work to cope with the costs of medical care and income loss. This study seeks to fill the gap in the literature by examining the determinants of wide range of strategies used by households to cope with the economic burden of health shocks. We also assess the effect of coverage under state insurance scheme on the likelihood of households opting for costlier strategies like borrowing,

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<sup>10</sup> Cross-country studies like Kruk et al. (2009) and Leive and Xu (2008) examined sources of health expenditure financing in least developed and developing countries. Studies like Binnendijk et al. (2012), Bonuet et al. (2005) and Pal (2010) examined the determinants of hardship financing in the Indian context.

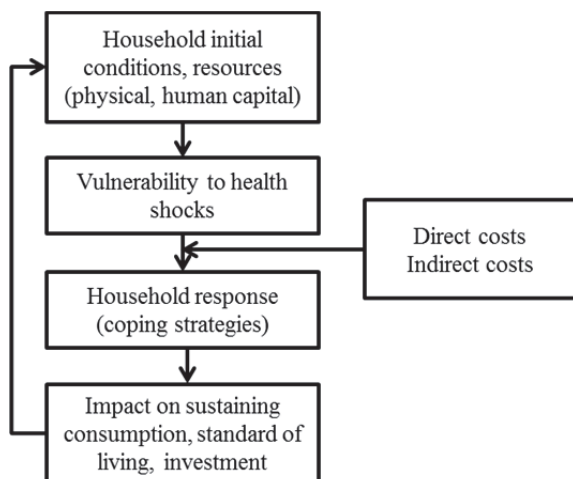


selling assets and reducing consumption by lessening the burden of direct costs. In the next section, we develop a conceptual framework to analyse the economic vulnerability of households facing health shocks. Further, we apply this framework to examine the strategies used by the households to cope with the economic burden of health shocks.

#### 4 Conceptual framework

A description of the conceptual framework used in the study is given below (Figure 1). Household initial conditions, resources, demographic characteristics etc. affect its economic vulnerability to health shocks (Bird and Prowse 2008). When one or more members of the household faces health shock, it decides whether to seek medical care based on the economic costs of illness as well as its own perceptions. Those that do not seek medical care may face further severity of illness or death leading to future welfare loss. Those that seek medical care may face both direct and indirect costs. Direct costs depend on type of treatment (outpatient or inpatient) and type of service provider (public or private) sought by the households as well as coverage under insurance. Indirect costs depend on whether working members of the household have protection against loss in income due to absence from work. Based on these costs and available resources, households decide on the coping strategies to sustain current levels of consumption. In such a pursuit, households may deplete their resources that increase their vulnerability to future shocks.

Figure 1: Conceptual framework



Source: Author's compilation.

#### 5 Data and summary statistics

We use the longitudinal dataset of Young Lives project that aims to study childhood poverty over a span of 15 years in four countries (Ethiopia, India, Peru, Vietnam) through household and child surveys. In India, the survey is conducted in the state of Andhra Pradesh and three rounds have been completed (2002, 2006, 2009). The sample consists of two age-groups of children: younger cohort of 2011 children born in 2001-02 and older cohort of 1,008 children born in 1994-95. The attrition rate from Round 1 to Round 3 is 3.6 per cent; it is 2.2 per cent if attrition due to child-deaths is excluded (Galabet al. 2011). The sampling method used in the survey is as follows: Andhra Pradesh has three agro-climatic regions: Telangana, Rayalaseema and Coastal

Andhra. One poor and one non-poor district were chosen from each region<sup>11</sup> and twenty sentinel sites (*taluk*) were then chosen from these districts. Those households with a child born in 2001-02 (numbering 100) and those with a child born in 1994-95 (numbering 50) were randomly selected from each sentinel site.

This longitudinal dataset gives a profile of households' assets, livelihoods and socio-economic characteristics. It also has rich information on income shocks and the type of responses to these shocks. The study asked sample households if they faced any income shock that affected the economy of the household negatively or reduced the economic welfare.<sup>12</sup> Table 2 gives the percentage of households that were affected by income shocks during the few years preceding the three rounds of survey. The percentage of households that reported being affected by income shocks is higher in Round 2 because it covered a longer recall period (4 years compared to 2 years and 2.5 years for Round 1 and Round 3 respectively). In the case of Round 1, percentage of households reporting income shocks is much higher for the older cohort compared to the younger cohort since the recall period was nine years for the former while two years for the latter (shocks affecting the household since the birth of Young Lives child). Crop loss and natural disasters like flood and drought are the major shocks that caused reduction in economic wellbeing of households. Health shock is the next major shock affecting 6-7 per cent of the households on an average every year.

Table 2: Income shocks faced by households

| Type of shocks              | Between childbirth and Round 1 (%) |       | Between Round 1 and Round 2 (%) |       | Between Round 2 and Round 3 (%) |       |
|-----------------------------|------------------------------------|-------|---------------------------------|-------|---------------------------------|-------|
|                             | Younger                            | Older | Younger                         | Older | Younger                         | Older |
| Serious illness/death       | 18.55                              | 27.38 | 28.67                           | 31.79 | 18.20                           | 20.71 |
| Theft/fire/eviction         | 5.87                               | 5.65  | 9.44                            | 7.95  | 6.00                            | 4.26  |
| Job loss/education expenses | 7.96                               | 14.48 | 3.64                            | 4.12  | 1.38                            | 1.12  |
| Livestock loss/disease      | 5.82                               | 8.04  | 6.31                            | 7.75  | 7.64                            | 9.34  |
| Crop loss/damage            | 28.19                              | 32.74 | 18.15                           | 21.63 | 21.32                           | 22.34 |
| Natural disasters           | 22.28                              | 24.11 | 30.56                           | 31.19 | 9.58                            | 11.27 |
| Price fluctuations          |                                    |       | 11.13                           | 11.27 | 78.58                           | 74.72 |
| Others                      | 0.10                               | 0.14  | 2.92                            | 4.23  | 8.82                            | 9.54  |
| Observations                | 2011                               | 1008  | 1950                            | 994   | 1951                            | 985   |

Source: Author's calculation based on unit level data of Young Lives survey.

The coping strategies used by the households that faced health shocks are reported in Table 3.<sup>13</sup> Only summary statistics of Round 2 and Round 3 are reported here. This is because the Round 1 survey recorded the coping strategies against health shocks only when health shock was reported to be one among the three most important economic shocks for the household. One-third of the households depended on credit to cope with the economic burden of serious illness/death of household members. The next important strategy used to cope with health shocks is transfers from friends, family, neighbours etc. This accounted for nearly one-fourth of all responses. Around 10 per cent of the households used their own savings to cope with economic costs of

<sup>11</sup> Poor and non-poor districts and mandals were selected based on a set of development indicators. In addition to the six districts, Hyderabad district, capital of Andhra Pradesh was also included. For details of the sampling method, refer to Galabet al. (2011)

<sup>12</sup> Table A1 in the Appendix gives detailed information on questions asked in each of rounds.

<sup>13</sup> The survey gives the first three responses of the household to reduction in economic wellbeing due to serious illness/death episode. However, only the most important strategy adopted by the household is used in this study.

illness in Round 2 and this increased to more than 15 per cent in Round 3. Around 5 per cent of the households worked more to bear the costs of health shocks (by sending children or other members of the family to work) while 3 per cent reduced their consumption expenditure.

Table 3: Household responses to economic costs of health shocks

| Household response                      | Between Round 1 and Round 2 |           | Between Round 2 and Round 3 |           |
|---|-----------------------------|-----------|-----------------------------|-----------|
|   | Younger (%)                 | Older (%) | Younger (%)                 | Older (%) |
| Ate less                                | 0.59                        | 2.15      | 1.19                        | 0.41      |
| Bought less                             | 2.38                        | 2.96      | 2.63                        | 2.46      |
| Migrated to find work                   | 1.93                        | 2.42      | 0.95                        | 0.41      |
| Nothing                                 | 17.68                       | 13.44     | 8.35                        | 0.82      |
| Received help from the community        | 2.08                        | 4.03      | 2.39                        | 8.61      |
| Received help from relatives/friends    | 20.51                       | 18.55     | 20.05                       | 20.08     |
| Received help from government/NGO       | 1.04                        | 0.27      | 2.39                        | 3.69      |
| Sent children to be cared for by friend | 0.74                        | 0.54      | 0.72                        | 1.23      |
| Sent children to work                   | 0.15                        | 1.34      | 0.24                        | 0.41      |
| Sold possessions/belongings             | 0.74                        | 0.81      | 0.48                        | 1.23      |
| Took children out of school             | 0.15                        | 1.34      | 0.24                        | 0.41      |
| Used credit                             | 34.32                       | 33.87     | 30.55                       | 32.79     |
| Used savings                            | 10.4                        | 7.8       | 16.47                       | 15.57     |
| Worked more                             | 4.9                         | 7.26      | 7.4                         | 6.97      |
| Mortgaged                               | 0.15                        | 0.27      | 1.91                        | 1.23      |
| Fled/moved away from problem            | 0.45                        | 0.81      |                             |           |
| Sold animals                            |                             |           | 1.43                        | 1.23      |
| Started looking for job                 |                             |           | 0.48                        | 0.41      |
| Sold properties                         |                             |           | 0.72                        |           |
| Others                                  | 1.78                        | 1.88      | 1.43                        | 2.05      |

Source: Based on the author's calculation from unit level data of Young Lives survey.

## 6 Methodology

This study uses logistic regression analysis as the outcomes of interest (health shocks faced by households and the coping strategies used) are categorical variables. The panel logit model using a latent variable framework is as follows:

$$y_{ij}^* = \alpha + h_j + \mathbf{x}_{ij}\boldsymbol{\beta} + u_{ij}$$

$$y_{ij} = 1[y_{ij}^* > 0]$$

$$y_{ij} = 0[y_{ij}^* \leq 0]$$

$$\text{andPr}(y_{ij} = 1 | \mathbf{x}_{ij}, h_j) = G(\alpha + h_j + \mathbf{x}_{ij}\boldsymbol{\beta}) \quad (2)$$

where  $i$  refers to the measurement occasions or round of the panel survey ( $i = 1, 2, 3$ ) and  $j$  refers to the household ( $j = 1, 2, 3..J$ ),  $y_{ij}^*$  is a latent variable,  $y_{ij}$  is the binary response variable,  $\mathbf{x}_{ij}$  is  $1 \times n$  vector of observed covariates,  $\boldsymbol{\beta}$  is  $n \times 1$  vector of parameters,  $h_j$  is an unobserved time

invariant household effect, and  $u_{ij}$  is a zero-mean residual.  $G(\alpha + h_j + x_{ij}\beta) = \frac{\exp(\alpha + h_j + x_{ij}\beta)}{1 + \exp(\alpha + h_j + x_{ij}\beta)}$  is the logistic cumulative distribution function.

There are different methods for estimation of logit model with panel data: (1) complete pooling, (2) unconditional fixed effects, (3) conditional fixed effects, and (4) random effects (Bartels, 2008). Under the complete pooling models, it is assumed that there are no individual unobserved effects (i.e.,  $h_j = 0$ ) thus ignoring the panel structure of the data. In this method,  $\beta$  coefficients are the same as those obtained from standard cross-section models but the standard errors are corrected to account for correlation within individuals. A disadvantage of this method is that ignoring unobserved heterogeneity can induce omitted variable bias. In the case of linear regression models,  $h_j$  can be eliminated by first-differencing or transformation. But this is not possible in the case of non-linear (logit) models. In unconditional fixed effect approach,  $h_j$  is estimated directly by adding dummy variables for  $J - 1$  individuals. But this may lead to incidental parameters problem: in the maximum likelihood method, if some parameters are not consistent, then all estimators become inconsistent. Thus, with small number of measurement occasions (here,  $I = 3$ ) and large  $J$ ,  $h_j$  will not be consistent which in turn renders the estimates of  $\beta$  to be inconsistent.

The unobserved heterogeneity at household level can also be taken into account through conditional fixed effects logit or traditional random effects model. In the conditional fixed effects approach, individual effects  $h_j$  disappear from the likelihood by conditioning on the total number of successes (minimum sufficient statistic).<sup>14</sup> For instance, when  $I = 2$ , we condition on  $y_{1j} + y_{2j} = 1$ . The possible sequences are  $\{1,0|0,1\}$ . When  $I = 3$ , we condition on  $y_{1j} + y_{2j} + y_{3j} = 1$   $\{1,0,0|0,1,0|0,0,1\}$  or  $y_{1j} + y_{2j} + y_{3j} = 2$   $\{1,1,0|0,1,1|1,0,1\}$ . Thus only those individuals whose responses vary across time periods are used in the estimation. In the traditional random effects model,  $h_j$  is assumed to follow normal distribution ( $h_j \sim N(0, \sigma_h^2)$ ). Usually  $h_j$  is integrated out of the likelihood and numerical methods like quadrature are used to estimate the coefficients as there is no analytical solution here.

Maddala (1987) lists the following disadvantages of using fixed effects approach. It uses within-individual differences and hence gives inefficient estimates if within individual variation is low. Also, the fixed effects approach cannot be used to estimate the effects of covariates that do not change over time like gender and race as those are captured by  $h_j$ . The random effects approach only estimates the variance of  $h_j$  thus saving a lot of degrees of freedom compared to fixed effects. Moreover, for large number of individuals and small number of measurement occasions, fixed effects method gives rise to inconsistent estimates due to incidental parameters problem. Thus we use random effects logit model to answer the questions mentioned in Section 2.<sup>15</sup>

Further, contextual or environmental factors like access to healthcare and average living standards of the community play an important role in influencing health shocks faced by households within a cluster, i.e., geographical area (Gibbons and Hedekar 1997). Thus, the outcomes of households within a cluster are more likely to be correlated than that of households between clusters. Usually, this is accounted for by relaxing the assumption of independence between households within the same cluster and correcting for intra-cluster correlation in the

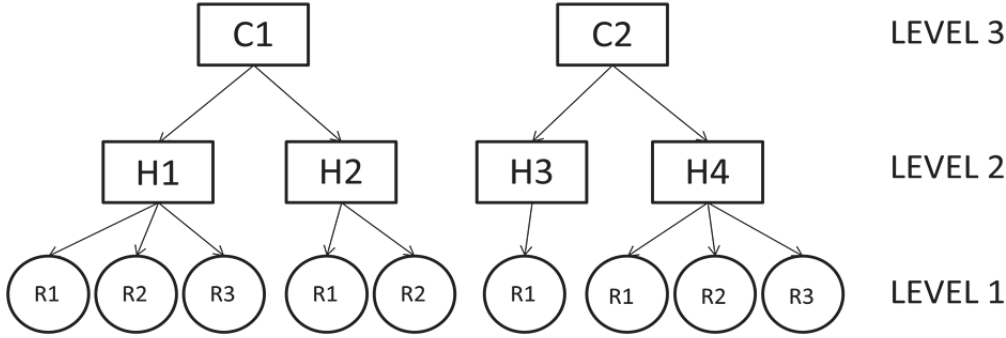
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<sup>14</sup> The conditional ML method is difficult to estimate for probit link function as these effects do not cancel out.

<sup>15</sup> The random effects model assumes that unobserved heterogeneity  $h_j$  is independent of the covariates,  $x_{ij}$ . We test for correlation between time-varying covariates and  $h_j$  using Chamberlain correlated random effects method and do not find it to be significant.

standard error formula. In addition, studies also include relevant group-level covariates or dummies along with household-level covariates in a single model. However this leads to treating data at higher level as independent information from much larger sample of lower-level units which gives rise to spurious results. We overcome these problems using multi-level modeling. Since the Young Lives project randomly selected 150 households each from 20 different clusters (taluk), we expect that the outcomes of households from the same cluster are correlated. We take into account this unobserved heterogeneity at the cluster level in addition to that at the household level by specifying a three-level random intercept model. The three levels are measurement occasions at the first level (denoted by Rounds—R1, R2 or R3 in Figure 2), household at the second level (H) and taluk or cluster at the third level (C).

Figure 2: Three-level random effects models



Source: Author's compilation.

The three-level random intercept model using latent variable formulation is written as follows:

$$y_{ijk}^* = \alpha + h_{jk} + c_k + \mathbf{x}_{ijk}\boldsymbol{\beta} + \mathbf{x}'_{jk}\boldsymbol{\beta}' + \mathbf{x}'_k\boldsymbol{\beta}' + \varepsilon_{ijk}$$

$$h_{jk} \sim N(0, \sigma_h^2); c_k \sim N(0, \sigma_c^2)$$

$$y_{ijk} = 1[y_{ijk}^* > 0]$$

$$y_{ijk} = 0[y_{ijk}^* \leq 0]$$

$$\Pr(y_{it} = 1 | \mathbf{x}_{ijk}, \mathbf{x}'_{jk}, \mathbf{x}'_k, h_{jk}, c_k) = G(\alpha + h_{jk} + c_k + \mathbf{x}_{ijk}\boldsymbol{\beta} + \mathbf{x}'_{jk}\boldsymbol{\beta}' + \mathbf{x}'_k\boldsymbol{\beta}' + c_i) \quad (3)$$

where  $i$  refers to the measurement occasions ( $i = 1, 2, 3$ ) and  $j$  refers to the household ( $j = 1, 2 \dots J$ ),  $k$  refers to the cluster or taluk ( $k = 1, 2 \dots 20$ ),  $y_{ijk}^*$  is a latent variable,  $y_{ijk}$  is binary response variable,  $\mathbf{x}_{ijk}$  is  $1 \times n_1$  vector of time-varying covariates at the household level,  $\mathbf{x}'_{jk}$  is  $1 \times n_2$  vector of time-invariant covariates at the household level,  $\mathbf{x}'_k$  is  $1 \times n_3$  vector of covariates at the cluster level,  $\boldsymbol{\beta}, \boldsymbol{\beta}'$  are  $\boldsymbol{\beta}'$  are  $n_1 \times 1, n_2 \times 1, n_3 \times 1$  vectors of parameters respectively,  $h_{jk}$  is an unobserved time invariant household effect and  $c_k$  the unobserved cluster effect,  $\varepsilon_{ijk}$  is a zero-mean residual and  $G(\cdot)$  is the cumulative logistic distribution function. Here the regression coefficients  $\alpha, \boldsymbol{\beta}, \boldsymbol{\beta}'$  and  $\boldsymbol{\beta}'$  are called fixed effects since they do not vary across levels while  $h_{jk}$  and  $c_k$  are called the random intercepts. The following sections detail on the variables used in the model.

## 6.1 Economic vulnerability to health shocks

The first three rounds of the Young Lives survey are pooled to determine the factors that lead to welfare loss from health shocks. The dependent variable is binary that takes value 1 if the household faced health shock that reduced the economic welfare of the household and 0 otherwise. The independent variables are classified into household head characteristics,

demographic, socio-economic and community characteristics.<sup>16</sup> The characteristics of household head include age, gender, education level and working status.<sup>17</sup> We hypothesize that households with educated and regular salaried head are less likely to face reduction in wellbeing due to health shocks and that vulnerability to health shocks increases with age of the household head. The socio-economic characteristics that are taken into consideration are wealth quartile group, caste and religious groups that households belong to. Wealthier households have more resources to cope with economic costs of health shocks and hence face lower probability of welfare loss. It is posited that households belonging to SC and Scheduled Tribes (ST) categories are more vulnerable to health shocks due to their low socio-economic status compared to other groups in general. The demographic characteristics like dependency ratios and presence of elderly and disabled members are other explanatory variables used. We hypothesize that households with elderly or chronically-ill members face more illness episodes and hence higher economic costs. A dummy variable indicating if the household was covered by the Rajiv Arogyasri health insurance scheme was included to investigate the role of the public insurance scheme in reducing the economic burden of health shocks<sup>18</sup>.

## 6.2 Coping strategies

The second and third rounds of the Young Lives survey are pooled to determine the likelihood of adopting different coping strategies when health shocks affect one or more household members. The first round was not included as households' responses were only available for the three most important economic shocks as previously mentioned in Section 5. The coping strategy used by the household are grouped into six categories (1-savings, 2-receive help, 3-credit or sale of assets, 4-take more work, 5-reduce expenditure, 6-others)<sup>19</sup> as shown in Table A2 in the Appendix. Three-level multinomial logistic regression analysis is used for investigating the determinants of coping strategies adopted by households that faced health shocks. Here the unit of analysis is at the household member level. This is because coping strategies used might differ across members of the household and also more than one member of the household may face health shock in a given period.

The independent variables used in the analysis are categorized into individual, household and community level factors. In order to determine if there are differences in coping strategies used among the members of the same household, dummy variables indicating whether father or

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<sup>16</sup> Refer to Table A3 in the Appendix for summary statistics.

<sup>17</sup> The nature of the job undertaken by the head was not controlled for due to issues with data consistency across rounds. Round 1 survey gives information on sector (agriculture, manufacturing, mining etc) in which the household head works while Round 2 and Round 3 survey has information on nature of the job (self-employed, regular-salaried, casual labourer etc.) only.

<sup>18</sup> Dummy variables for each round of the survey were also used in the model. These are used to take into account variation due to differences in recall period between the rounds. Other variables used are as follows. A significant number of observations in Round 1 did not have information on employment status of household heads. So a dummy variable is included to capture those observations for which employment status is missing. A dummy variable taking value 1 if the observation belongs to older cohort of Round 1 is used to take into account the difference in recall periods for the younger and older cohorts in that round. Refer Section 5 for details. It is possible that households that faced welfare loss from weather shocks or other income shocks are more vulnerable to health shocks. But this could not be controlled for in the analysis since the Young Lives survey does not have information on chronological order of the shocks faced by households. Since weather related shocks affect many households in a particular area, this is captured to some extent by cluster-level intercepts and dummy for area of residence (urban/rural).

<sup>19</sup> Coping strategies, such as taking more work or reducing expenditure, are mostly adopted by the poorest wealth quartile groups. The former involves household members working overtime or sending children to work while the latter involves reducing food or education expenditure of the household. These strategies have implications for human capital formation and hence are termed more costly than other strategies.

mother of the Young Lives child was affected by ill-health are used. The base category is health shock faced by other members of the household. We hypothesise that more resources are allocated for treatment of an individual member whose contribution to household production is higher. Thus, we expect that households adopt very costly strategies when the father of Young Lives child faces health shock as he is the breadwinner in a majority of the surveyed households. The household level characteristics used in the model include age, gender, education level and employment status of the head. Age of the household head is used as a proxy for life-cycle stage of the household and is likely to influence the coping strategies used. Sauerborn et al. (1996) argued that as household matures, dependency ratios become more favourable and children move from being net consumers to net producers. Thus with increasing age households are more likely to rely on their savings to cope with health shocks. Regular salaried employment and high education levels are expected to reduce the adoption of costlier strategies like reducing consumption, borrowing and sale of assets. Indicators of socio-economic characteristics of the household like caste and religious groups and wealth quartile group are also used in the model. A dummy variable for RAS insurance coverage is used. Since all the transactions under the scheme are cashless, it is also expected to reduce the incidence of borrowing, sale of assets etc. among the insured households which face health shocks.

## 7 Findings

It is important to establish if a three-level model is required in the case of longitudinal and clustered data structure, i.e., if households' responses over time are significantly correlated with each other and if households nested in a geographical area are more alike. For this, we estimate the unconstrained or null model (i.e., model without the covariates  $x_{ijk}$ ,  $x'_{jk}$ ,  $x'_k$  in Equation 3) and test if the random effects are statistically significant at the household level and cluster level ( $h_{jk}$  and  $c_k$  respectively). Table 3 shows the results of null model for health shocks as well as coping strategies. The null hypothesis that variances of  $h_{jk}$  and  $c_k$  are zero is rejected at 1 per cent significance level in the case of health shocks as well as coping strategies. Thus, contextual factors play a significant role in determining the economic vulnerability to health shocks faced by households and coping strategies adopted by them.<sup>20</sup>

Table 3: Results of multi-level analysis: null model

| Variable        | Constant            | se       | $\sigma_h^2$ | se    | $\sigma_c^2$ | Se    |
|-----------------|---------------------|----------|--------------|-------|--------------|-------|
| Health shock    | -1.335***           | 0.226    | 0.159***     | 0.021 | 0.407***     | 0.192 |
| Coping strategy | Transfers           | 1.929*** | 3.143***     | 0.767 | 0.710***     | 0.213 |
|                 | Credit /assets sale | 2.285*** |              |       |              |       |
|                 | Work more           | 0.885**  |              |       |              |       |
|                 | Spend less          | 0.292    |              |       |              |       |
|                 | Others              | 1.464*** |              |       |              |       |

Note: Robust standard errors are reported in parentheses (clustered for region); \*\*\* p<0.01, \*\* p<0.05.

Source: Author's calculation based on unit level data of Young Lives survey.

<sup>20</sup> Around 4 per cent of the households in Round 2 lived in a cluster different from that in Round 1 and this was 5 per cent in the case of Round 3. However, a majority of the households migrated to a new cluster within the same region (Rayalaseema, Telengana, Coastal Andhra) and also the migration was mostly rural to rural or urban to urban. Such households (rural-rural and urban-urban migration within the same region) were assigned to their original cluster of Round 1 since we expect the community conditions to be similar. Other households were dropped from the sample.

The proportion of variance at the cluster level (correlation across households within the same cluster) is obtained using the following estimator:  $\rho = \frac{\sigma_c^2}{\sigma_c^2 + \sigma_h^2 + \frac{\pi^2}{3}}$  where  $\pi^2/3$  is the variance of  $\varepsilon_{ijk}$ .

This is a high 10.6 per cent for health shocks faced by households and 9.94 per cent in the case of coping strategies. Thus, the results prove that cluster effects are highly significant.<sup>21</sup>

## 7.1 Economic vulnerability to health shocks

This section details on the determinants of economic vulnerability to health shocks faced by households (Table 4). The base scenario refers to no health shock reported by the household. The results of both pooled model as well as three level random intercept logit model are presented for comparison. The inclusion of random effects moderates the strength of the relation between the dependent variable and covariates (though the direction of relation remains the same for all the covariates). Also, the proportions of variance explained at the household level and cluster level decrease (in comparison with the null model) once the covariates are added.

Vulnerability to health shocks increases with the age of the household head, and female-headed households have higher probability of facing welfare loss from health shocks than male-headed ones. Completion of primary education and regular salaried employment of the household head have negative effects on vulnerability to health shocks but only the latter is statistically significant. Households with elderly member, chronically ill or disabled members and high dependency ratios are more prone to welfare loss from health shocks. Households belonging to bottom wealth quartile groups face higher economic vulnerability to health shocks compared to the topmost quartile group. Similarly, SC and Muslim households have higher incidence of welfare loss from serious illness or death compared to other caste and religious groups respectively. Also, households living in rural areas of Andhra Pradesh are more susceptible to reduction in wellbeing from health shocks compared to those in urban areas. Inclusion of households under Rajiv Arogyasri health insurance scheme does not have a significant effect in reducing the incidence of welfare loss from health shocks. Other studies like Mitchell et al. (2011) and Selvaraj and Karan (2012) also found that the scheme did not have any clear effects on catastrophic medical spending.

The key variable of interest-coverage under the state health insurance scheme has no significant effect on the likelihood of adopting costly coping strategies. The model specified might suffer from the problem of endogeneity if there is self-selection into the scheme (Wagstaff and Lindelow 2008). But in the case of RAS, there is no separate enrolment for the scheme; all households that have BPL cards (by satisfying the income criteria of the state government) are automatically eligible for the insurance<sup>22</sup> and hence issue of self-selection may not arise in our context.<sup>23</sup>

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<sup>21</sup> We also conduct likelihood ratio (LR) tests of three-level versus two-level model and three-level versus single level model and obtain similar results.

<sup>22</sup> Source [www.aarogyasri.gov.in/ASRI/index.jsp](http://www.aarogyasri.gov.in/ASRI/index.jsp), accessed 16 September 2013

<sup>23</sup> However, if selection into the scheme is based on unobservables, the insurance and random intercepts are likely to correlated with one another and this will bias the coefficient on insurance (Wagstaff and Lindelow 2008). One method to address the issue of endogeneity is through fixed effects (FE) model. But, estimation of FE model drops 50 per cent of the observations in our sample due to no variation in dependent variable across time which in turn introduces sample bias. Hence, we check for the issue of self-selection in the following way. During Round 2 survey, 84.9 per cent of the households possessed BPL cards (before the scheme was launched) and this increased to 90.6 per cent in Round 3 survey (after the launch of the scheme in 2007). We introduce a dummy variable for those households that joined the BPL category after Round 2 assuming that they self-selected into the scheme. We then



Table 4: Factors leading to welfare loss from health shocks (Rounds 2002, 2006, 2009)

| Variables          | Complete pooling |                | Random effects (3 level) |                |
|--------------------|------------------|----------------|--------------------------|----------------|
|                    | Coefficient      | Standard error | Coefficient              | Standard error |
| Age                | 0.0230           | 0.015          | 0.0228***                | 0.006          |
| Age squared        | -0.0003          | 1.5e-4         | -0.0003***               | 8.3e-5         |
| Female             | 0.816***         | 0.098          | 0.820***                 | 0.108          |
| Education          | -0.0635          | 0.068          | -0.0665                  | 0.046          |
| Salaried           | -0.0979          | 0.090          | -0.110**                 | 0.049          |
| Disability         | 0.388***         | 0.084          | 0.395***                 | 0.074          |
| Elderly            | 0.477***         | 0.072          | 0.487***                 | 0.102          |
| Dependency ratio   | 0.0679           | 0.050          | 0.0679***                | 0.021          |
| Quartile II        | -0.0006          | 0.073          | -0.0022                  | 0.103          |
| Quartile III       | -0.130           | 0.080          | -0.137                   | 0.112          |
| Quartile IV        | -0.156           | 0.115          | -0.160***                | 0.039          |
| SC                 | 0.113            | 0.075          | 0.133***                 | 0.018          |
| ST                 | 0.0714           | 0.115          | 0.0763                   | 0.200          |
| Muslim             | 0.171            | 0.238          | 0.265***                 | 0.088          |
| Older cohort       | 0.162**          | 0.074          | 0.169**                  | 0.067          |
| Rural              | 0.861***         | 0.186          | 0.555***                 | 0.156          |
| Round 2            | 0.586***         | 0.084          | 0.593                    | 0.402          |
| Round 3            | -0.042           | 0.147          | -0.041                   | 0.119          |
| Old cohort of R1   | 0.368***         | 0.126          | 0.372***                 | 0.070          |
| Missing salaried   | 0.093            | 0.147          | 0.091                    | 0.154          |
| Insurance          | -0.140           | 0.141          | -0.147                   | 0.176          |
| Constant           | -2.167***        | 0.362          | -2.697***                | 0.343          |
| Observations       | 8,751            | -              | 8,751                    | -              |
| Level 2 units      | -                | -              | 3,019                    | -              |
| Variance at level2 | -                | -              | 0.096***                 | 0.028          |
| Level 3 units      | -                | -              | 20                       | -              |
| Variance at level3 | -                | -              | 0.299***                 | 0.168          |

Note: Dummy variables for clusters were included for the complete pooling model; standard errors reported take into account clustering at the region level for the three-level model.

Source: Author's calculation based on unit level data of Young Lives survey.

## 7.2 Coping strategies

This section details on factors affecting the likelihood of households adopting different coping strategies against health shocks using three-level multinomial logistic regression analysis (Table 5). Only those households that reported health shock are included in the analysis. The reference scenario pertains to households using savings as the first response. The characteristics of households adopting different coping strategies are as follows.

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interact this dummy with the insurance variable to check if there is any selection bias. But the coefficient on the interaction term is not significant and coefficient on insurance is also not affected.

Table 5: Coping strategy used by households (Rounds 2006, 2009)

| Variables               | Receive help         | Credit or sale of assets | Take more work       | Reduce expenditure   | Others               |
|-------------------------|----------------------|--------------------------|----------------------|----------------------|----------------------|
| Father                  | 0.535<br>(0.366)     | 0.531<br>(0.433)         | 0.485***<br>(0.0611) | 0.934***<br>(0.228)  | -0.362<br>(0.283)    |
| Mother                  | 0.221<br>(0.463)     | 0.166<br>(0.541)         | -0.299<br>(0.375)    | 0.317<br>(0.313)     | -0.776***<br>(0.216) |
| Head age                | -0.230***<br>(0.044) | -0.215***<br>(0.043)     | -0.266***<br>(0.034) | -0.207**<br>(0.083)  | -0.257***<br>(0.057) |
| Age squared             | 0.002***<br>(0.001)  | 0.002***<br>(0.001)      | 0.003***<br>(0.001)  | 0.002***<br>(0.001)  | 0.003***<br>(0.001)  |
| Female                  | 0.737<br>(0.752)     | 0.0541<br>(0.527)        | 1.076***<br>(0.401)  | 0.896<br>(0.951)     | 0.722<br>(0.706)     |
| Education               | -0.098<br>(0.564)    | -0.079<br>(0.184)        | -0.224***<br>(0.049) | 0.302<br>(0.572)     | -0.050<br>(0.548)    |
| Regular salaried        | -0.696***<br>(0.157) | -0.360<br>(0.353)        | -0.966***<br>(0.217) | -1.246***<br>(0.444) | -0.385<br>(0.266)    |
| Quartile II             | -0.585***<br>(0.114) | -0.789***<br>(0.259)     | -0.609***<br>(0.074) | -0.852<br>(0.658)    | -0.906***<br>(0.132) |
| Quartile III            | -0.794<br>(0.539)    | -1.009***<br>(0.343)     | -0.938***<br>(0.255) | -1.828***<br>(0.038) | -0.761***<br>(0.247) |
| Quartile IV             | -1.609**<br>(0.672)  | -2.026***<br>(0.520)     | -2.232***<br>(0.098) | -2.184***<br>(0.139) | -1.408***<br>(0.432) |
| SC                      | 0.250<br>(0.250)     | 0.300***<br>(0.108)      | 0.802***<br>(0.270)  | 0.389<br>(0.227)     | 0.582<br>(0.350)     |
| ST                      | 0.136<br>(0.669)     | -0.177*<br>(0.098)       | 0.307<br>(0.319)     | 0.555<br>(0.736)     | 0.212<br>(0.516)     |
| Muslim                  | 0.680***<br>(0.219)  | 0.485***<br>(0.120)      | 0.818<br>(0.785)     | 0.996***<br>(0.141)  | 0.785***<br>(0.248)  |
| Dependency              | 0.148<br>(0.222)     | 0.138<br>(0.117)         | 0.222<br>(0.174)     | -0.277<br>(0.402)    | 0.250<br>(0.198)     |
| RAS card                | 0.453<br>(0.239)     | 0.118<br>(0.258)         | 0.031<br>(0.227)     | -0.376<br>(0.555)    | 0.089<br>(0.358)     |
| Old cohort              | 0.404<br>(0.286)     | 0.490<br>(0.335)         | 0.771<br>(0.474)     | 0.759<br>(0.432)     | 0.405<br>(0.443)     |
| Rural                   | -1.356<br>(0.737)    | -0.688<br>(0.538)        | -1.103***<br>(0.419) | -1.816***<br>(0.254) | -1.386<br>(0.750)    |
| Round 3                 | -1.026**<br>(0.399)  | -0.736<br>(0.437)        | -0.672<br>(0.624)    | -0.678<br>(1.309)    | -1.111<br>(0.679)    |
| Constant                | 8.705***<br>(0.447)  | 8.338***<br>(0.521)      | 8.344***<br>(0.479)  | 7.746**<br>(3.282)   | 9.292***<br>(1.949)  |
| Number of level 1 units |                      | 1,659                    |                      |                      |                      |
| Number of level 2 units |                      | 1173                     | Variance at level 2  |                      | 2.400 (.939)         |
| Number of level 3 units |                      | 20                       | Variance at level 3  |                      | 0.758 (.321)         |

Note: Robust standard errors are reported in parentheses (clustered for region).

Source: Author's calculation based unit level data of Young Lives survey.

### *Savings*

Households with middle-aged heads dissave to cope with economic costs of health shocks, but those with very elderly heads are more likely to resort to borrowing, transfers, reducing expenditure on consumption, taking more work etc. Households belonging to top wealth quartile groups are more likely to use savings compared to other strategies to manage the economic costs of health shocks.

### *Increase work or reduce consumption*

Households that face serious illness or death of father of the Young Lives child are more likely to adopt strategies like reducing consumption and children or other members of family taking work. This might be due to the fact that father of the Young Lives child is the breadwinner in a majority of the sample households. Since, health shock to the earning member results in high indirect costs in addition to the direct costs, the household resorts to very costly coping strategies. SC and female headed households are more likely to send children or other members to work to manage the costs of health shocks while those with heads who have completed primary education or have regular salaried employment are less likely to opt for such a strategy. Regular salaried employment also reduces the likelihood of cutting down expenditure on food, education etc. while Muslim households are more likely to adopt this strategy in comparison with other socio-economic groups. The coefficients on rural areas have signs contrary to the expected results as they imply that these households are less likely to use costly strategies compared to their urban counterparts.

### *Credit or sale of assets*

This strategy is more commonly used among SC and Muslim households. Also, households belonging to top wealth quartile groups are least likely to borrow from formal or informal sources and sell assets. The key variable of interest-coverage under state health insurance scheme did not have any effect on the likelihood of adopting costly strategies to cope with health shocks.

## **8 Conclusion**

It is important to know who are vulnerable to health shocks, what are the household responses to cope with economic burden of health shocks and if policy programs are effective in reducing this economic vulnerability. Vulnerability to welfare loss from health shocks is higher among households with elderly and disabled members and those with female heads. Similarly, poorest households and those in the rural areas are the worst affected by health shocks. The results show that regular salaried employment of the household head reduced the vulnerability to health shocks and the probability of using costly strategies like reduction of consumption expenditure and sending children or other members to work. Socially vulnerable groups like SC and Muslim households are more likely to use costly strategies to cope with health shocks which lead to higher welfare loss among these groups.

Rajiv Arogyasri health insurance scheme does not have a significant effect in reducing the household welfare loss from health shocks and their coping strategies. This is because only 3.76 per cent of the eligible households accessed benefits under the scheme. There can be several reasons behind this. The insurance scheme covers mostly in-patient expenditures only. But out-patient services and costs of medicines contributed to 80 per cent of OOP medical expenditures and hence the insurance scheme by design cannot eliminate catastrophic spending arising out of such cases (Fan et al. 2012; Shahrawat and Rao 2012). Diseases such as tuberculosis, infectious diseases, malaria, filaria, gastroenteritis and jaundice are not covered under the insurance since they are already addressed under national health programmes. But these are still leading causes of serious ailments among the

poor (Reddy and Mary, 2013). Thus, the scheme is skewed towards high-cost medical interventions which account for less than two per cent of the disease burden of the population (Prasad and Raghavendra 2012). Added to this, the utilization rates (number of treatments preauthorized per lakh of the beneficiaries covered) under the scheme are highest in those districts with good access to hospitals. Thus, more than 90 per cent of preauthorized surgeries were performed in cities with a good network of hospitals while the districts with poor health infrastructure accounted for less than 10 per cent (Prasad and Raghavendra 2012). This indicates that contextual factors like physical proximity to hospitals are important determinants of households seeking medical care under the insurance scheme. In addition to this, the utilization rates for disadvantaged groups like SC and ST were lower than their population proportions (Fan et al. 2011; Rao et al. 2012). Besides, it might be little early or premature to evaluate the effect of the state insurance scheme since it was launched only in 2007 and the government was in the process of expanding the scheme by including more procedures and diseases under insurance coverage.

The conclusions of the study have certain caveats attached to them. The dataset may not be representative sample of households in Andhra Pradesh as only those with one-year or eight-year old children were included for the panel survey in 2002. The study uses self-reported measures of health shocks as the dependent variable which has its own limitations. Perceptions of reduction in economic wellbeing due to health shocks might vary across households. One cannot know if the welfare loss is predominantly due to direct costs or indirect costs of health shocks. If indirect costs contribute significantly to the economic burden, public health insurance schemes cannot prevent the reduction in wellbeing arising out of these costs. Nevertheless, the study complements the existing literature by identifying factors causing economic vulnerability to health shocks and their coping strategies. This helps in better targeting of public health insurance schemes of the central and state governments. The importance of contextual factors like access to medical care suggests that protection through social insurance schemes should go hand-in-hand with the improvement of public health systems. In addition, it is imperative for public policies to promote preventive healthcare that reduces vulnerability to health shocks and thereby, the economic losses associated with these shocks (Dupas 2011).

## Appendix

Table A1: Differences in questionnaires of three survey rounds

|                   | Round 1  | Round 2  | Round 3  |
|-------------------|--|--|--|
| Health shocks     | <p>Since your pregnancy with the Young Lives child, has there been a major event that decreased the economic welfare of the household?</p> <ul style="list-style-type: none"> <li>- Severe illness or injury</li> <li>- Death or reduction in household members</li> </ul> | <p>Have there been following events within the family that have affected the household economy negatively since the last time we came to see you?</p> <ul style="list-style-type: none"> <li>-Death of child's father</li> <li>-Death of child's mother</li> <li>-Death of another person from the household</li> <li>-Serious illness of child's father</li> <li>- Serious illness of child's mother</li> <li>- Serious illness of another person from the household</li> </ul> | <p>Have there been following events within the family that have affected the household economy negatively since the last time we came to see you?</p> <ul style="list-style-type: none"> <li>-Death of child's father</li> <li>-Death of child's mother</li> <li>-Death of another person from the household</li> <li>-Serious illness of child's father</li> <li>- Serious illness of child's mother</li> </ul> |
| Coping strategies | <p>Which were the three worst events?<br/>What was the household response to the worst event?</p>  | <p>What did your household do in response to these events?</p> <ul style="list-style-type: none"> <li>-Death of child's father</li> <li>-Death of child's mother</li> <li>-Death of another person from the household</li> <li>-Serious illness of child's father</li> <li>- Serious illness of child's mother</li> <li>- Serious illness of another person from the household</li> </ul>  | <p>What did your household do in response to these events?</p> <ul style="list-style-type: none"> <li>-Death of child's father</li> <li>-Death of child's mother</li> <li>-Death of another person from the household</li> <li>-Serious illness of child's father</li> <li>- Serious illness of child's mother</li> </ul>  |

Source: Young Lives Survey: household questionnaire (India).

Table A2: Definition of variables

| Variable                    | Definition  |
|-----------------------------|---|
| Dependent variables         |   |
| Health shock                |   |
| 0- No health shock          | None of the members faced serious illness/death   |
| 1- Faced health shock       | One or more household members faced serious illness or death that reduced the economic wellbeing of the household |
| Coping strategies           |   |
| 1-Used savings              | Used savings  |
| 2-Transfers                 | Received help from relatives, NGOs, government, friends, neighbours, community etc                                |
| 3-Borrowed/sold assets      | Borrowed from formal or informal sources, mortgaged assets, sold belongings/possessions/animals/properties        |
| 4-Worked more               | Sent children to work, started work, worked more, migrated to find work   |
| 5-Reduced Expenditure       | Ate less, bought less, took children out of school, sent children to be cared for by friends                      |
| 6-Others                    | Nothing, fled or moved away, others   |
| Household member            |   |
| Independent variables       |   |
| Father                      | Father of the Young Lives child faced serious illness or death  |
| Mother                      | Mother of the Young Lives child faced serious illness or death  |
| Other member                | Other members of the household faced serious illness or death   |
| Head characteristics        |   |
| Age                         | Age of household head   |
| Age squared                 | Squared age of the head   |
| Female                      | Dummy takes value 1 if household head is female   |
| Education                   | Dummy variables takes value 1 if the head has completed primary education   |
| Salaried                    | Dummy for household head has a regular salaried job   |
| Demographic characteristics |   |
| Disability                  | Dummy variable takes values 1 if one or more household members are disabled                                       |
| Elderly                     | Dummy variable takes value 1 if there are one or more household members above 60 years of age                     |
| Dependency ratio            | (Number of household members aged 0-14 and >64)/Number of households members aged 15-64                           |

(table continues)

Table A2: Definition of variables (continued)

| Socio-economic characteristics |  |
|--------------------------------|--|
| Wealth index                   | Wealth index is constructed as a sum of housing quality index, consumer durables index and services index (Young Lives report).<br>Quartile I takes value 1 if household belongs to the bottom 25% and Quartile IV takes value 1 if household belongs to the top 25% wealth group. |
| Quartile I                     |  |
| Quartile II                    |  |
| Quartile III                   |  |
| Quartile IV                    |  |
| SC                             | Dummy variables takes value 1 if household belongs to SC category  |
| ST                             | Dummy variables takes value 1 if household belongs to ST category  |
| Muslim                         | Dummy variable takes value 1 if a Muslim household   |
| Insurance                      | Dummy variable take value 1 if household is covered by public health insurance scheme (Rajiv Arogyasri) in Round 3. The variable takes value 0 in the case of Round 1 and Round 2.   |
| Community characteristics      |  |
| Rural                          | Dummy variable takes value 1 if the household lives in rural area  |
| Clusters (1-20)                | Dummy variable takes value 1 if the household belongs to that cluster (Taluk)  |
| Others                         |  |
| Round 2                        | Dummy for second round of survey – 2006  |
| Round 3                        | Dummy for third round of survey – 2009   |
| Older cohort                   | Dummy take value 1 if the household belongs to the older cohort  |
| Older cohort of R1             | Dummy takes value 1 for older cohort households in Round 1   |
| Missing salaried               | Dummy takes value 1 if data is missing for regular salaried variable (Some observations in Round 1 had data missing on regular salaried employment)  |

Source: Author's compilation.

Table A3: Summary statistics

| Variables                     | Younger cohort |       |       | Older cohort |       |       |
|-------------------------------|----------------|-------|-------|--------------|-------|-------|
|                               | R1             | R2    | R3    | R1           | R2    | R3    |
| Observations                  | 2,011          | 1,950 | 1,930 | 1,008        | 994   | 975   |
| Attrition rate (from R1)      | -              | 3.03  | 4.03  | -            | 1.39  | 3.27  |
| Head                          |                |       |       |              |       |       |
| Age (mean years)              | 39.96          | 38.51 | 38.58 | 40.17        | 42.51 | 44.16 |
| Female                        | 8.45           | 5.18  | 5.44  | 7.84         | 10.87 | 11.20 |
| Education                     | 41.22          | 38.21 | 40.57 | 40.18        | 35.11 | 34.97 |
| Regular salaried              | 14.47          | 14.92 | 16.89 | 16.27        | 14.48 | 16.51 |
| Dependency                    |                |       |       |              |       |       |
| Elderly                       | 11.88          | 19.85 | 38.81 | 11.31        | 18.51 | 32.72 |
| Disabled                      | 13.87          | 9.03  | 9.74  | 11.01        | 9.36  | 7.59  |
| Dependents ratio (mean)       | 0.69           | 0.93  | 1.05  | 1.12         | 0.84  | 0.44  |
| Religion                      |                |       |       |              |       |       |
| Hindu                         | 90.95          | 91.69 | 91.87 | 92.06        | 92.15 | 92.21 |
| Muslim                        | 7.76           | 7.33  | 7.20  | 6.65         | 6.54  | 6.46  |
| Christian                     | 1.19           | 0.92  | 0.88  | 1.29         | 1.31  | 1.33  |
| Caste                         |                |       |       |              |       |       |
| SC                            | 18.20          | 18.15 | 18.08 | 20.34        | 20.42 | 20.31 |
| ST                            | 12.73          | 12.82 | 12.85 | 10.12        | 10.06 | 10.05 |
| OBC                           | 47.39          | 47.95 | 48.13 | 48.71        | 48.79 | 48.92 |
| OC                            | 21.68          | 21.08 | 20.93 | 20.83        | 20.72 | 20.72 |
| Residence                     |                |       |       |              |       |       |
| Rural                         | 74.89          | 75.33 | 75.28 | 75.10        | 75.35 | 75.49 |
| Urban                         | 25.11          | 24.67 | 24.72 | 24.90        | 24.65 | 24.51 |
| Region                        |                |       |       |              |       |       |
| Coastal                       | 34.81          | 35.09 | 35.18 | 34.72        | 34.51 | 34.56 |
| Rayalaseema                   | 30.13          | 29.91 | 29.89 | 30.46        | 30.48 | 30.05 |
| Telangana                     | 35.06          | 34.99 | 34.92 | 34.82        | 35.01 | 35.38 |
| RAS card (insurance coverage) | -              | -     | 82.64 | -            | -     | 84.82 |

Note: All numbers are in percentages unless mentioned otherwise.

Source: Author's calculation based on unit level data of Young Lives survey.



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