How Does the Change in Household Age-Sex Composition Affect Out of Pocket Healthcare Expenditure of Older Adults in India?

Barsharani Maharana[1] · Laishram Ladusingh[2]

Abstract

Household age-sex composition in India is changing fast due to persistently declining fertility and improvement in life expectancy, rural–urban migration and change in family orientation. Under such circumstances healthcare of older adults is expected to be affected as they mostly depend on other household members. Keeping this in view the present study attempts to answer the question 'How does the change in household age-sex composition affect out of pocket healthcare expenditure of older adults in India?'. Household age-sex composition and healthcare expenditure for rounds of National Sample Survey Organaization (NSSO) conducted in 1993, 1999–00 and 2007–08 are used for the study. Considerable shift in the share of older adults over period of time is noticed and the change in household age-sex composition is found to have significant effect on healthcare expenditure of older adults. More specifically the share of consumption by older adults above 60 years has increased substantially over time with the increase in their composition. The study provides empirical evidence to support the need for public policies to respond to the growing challenges of the changing age structure of India's population.

Keywords Age-sex composition · Household health expenditure · Older adults · Decomposition analysis

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Introduction

Demographic transition in India has resulted in unprecedented increase in the share of older adults and gradual decline in child population which is enhancing diverse healthcare requirement for the older adults. UN projections reveal that the size of the older adults is expected to reach 100 million or more by the end of this decade with the steady increase in their life expectancy. The growth of older adults or ageing population is a cause for concern as it will affect the household age composition which further affects the household expenditure for healthcare. Ageing population is a major driver of health care spending in both developed and developing countries and shall escalate further in the decades to come. In developed countries, per capita expenditures on health care for older adults are relatively high. Gradual ageing of the population in developing countries including India shall certainly increase out-of-pocket health care expenditure. Expenditure on health as a fraction of gross domestic product (GDP) in India is one of the lowest, even among the developing countries. India spends around 4.1 percent of GDP on health (Dhawan, 2013). India is one of those very few countries that have higher percentage of private out of pocket expenditure than that of the public expenditure. Currently, India is experiencing demographic transition which has a strong influence on economic development. The change in demographic composition also affects the household consumption-expenditure. The age structure in India is changing and this change, especially the distribution of adult and older adult population and age-sex composition changes the expenditure pattern of households. The consumption pattern in India underwent a comprehensive structural change and now it tends towards assuming a new mobility (Sooryamoorthy, 2007).

The burden of health expenditure on households is at the cost of expenditure on items which are essential to sustain minimum living standard. In general, households with older adults members incurred higher out of pocket health expenditure than others. Also, females are the deprived group in India and less privileged in terms of health care, although their composition has increased over time.

Family composition is considered to be the most important variable influencing family expenditures for goods and services (Brown & Deaton, 1972). Expenditure data of the 1972–1973 Consumer Expenditure Survey (CES) in U.S. is used to test the effect of family life cycle variables on expenditure and it is concluded that family composition significantly affects expenditure pattern (Wagner & Hanna, 1983). The influence of age on consumption has been studied by Wharton School, University of Pennsylvania, USA and the study indicates that age has a significant influence on the expenditure of a number of commodities (University of Pennsylvania, 1960). From a survey in the USA, it is found that prime-age people consume less relative to their income than persons in other age groups (Fair & Dominguez, 1991).

Researchers have tried to highlight the effect of age composition on per capita income. For instance, two persons of widely differing physical dimensions have a systematic association between them and income. However, this is not the case for persons of different age. To satisfy similar need for food, clothing,

etc., a child's requirements are, on the whole, lesser than that of an adult. Consequently, the same per capita income represents a higher standard of living for a population consisting largely of children than for one consisting mainly of adults. According to the researchers, the rise in per capita income over time was accompanied by a decrease in the share of the younger age groups in the population (Kleiman, 1996). The age structure of a household influences the items of consumption and the expenditure pattern. Also, the expenditure pattern changes over time due to the increasing number of adult and older adult members in the households (Biljana & Petar, 2012). Consumer spending patterns by different age groups are investigated in 1973 using Survey of Consumer Expenditure, and the findings concluded that age differences in consumption pattern existed for most of the items (Chen & Chu, 1982). Using 1972–74 consumer expenditure survey in America, researchers enumerated how overall food expenditures have changed and identified the relationships between such expenditures and selected socio-economic factors. Their study found out that per capita food expenditures increase as the head of the family grows older till age 65 and there is a strong negative relationship between family size and per capita expenditures on all types of food consumption (Rogers & Green, 1978). Thus, it is seen that ageing has a positive and significant effect on health expenditure (Meijer et al., 2013). Researchers have tested the hypothesis that health care cost is a function of age and concluded that with advancing age, individual health care expenditure also increases (Sghari & Hammami, 2014).

In addition to the trends in the composition of household expenditure over time, analysing expenditure differences on the basis of household characteristics of Australia, panel data estimation is used to explore the most important contributors to socio-economic health inequalities in Great Britain and it is found that age and financial status are major determinants of ill health. Both factors make a major contribution to income related inequality in health (Wildman, 2003). The change in the pattern of expenditure of the American older adults is studied by analysing the Health and Retirement Study (HRS) data, and findings reveals that health related expenses are the largest component in the budget of older adult American population and the only component which steadily increases with age (Banerjee, 2012). The hypothesis which states that the monthly per capita household health spending of the elderly households is significantly higher than that of the non-elderly households in India is tested using the consumption expenditure data of National Sample Survey, 2009–10, and the result affirms that the monthly per capita health spending of the elderly households is 3.8 times higher than that of the non-elderly households (Mohanty et al., 2014). A community based cross-sectional study in Bihar provided evidence that out of pocket expenditure for health care services is quite high and even catastrophic among 12.5% of older adults who had sought any sort of treatment (Shukla et al., 2016). Findings based on Study on Global Ageing and Adult Health (SAGE) in India indicate that reducing out-of-pocket health expenditure among older people is an important public health issue, in which social as well as medical determinants should be prioritised (Brinda, 2015). In fact, another study based on SAGE data reveals, that by 2030, older adults will bear two-thirds of the total disease burden in China and nearly half in India (Chatterji et al., 2008). National

Sample Survey data for the 60th round shows that annual per capita out-of-pocket health spending in India is almost four times as high among the older adults as among members of working-age groups (Bloom et al., 2010). Findings indicate that India's rapidly ageing population raises concerns about the burden of health care payments among older individuals who may have both limited income and greater health care needs. The significant association between advancing age and healthcare expenditure revealed that both the probability of experiencing health problems and mean total out-of-pocket health expenditures increase with age (Lee et al., 2017). Due to increased morbidity from chronic diseases, older adults have long-term healthcare needs and a large likelihood of having health expenditures in general and out of pocket expenditures in particular. The need for healthcare increases with age. Those above 65 years spend on average 1.5 times on healthcare compared to those in the 60–64 year age category (Mahal & Berman, 2002).

From the above review of literature, it is noted that sporadic attempts have been made to find the influence of changing age-sex composition on household health expenditure pattern in India and that the studies are far from complete. The present study is an attempt to fill this research gap and provide empirical evidence on the extent of changing age-sex composition and health expenditure pattern in India. As highlighted in the preceding paragraphs, with the changing pattern of population growth, the age and sex distribution has also been changing in India which may have considerable influence on health expenditure. Thus, the objective of this study is to examine the influence of changing household age-sex composition on health expenditure pattern in India.

Data & Methodology

Data

Three rounds of National Sample Survey (49th round, 1993; 55th round, 1999–2000 and 64th round, 2007–08) on household consumer expenditure are employed to fulfil the objectives of the present study. The National Sample Survey Organisation (NSSO) conducts regular consumer expenditure surveys as part of itsrounds, each round being normally of a year's duration and covers more than onesubject of study. The surveys are conducted through household interviews, using a random sample of households practically covering the entire geographical area of the country. The sampling designs adopted in all the rounds of NSSO surveys are multi-stratified sampling and are comparable. The household consumer expenditure schedule used for the survey has collected information on quantity and value of household consumption with a reference period of the last 30 days for most items of consumption and last 365 days for less frequently purchased items.

The analysis is based on a sample of 29,995, 120,309 and 50,297 households with 149,826, 600,016 and 242,369 individual members for the period 1993, 1999–00 and 2007–08 respectively. Expenditure on household medical institutional goods and services (medicine, X-Ray, ECG, pathological test, doctor's/surgeon's fee, hospital and nursing home charges and other medical expenses) are collected for the last 365 days prior to the survey, while expenditure on medical non-institutional goods and services

(allopathic medicine, homeopathic medicine, ayurvedic medicine, unani medicine, other medicines, X-Ray, ECG, pathological test, doctor's/surgeon's fee, family planning appliances and other medical expenses) are collected for the last 30 days prior to the survey by NSSO for 1999–00 and 2007–08. However, both the medical institutional and non-institutional expenditure are collected for the last 30 days for the period 1993. Hence, to calculate health expenditure, the institutional medical expenditure in last 365 days are converted to the expenditure in last 30 days for the periods 1999–00 and 2007–08, and both institutional and non-institutional medical expenditure are combined for all the surveys. Health expenditure data for the year 1999–00 and 2007–08 are first adjusted to the price of 1993 considering 1993 as base year.

Methods

Descriptive statistics, bivariate analysis and diagrammatic representation are used to describe the pattern of healthcare expenditure. For the allocation of household health expenditure to individual members by age, a cubic polynomial regression is adopted. The cubic polynomial of age is used and functional form is shown below.

$$C^{health} = \sum \beta_0 M(a) + \sum \beta_1 aM(a) + \sum \beta_2 a^2 M(a) + \sum \beta_3 a^3 M(a)$$

where C^{health} is the household out of pocket (OOP) healthcare expenditure, M(a) is the number of persons of age 'a' in the households and βs are coefficients of the cubic polynomial.
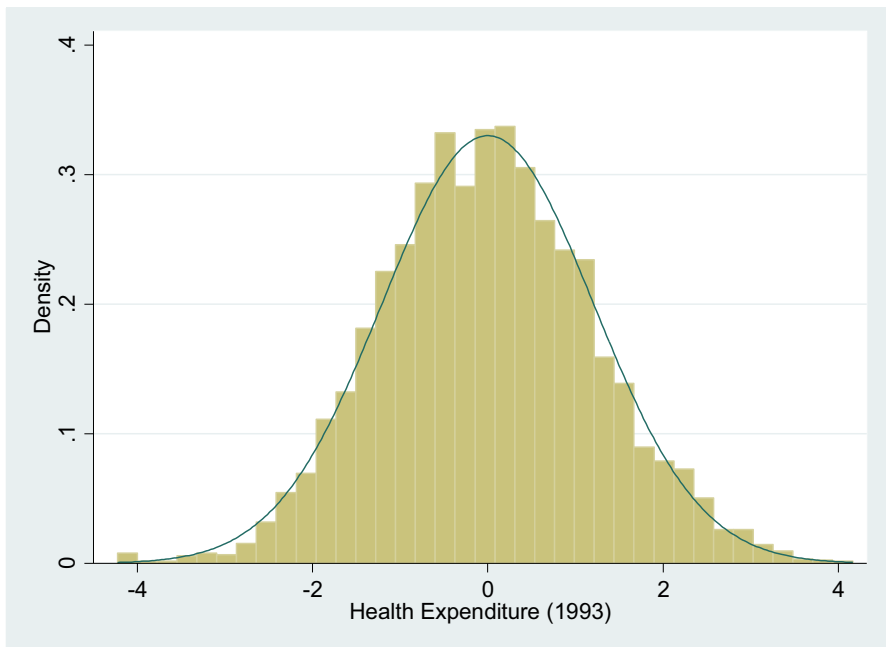

Fig. 1 Density plot for healthcare expenditure, 1993

Using the coefficients βs allocation of healthcare expenditure to household members by age is obtained as follows:

$$H(a) = C^{health} * \left[\frac{\beta_0(a) + \beta_1(a) + \beta_2(a) + \beta_3(a)}{\sum_a \left(\beta_0(a) + \beta_1(a) + \beta_2(a) + \beta_3(a) \right)} \right]$$

To assess determinants of out of pocket healthcare expenditure H(a) in log scale is used as the dependent variable and individual and household background as independent variables in fitting multiple regression. To test appropriateness of multiple linear regression, histograms and density plots of H(a) in log scale are shown in Figs. 1, 2 and 3 as below.

A multivariate decomposition analysis is used to study whether the shift in the demographic composition has made a significant contribution to the overall change in health expenditure (Sobel, 1983). The decomposition procedure applied in this study is based on the linear models estimated for the two surveys.

Equation for health care expenditure for the period 1993 (I) & 1999–00 (II):

$$E(ln(HealthExpenditure))_{II} - E(ln(HealthExpenditure))_I$$

$$= \left(\alpha_{II} - \alpha_I \right) + \sum E(x_{ij})_{II} \left(\beta_{ij_{II}} - \beta_{ij_I} \right)$$

$$+ \sum \beta_{ij_{II}} \left(E(x_{ij})_{II} - E(x_{ij})_I \right) - \sum \left(E(x_{ij})_{II} - E(x_{ij})_I \right) \left(\beta_{ij_{II}} - \beta_{ij_I} \right)$$
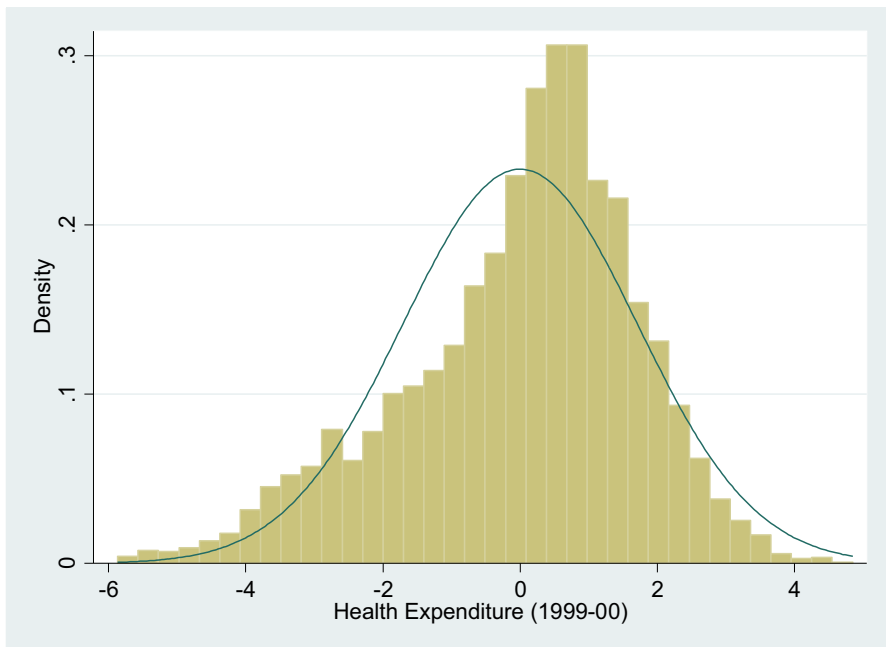

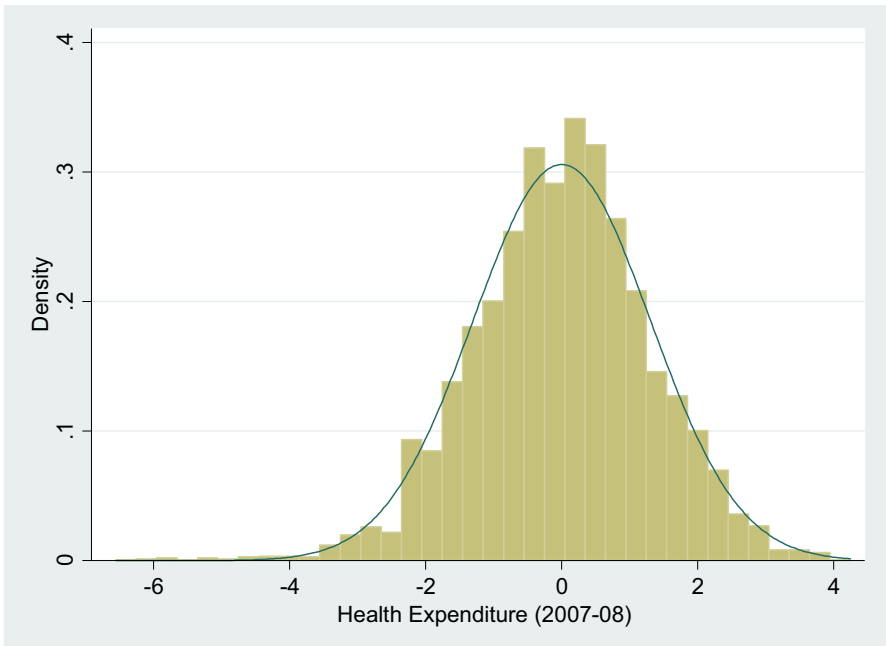Fig. 2 Density plot for healthcare expenditure, 1999–00

Fig. 3 Density plot for healthcare expenditure, 2007–08

where α_I is the regression constant in $NSSO_{1993}$

α_{II} is the regression constant in $NSSO_{1999-00}$

$E(x_{ij})_I$ is the mean of jth category in ith covariate in $NSSO_{1993}$

$E(x_{ij})_{II}$ is the mean of jth category in ith covariate in $NSSO_{1999-00}$

$\beta_{ij\,I}$ is the coefficient of jth category of the ith covariate in $NSSO_{1993}$

$\beta_{ij\,II}$ is the coefficient of jth category of the ith covariate in $NSSO_{1999-00}$

Equation for health care expenditure for the period 1999–00 (II) & 2007–08 (III):

$$E(ln(HealthExpenditure))_{III} - E(ln(HealthExpenditure))_{II}$$

$$= \left(\alpha_{III} - \alpha_{II}\right) + \sum E(x_{ij})_{III}\left(\beta_{ij\,III} - \beta_{ij\,II}\right)$$

$$+ \sum \beta_{ij\,III}\left(E(x_{ij})_{III} - E(x_{ij})_{II}\right) - \sum \left(E(x_{ij})_{III} - E(x_{ij})_{II}\right)\left(\beta_{ij\,III} - \beta_{ij\,II}\right)$$

where α_{II} is the regression constant in $NSSO_{1999-00}$

α_{III} is the regression constant in $NSSO_{2007-08}$

$E(x_{ij})_{II}$ is the mean of jth category in ith covariate in $NSSO_{1999-00}$

$E(x_{ij})_{III}$ is the mean of jth category in ith covariate in $NSSO_{2007-08}$

$\beta_{ij\,II}$ is the coefficient of jth category of the ith covariate in $NSSO_{1999-00}$

$\beta_{ij\,III}$ is the coefficient of jth category of the ith covariate in $NSSO_{2007-08}$

Equation for health care expenditure for the period 1993 (I) & 2007–08 (III):

$$E(ln(HealthExpenditure))_{III} - E(ln(HealthExpenditure))_I$$

$$= \left(\alpha_{III} - \alpha_I\right) + \sum E(x_{ij})_{III}\left(\beta_{ij\,III} - \beta_{ij\,I}\right)$$

$$+ \sum \beta_{ij\,III}\left(E(x_{ij})_{III} - E(x_{ij})_I\right) - \sum \left(E(x_{ij})_{III} - E(x_{ij})_I\right)\left(\beta_{ij\,III} - \beta_{ij\,I}\right)$$

where α_I is the regression constant in $NSSO_{1993}$

α_{III} is the regression constant in $NSSO_{2007-08}$

$E(x_{ij})_I$ is the mean of jth category in ith covariate in $NSSO_{1993}$

$E(x_{ij})_{III}$ is the mean of jth category in ith covariate in $NSSO_{2007-08}$

$\beta_{ij\,I}$ is the coefficient of jth category of the ith covariate in $NSSO_{1993}$

$\beta_{ij\,III}$ is the coefficient of jth category of the ith covariate in $NSSO_{2007-08}$

Results

Dynamics of Household Health Expenditure Over the Period

The change in the share of household expenditure on food, non-food, health and education from 1993 to 2007–08 shown in Fig. 4 divulge that the share of household food expenditure has substantially declined over the period. In 1993, 75.4 percent of
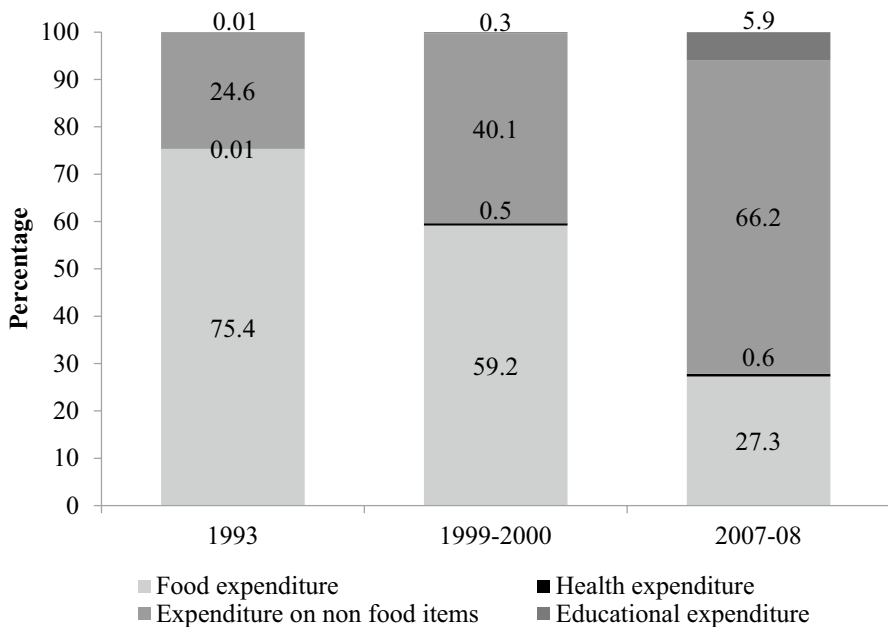

Fig. 4 Components of household expenditure for three points of time, 1993, 1999–00 & 2007–08

household expenditure was spent on food items whereas it has declined to 59.2% in 1999–00 and 27.3% in 2007–08. On the contrary, non-food expenditure of household has increased from 24.6% to 66.2% during this period. Household expenditure on education is 0.1% in 1993, 0.3% in 1999–00 and has considerably increased to 5.9% in 2007–08. Virtually share of household expenditure on health care is negligible compared to expenditure on other food and non-food expenditure and has not improved much over time.

Changing Age Composition Over Time

The change in the age composition of population over time is shown in Fig. 5, 6 and 7 illustrates that the child population (0–14) has declined from the period between 1993 and 2007–08. However, a substantial shift in the percentage of adult (15–59) and older adult (60 & above) population is seen over time, and the shift among older adult women is noticeable.

The pattern in the distribution of household health expenditure among different age-sex groups has been changing over time (Table 1). In 1993, out of the total household health expenditure 31.7% is spent on children. However it has reduced to 4.4% in 2007–08. Among adults and older adults, the distribution of health care expenditure has changed over time. In the first survey, 53.6% is spent on adults, which has increased to 76.3% in the latest survey. Similarly, the share of household health care expenditure among older adults has substantially increased over time from 14.7% to 19.2%. Percent spent on both male and female children has also reduced over time. However a significant increase is seen among adult and older adult male and female. The spending has increased from 56.8 to 76.2% and from 50.6 to 76.4% among male and female adults respectively. Likewise, amongst male and female older adults, it has increased from 15.2 to 19.6% and 14.3 to 18.8%.
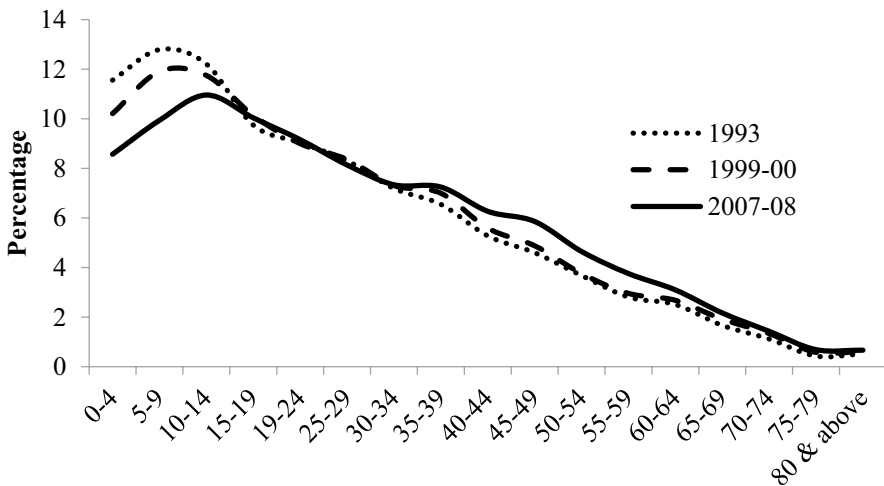

Fig. 5 Age group wise percentage of population in India for three points of time, 1993, 1999–00 & 2007–08
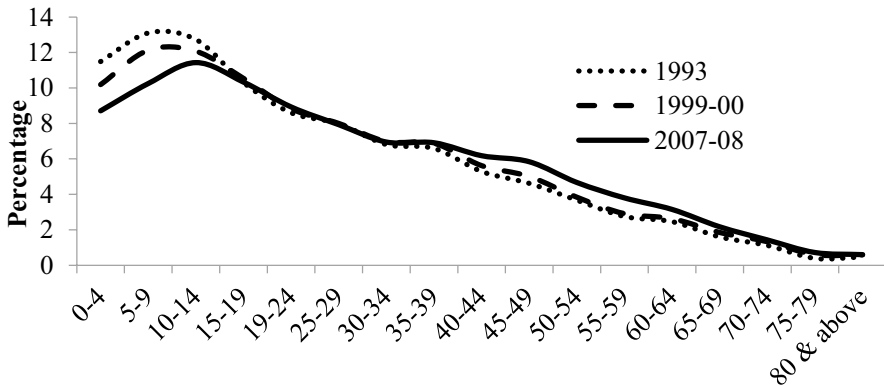
Fig. 6 Age group wise percentage of male population in India for three points of time, 1993, 1999–00 & 2007–08

During the period between 1993 and 1990–00, spending on health among children has reduced by 14.3%, and during 1999–00 and 2007–08, it has decreased by 12.3% and there by an overall decrease of 27.3% is observed from the period 1993 to 2007–08 (Fig. 8). Household health care expenditure among adults has increased by 22.7% over time, and among older adults, it has increased by 4.5%. Males and females are also experiencing the same pattern in the change in household health expenditure. During the period between 1993 and 1999–00 and between 1999–00 and 2007–08, health care expenditure on male children has reduced by 12.2% and 11.6% respectively. Examining at the same two periods health care expenditure on female children were found to have reduced by 16.5% and 13.9% respectively. Among male adults, the expenditure has increased by 19.4% from 1993 to 2007–08 while expenditure on female adults has increased by 25.8% due to the rapid increase in female adult population. On the contrary, percent increase in household health care expenditure among male older adults is more than the female older adults. It
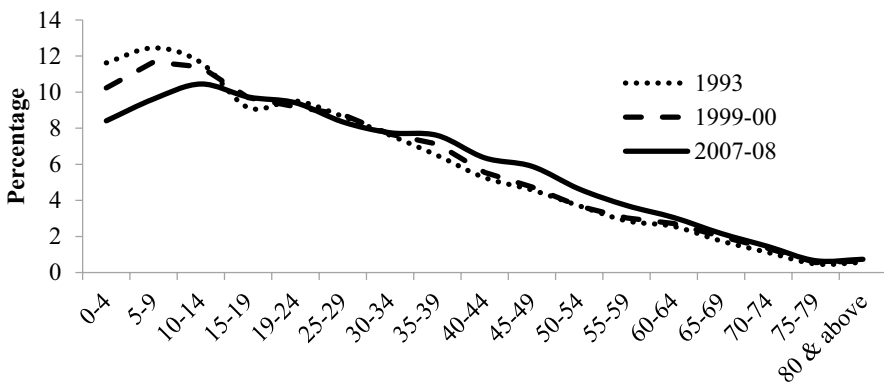

Fig. 7 Age group wise percentage of female population in India for three points of time, 1993, 1999–00 & 2007–08

Table 1 Age-sex wise distribution of household health expenditure for three points of time, 1993, 1999–00 & 2007–08

	Distribution of household health expenditure			Distribution of household health expenditure among males			Distribution of household health expenditure among females		
Age	1993	1999–00	2007–08	1993	1999–00	2007–08	1993	1999–00	2007–08
0–14	31.7	17.3	4.4	28.0	15.8	4.2	35.1	18.6	4.7
15–59	53.6	66.1	76.3	56.8	68.9	76.2	50.6	63.5	76.4
60 & above	14.7	16.7	19.2	15.2	15.3	19.6	14.3	17.9	18.8

is observed that over time expenditure on male older adults has increased by 4.5%; nevertheless female older adults have experienced an increase of 0.9%.

Health Expenditure by Number of Children, Adults and Older Adults

The average monthly health expenditure of households with and without children, adults and older adults during 1993 to 2007–08 are shown in Figs. 9, 10 and 11. The average monthly household health expenditure on children is relatively high in 1999–00 than 1993 and declined in 2007–08 (Fig. 9). In 1999–00, the expenditure is moderately high among the households with more than four children however, in the third survey, households with more than three children spend less compared to the households without any child or with one child. The plausible reason is the composition of households with children is changing according over time as evident from the increasing number of households without child and with one child is increasing over time. It is observed from the Fig. 10 that the average health expenditure of households is increasing with the increase in number of adults living in the house
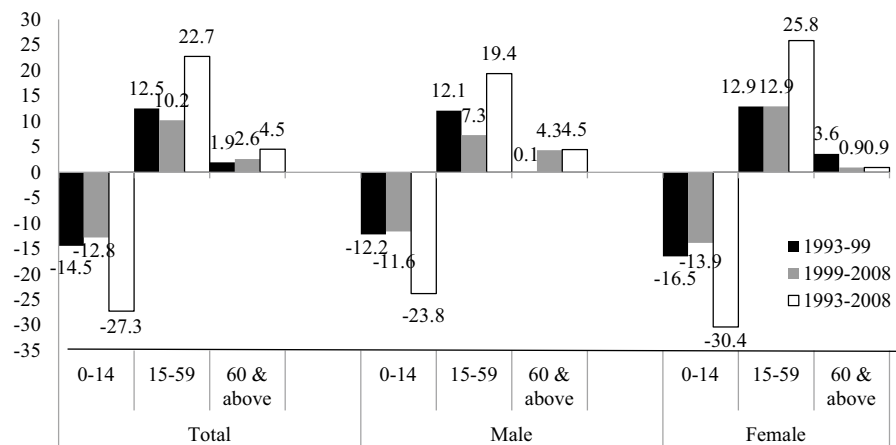

Fig. 8 Percent Change in the Health care Distribution among Different Age-sex Groups in India Over Time, 1993–2008

Fig. 9 Average monthly health expenditure of households with children for three points of time, 1993, 1999–00 & 2007–08

in all the surveys. The figure also illustrates that there is a substantial increase in household health expenditure on adults over time since the percentage of households with more than three adults has increased from the first to the latest survey period. The average monthly health expenditure of households with more number of older adults is substantially high as compared to households without or less number of older adults at three point of time (Fig. 11). Health expenditure of households with more number of older adults is reasonably high in 2007–08 than the rest surveys.

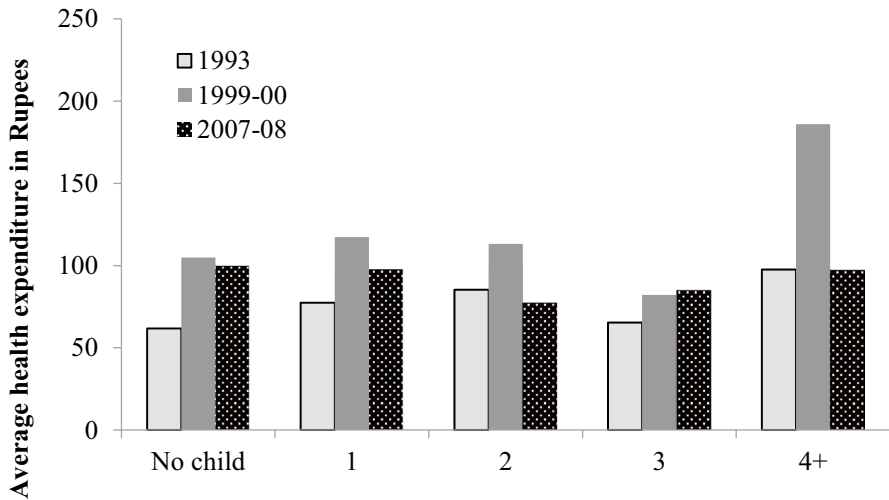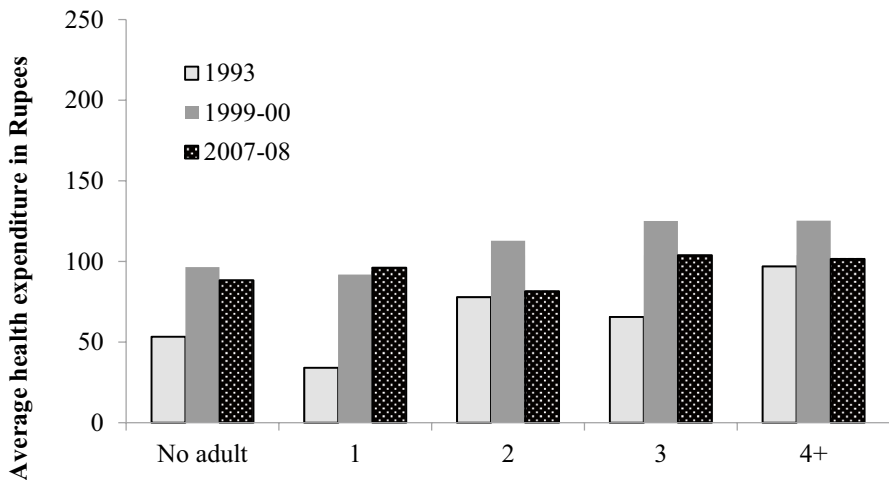**Fig. 10** Average monthly health expenditure of households with adult for three points of time, 1993, 1999–00 & 2007–08
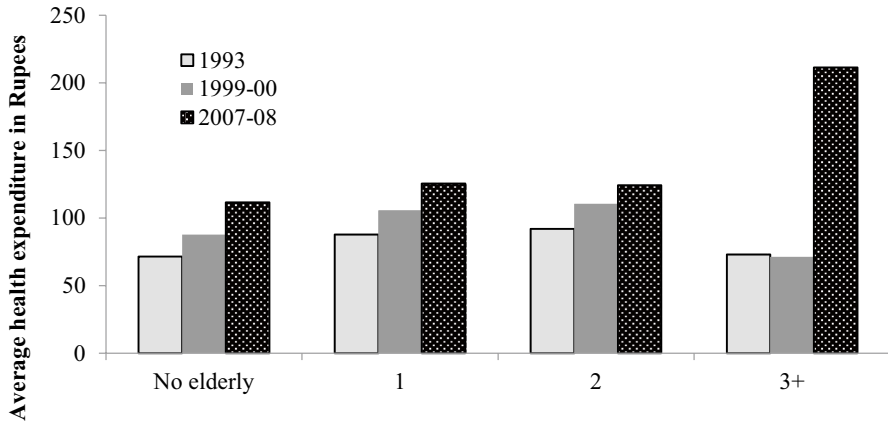
Fig. 11 Average monthly health expenditure of households with elderly for three points of time,1993, 1999–00 & 2007–08

This is due to the shift in the distribution of the older adult population in households over time.

Household Expenditure on Different Health Items

The change in the household expenditure on different health items is described in Table 2. The table illustrates that household expenditure on medicine is quite high in all the surveys than the expenditure on other items and has increased over time. For example, in 1993, out of the total health expenditure, 73.9% is spent on medicines, whereas in 2007–08, it has increased to 80.2%. Spending on family planning appliances has declined due to the government policy and facilities provided for family planning. After medicine, expenditure on pathological tests and doctor's/surgeon's fee has increased from 1993 to 2007–08. Out of the total household health expenditure, 0.9% is spent on pathological tests and it has increased to 6.2% in 2007–08. Likewise, doctor's/surgeon's fee has increased from 5.6% to 8.3% from the first to the latest survey. Furthermore, the hospital and nursing home charges have increased over time.

Table 2 Distribution of household expenditure on different health items for three points of time, 1993, 1999–00 & 2007–08

Health Items	1993	1999–00	2007–08
Medicine	73.9	76.5	80.2
Family planning appliances	8.9	6.7	0.3
X-ray, ECG, pathological test, etc	0.9	5.3	6.2
Doctor's/surgeon's fee	5.6	5.8	8.3
Hospital & nursing home charges	0.7	2.2	3.3
Other medical expenses	10.0	3.5	1.7

As the spending pattern on various health care items like medicine, x-ray, ECG, pathological tests, doctor's/surgeon's fee, hospital & nursing home charges, other medical expenses have changed over time, the change in the expenditure pattern in the above medical items among the children, adults and older adults is also observed over the period. Table 3 represents that out of the total household medicine expenditure, 23.6% is spent on children for the period 1993 which has decreased to 20.1% in 1999–00, but a tremendous reduction (0.3%) is observed in 2007–08. On the other hand, spending on medicine among adults has increased from 59.2 to 75% over time. Similarly, expenditure on older adults has increased from 17.2 to 24.7%. A substantial increase from 1.5 to 28.9% among older adults is observed for spending on x-ray, ECG, pathological tests from 1993 to 2007–08. Doctor's/surgeon's fee has increased from 11.9 to 51.7% for adults and for older adults the increment is from 11.8 to 28%.

Among children, a significant increase of 21% in hospital and nursing home charges is observed from the period 1993 to 2007–08, likewise percent spent by households on adults for hospital and nursing home charges has increased over time. For both the males and females, the scenario of change in the expenditure pattern over the period is same. It is observed that expenditure on all medical items among children has reduced over time except hospital and nursing home charges, because of the fact that the delivery cost of new borns in private hospitals is substantially high. However, spending on all the health items for adults and older adults in households has increased from 1993 to 2007–08 due to the shift in the composition of adult and older adult population.

Linear Regression Analysis for Health Expenditure

Multicollinearity of predictors of health expenditure considered in the analysis is tested by calculating variance inflation factor (VIF) and values numerically are close to one for most variables suggesting absence of multicollinearity among them. Residual analysis also shows that error is distributed around zero mean and distribution is normal.

The result of linear regression analysis reveals that age, sex, sector, household size, caste, education, monthly percapita expenditure and regions are strong determinants of health care expenditure. Many of the predictor variables are statistically significantly associated with health expenditure in all the surveys. Table 4 shows that spending on health care in 1999–00 is 0.3167 units ($p < 0.01$) and in 2007–08 is 0.2749 units ($p < 0.01$) more than 1993 which indicates that health care expenditure is increasing over time. It is observed that in all the survey periods, expenditure on adults and older adults is more than the children. In 1993, health care expenditure among adults and older adults was 0.5658 units($p < 0.01$) and 1.3896 units ($p < 0.01$) more than the children. Likewise, in 2007–08 it is noticed that expenditure on adults and older adults are respectively 0.8079 and 1.4864 units morecompared to children. Though female population composition has been increasing over the period, it is noticed that in all the surveys, spending on females is less than males. It is also observed that higher caste groups have higher spending on healthcare than the

Table 3 Age-sex wise distribution of household expenditure on medical items for three points of time, 1993, 1999–00 & 2007–08

	1993			1999–00			2007–08		
Total	0–14	15–59	60 & above	0–14	15–59	60 & above	0–14	15–59	60 & above
Medicine	23.6	59.2	17.2	20.1	60.1	19.8	0.3	75.0	24.7
X-ray, ECG, pathological test, etc	15.2	83.3	1.5	12.8	73.4	13.8	5.8	65.3	28.9
Doctor's/surgeon's fee	76.3	11.9	11.8	52.8	23.0	24.2	20.3	51.7	28.0
Hospital & nursing home charges	1.4	66.2	32.4	3.4	66.8	29.7	22.3	69.3	8.4
Other medical expenses	0.4	46.2	53.4	2.4	51.2	46.4	3.5	68.7	27.8
Male									
Medicine	25.2	58.2	16.5	19.7	60.4	19.9	0.4	77.7	21.9
X-ray, ECG, pathological test, etc	16.4	80.6	3.0	13.2	71.0	15.8	7.7	65.1	27.2
Doctor's/surgeon's fee	74.7	12.5	12.8	56.2	24.5	19.3	21.4	54.5	24.1
Hospital & nursing home charges	7.0	72.7	20.3	12.1	69.6	18.3	32.7	59.3	8.0
Other medical expenses	0.7	48.8	50.5	2.1	50.2	47.7	3.7	65.4	30.9
Female									
Medicine	21.7	63.2	15.1	17.2	64.3	19.5	0.3	74.4	25.3
X-ray, ECG, pathological test, etc	14.3	82.4	3.3	11.5	72.9	15.6	6.2	64.7	29.1
Doctor's/surgeon's fee	75.8	13.4	10.8	51.6	25.0	23.4	22.2	51.7	26.1
Hospital & nursing home charges	3.5	65.9	30.6	10.7	66.6	22.7	20.1	72.3	7.6
Other medical expenses	0.5	43.5	56.0	1.8	53.2	45.0	4.6	66.2	29.2

Table 4 Result of Linear Regression Analysis for Log of Healthcare Expenditure

	1993	1999–00	2007–08	Pulled Data
Age				
0–14®				
15–59	0.5658***	0.0237	1.8923***	0.8079***
60 & above	1.3896***	0.5108***	2.5169***	1.4864***
Sex				
Male®				
Female	-0.0623*	-0.0837	-0.0678*	-0.0216
Sector				
Rural®				
Urban	0.0166	0.2338***	0.1219**	0.0881**
Household size	-0.0557***	-0.0400***	-0.0749***	-0.0758***
Caste				
SC/ST®				
Others	0.1139**	0.1692**	0.1399**	0.1894***
Education				
Illiterate®				
literate	-0.1356***	-0.1912***	-0.0816*	-0.0416
MPCE	0.0001***	0.0011***	0.0002***	0.0003***
Region				
North®				
West	-0.0828	-0.0411	-0.2066**	-0.1637***
South	-0.3784***	0.1164	-0.1978**	-0.2595***
Central	0.0160	0.1705*	0.0315	-0.0360
East	-0.1658***	-0.1821**	-0.4343***	-0.4026***
North-east	-0.4763***	-1.1510***	-0.3238***	-0.5866***
Time				
1993®				
1999–00				0.3167***
2007–08				0.2749***
Constant	1.1961	1.4860	0.5091	1.4594

® Reference category

***P < 0.01; **p < 0.05; *p < 0.10

scheduled castes/ scheduled tribes do. Spending on health care in urban areas are 0.0166, 0.2338 and 0.1219 units more compared to rural areas for 1993, 1999–00 and 2007–08 respectively. As the household size increases, health care expenditure reduces by 0.0557, 0.0400, 0.0749 units correspondingly for the period 1993, 1999–00 and 2007–08. On the contrary, with the increase in monthly per capita expenditure, health care expenditure also increases. It is clear from the Table 4 that expenditure on adults and older adults is increasing over time, hence it can be said that health care expenditure is strongly associated with age structure of the population.

Result of Decomposition Analysis

The result of decomposition analysis is presented in Table 5 in terms of magnitude and direction of change associated with the covariates included in the study: age, sex, place of residence, marital status, caste, education and occupation. The change in the direction in the rates shows an inclining or declining trend among different subgroups with respect to the respective reference categories. In case of health expenditure during the time period between 1993 and 1999–00, and between 1999–00 and 2007–08, it is observed that for sex and education, the sign of rate is negative which indicates that expenditure among females is less than males, and as educational qualification increases, expenditure on health decreases among the population.

Change in the composition refers to a structural change in the population. Yet again, the result depicts whether the shift in the socio-economic and demographic composition has made a significant contribution to the overall change in health expenditure. The table depicts that with a compositional change in age, i.e. with an increase in the proportion of the older adult population, the health expenditure has increased from 1993 to 1999–00 and also from 1999–00 to 2007–08. It is interesting to observe that composition of the female population has increased from the first to the second survey period, however, the health expenditure has decreased. It is also noticed that with increase in composition of educated population, the expenditure has declined from 1993 to 1999–00 and from 1999–00 to 2007–08. The plausible explanation of this finding is that, with improving education, awareness of health and hygiene increases among the population. Therefore, educated people take more precautions and have fewer chances to experience health hazard. With the increase in household size, health care expenditure has reduced over time. Hence, it can be concluded that the change in age-sex and socio-economic composition of the population has a significant impact on the change in health expenditure pattern over time.

Table 5 Decomposition of Change in Healthcare Expenditure in India, 1993–2008

Factors	1993–99			1999–2007			1993–2007		
	R	**C**	**I**	**R**	**C**	**I**	**R**	**C**	**I**
Age	-0.3825	0.0049	-0.0175	-0.5428	0.7306	-0.5150	-0.4865	0.5104	-0.3188
Sex	-0.0103	-0.0001	0.0000	0.0001	-0.0733	0.0003	0.0002	-0.0630	0.0005
Sector	0.0815	0.0051	0.0047	-0.0076	-0.0350	0.0070	-0.0050	0.0329	-0.0043
Education	-0.0342	-0.0153	-0.0045	-0.0078	-0.0779	0.0105	-0.0144	-0.0384	0.0095
Caste	0.0406	0.0083	0.0027	-0.0007	-0.0214	0.0001	0.0061	0.0189	0.0011
Household size	0.1007	-0.0023	0.0009	0.0153	-0.2163	0.0072	0.0110	-0.1187	0.0028
MPCE	0.7445	-32.6228	-32.1315	0.0914	-136.8350	-61.6963	0.1534	-1.8612	-1.4079
Regions	0.0464	0.0105	0.0018	-0.0010	-0.2892	-0.2274	0.0015	0.1251	0.1345
Total	**0.59**	**-32.61**	**-32.14**	**-0.45**	**-136.82**	**-62.41**	**-0.33**	**-1.39**	**-1.58**

R rate, *C* composition, *I* interaction

Discussion

The current study shows that in India, the changing household age-sex and socio-economic composition influences health expenditure patterns. The findings show that when spending on non-food items and education has increased, household share for food items has substantially declined over time. Though, the household share on health spending has increased over the period from 1993 to 2007–08, it is negligible compared to other food and non-food expenditure. Spending on health care services is highly concentrated among a small proportion of people with very high use for all the surveys and per capita spending on this particular group has increased three times from 1993 to 2007–08. The health spending has become slightly less concentrated over time as high spending has spread to a broader swatch of the population. Findings also reveal that the distribution of child population has declined, however the share for adult and older adult population has substantially increased from 1993 to 2007–08. Distribution of health care expenditure for different age groups has changed over time, where household share for children has reduced and for adults and older adults has increased and the change in the spending pattern is same for both the males and females during this period. Spending on health care has declined for male and female children and increased for male and female adults as well as older adults. Nevertheless, percent increase in household health care expenditure among male older adults is more than the female.

The average monthly household health expenditure on children is relatively high in 1999–00 than 1993 and declined in 2007–08. In the third survey households with more than three children spend less compared to the households without any child or with one child. The average health expenditure of households is increasing with the increase in number of adults living in the house in all the surveys. Since the percentage of households with more than three adults has increased over the time a considerable increase in household health expenditure on adults is observed over time. The average monthly health expenditure of households with more number of older adults is substantially high as compared to households without or less number of older adults during all the survey period.

Expenditure patterns on different health items like medicine, x-ray, ECG, pathological tests, doctor's/surgeon's fee, hospital & nursing home charges, and other medical expenses among the children, adults and older adults have changed over the period. The change indicates a shift in the share of medicine, various pathological tests, doctor's fee and hospital charges from 1993 to 2007–08. The household share on medicine is considerably high than the other health items in all the surveys and has increased over the period. Expenditure on pathological tests and doctor's/surgeon's fee has also substantially increased from 1993 to 2007–08. Percent spent on children for most of the medical items has reduced except hospital and nursing home charges, due to the fact that delivery cost in private hospitals is considerably high. However, the spending on all the health items has increased for adults and older adults specially for medicine, X-ray, ECG, pathological test, and Doctor's/surgeon's fee.

Results from multivariate analysis indicate that age and sex, sector, household size, caste, monthly percapita expenditure are the significant factors of health care expenditure. In all the survey periods household health care spending is more among adults and older adults than the children. It is observed that health care expenditure on females is less as compared to males, which is a matter of concern as the female population composition has increased over the period. Further, people higher caste/ groups, urban areas spend more on health care than their counterparts. The findings also reveal that health care expenditure increases with increase in household percapita expenditure and decreases with increase in household size. From the decomposition analysis, it was observed that with a compositional change in age, i.e. with the shift in the proportion of adult and older adult population, the health expenditure has increased over the period. However, with the shift in the composition of the female population, the health expenditure has declined from 1993 to 2007–08. Results from decomposition analysis signify that the change in household age-sex composition significantly influence the change in health care expenditure pattern.

Conclusion

The impact of an ageing population on health care expenditure is an issue of increasing importance for health policy in all the developed and developing countries over the time. Population ageing is often referred to as an explanation for the ever growing demand for health care resources in terms of health expenditure. The demographic transition resulting in increasing adult and older adult population in India gives a prelude to a new set of medical, social and economic problems that could arise if timely initiative in this direction is not taken by the program managers and policy makers.

Despite various National Health Programmes, older adults belonging to lower class had to spend on medical and diagnostic services that are not available in government health facilities in rural and remote areas (Shukla et al., 2016). A study on older adults in the rural and urban areas of Lucknow provides evidence of high catastrophic health expenditure among low- income group compared to the high-income group (Pandey & Singh, 2017). Most of India's older adults and women are economically dependent, and government health care expenditure is negligible and cost of treatment is often a burden on the household. Hence, there is a need for expansion of social and community services for older adults and women, and enhancement in their accessibility and use by making the services as client oriented and user friendly. It can be done by subsidizing health care costs in terms of reduction in the cost of medicines, doctors' fee, pathological tests and hospital charges. Secondly, provision for separate queues and reservation of beds for older adult patients in hospitals and nursing homes. Thirdly, effective execution of strong social security options to manage the bare necessities for older adults through day care centres, engaging them in community activities. Furthermore, providing transportation facilities, legal and financial support with special attention to older adult women who are less privileged than men.

Finally, education and awareness of the family and community are help in preventing social isolation of the older adults which further protects them from health hazards.

Limitations

As the data sets used for the study provides information on expenditure for food, non-food, education and health at household level, various methods were adopted for the allocation of household expenditure to individual members. The study lacks the information on income of the households as well as individuals to understand the dynamics of income over time which would have given a more evened approach to this research.

Implications

In India there are dearth of studies on consumption expenditure related to household composition. Research on the changing health care expenditure patter is limited in the Indian context. The findings from this study indicate a strong influence of changing household age-sex composition on health care expenditure pattern. Also it is expected by the researchers that the demographic structure of India is going to change over time. Hence, there is a scope for further research in coming decades on changing household age-sex composition and health care expenditure pattern in India.

Declarations

Conflict of Interests The Authors declare that there is no conflict of interest.

Informed Consent Since the study is based on secondary data, informed consent is not obtained from individual participants in the study.

Ethical treatment of Experimental Subjects (Animal and Human) This article does not contain any studies with human participants performed by any of the authors.

Ethical Statement The study is based on publicly available data and no ethical issues are involved.

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