Implications of Age Profile of Healthcare Expenditure and Age Structural Transition on Future Healthcare Spending in India

Abstract:

This study sheds height on implication of changing demographics, particularly of gradual population ageing in India on burden of healthcare cost as share of the gross domestic product. The key input is estimating the age patterns of healthcare cost by integrating inpatient and outpatient costs from the unit level data of National Sample Survey and linking these with trend in aggregate level healthcare expenditure from the National Account Statistics and Population projection of the United Nations, and finally examining the population ageing effects on future healthcare cost. Findings reveal that the growth of age-compositional index on healthcare cost shall increase from 0.5% in 2005 to 0.8% in 2025 and shall stagnant afterwards. However, age-compositional effect on GDP may drop from 0.6% to 0.4% during the same period. The findings of the study are crucial for evolving a sustainable healthcare support system in view of the impending population ageing in India.

Key words: Healthcare expenditure, age structural transition, population ageing

1. INTRODUCTION:

Healthcare cost is age dependent, after the high cost in the first year of life, it is lowest for children, rise slowly throughout adult life, and increase exponentially after age 50 (Meerding et al., 1998). Bradford and Max (1996) found that annual costs for the elderly health care are-four to five times than these in early times. A number of studies Colombier and Weber (2010), Labitz et al (2003), Ruggeri (2002), OECD (2006), Pammolli et al (2008), Ogawa et al. (2009) and Johnston and Teasdale (1999) among others have identified are share of elderly as a key driver of healthcare cost. Ladusingh and Pandey (2013) have provided evidence that hospitalisation cost of decedents is much higher than that of survivors throughout the life course. For developing country such as India, which is experiencing gradual ageing with proportion of 60 and above population expected to increase from 7.7 percent in 2010 to 18.3 percent in 2050 (United Nations World Population Prospects, 2012), the aforesaid findings has alarming implications in meeting health care needs of the population. Forecasting expected magnitude of monetary implication of impending population ageing in India is crucial for evolving a sustainable long-term healthcare cost and project healthcare cost.

Though on the contrary a number of studies, in particular by Zweifel et al (1999), Felder et al (2000) and Seshamani and Gray (2004) have negated the view that populating ageing increases the burden of healthcare cots controlling for proximity to death, the present study is not intended to prove disprove either of two schools of approach. The findings of the study shall serve as wakeup call to the stake holders about the gravity of preparedness required to support the healthcare cost of gradually ageing population of India.

The study is pertinent from Indian context not only from the point of view of changing demographics but also from the consideration of growing share of out-of-pocket expenditure in the total healthcare expenditure. As the share of older population grows, health spending also will grow due to the double burden of disease from the morbidity expansion during the epidemiological transition (Crimmins et al., 1994; 1996; 1997; Andrews 2001). The second important factor is the rising cost of healthcare regardless of age and demand for high and healthcare products and services.

India's share in burden of non-communicable disease shall also increase with the ongoing epidemiological transition. The projection of burden of disease shown in Table-1 provides statistics for South Asian region that can reflect the closest Indian situation. Share of age 60 years and over in disability adjusted life years (DALYs) of south Asian region shall increase from 15 to 22 percent. Moreover, DALYs among elderly from this region shall contribute by 23 percent in 2015 and 24 percent in 2030, to DALYs among elderly from the World. Studies revealed that extended years of life gained by the increase in life expectancy are translating in poor health state, and there is morbidity expansion during the epidemiological transition (Crimmins et al., 1997; Andrews 2001). However, Visaria (2004) revealed that India will face the 'double burden of disease', that is, degenerative

ailments will grow, and on the other hand, major infectious disease will remain serious health problems.

Table-1: A comparative scenario of population ageing and health in India and World

Indicators	2015	2030	2015	2030	2015	2030
	India		World		India's share (%)	
Population (60+) (%)*	8.7	12.3	13.7	18.5	12.1	13.1
Life expectancy at birth*	67.4	71	70.4	73.3	--	--
Life expectancy at age 60*						
Old age dependency ratio (%)*	8	12	13	18	--	--
	South Asia		World		South Asia's share (%)	
Share of age 60 and over in DALYs (%)#	15.3	22.0	18.5	25.3	23	24
Burden of Non communicable disease in 60+ aged #						
DALYs (billion)#	50	72	235	315	21	23
DALY (%)#	86	89	90	91	--	--

Note: DALYs: Disability adjusted life years (The DALY combines in one measure the time lived with disability and the time lost due to premature mortality); ##contribution of DALYs due to non-communicable disease in total DALYs,
Sources: *Authors compilation from World Population Prospects (2010, revision), United Nations
#Authors compilation from Projection of mortality and global burden of disease, 2004-2030, World Health Organisation (2004)

Identifying the role of population age structure in prospects of health spending may give useful information for policy and planning perspectives for graying population. Further, linking the longevity improvements with HCE per-capita may unearth in understanding of the healthy population ageing. The study first presents the past trends in healthcare spending from public and private source. Therefore, the present paper contribute to estimate age-specific HCE by combining expenditures from both the components that is, inpatient and outpatient care for the year 2004-05 for India and states. Further, by using the estimated age profile of health spending, we examine the role of age structural change in future healthcare spending.

2. METHODOLOGY

***2.1 Data sources*:** The study utilises the following listed data sources for the projections:

2.1.1 Population age structure: We use the age-sex population structure for the period of 1990-2050, by five year age groups of the population from the United Nations World Population Prospects (The 2012 revision). In addition, we gather state wise age-population data from the report by Office of the Registrar General and Census Commissioner, Government of India (ORGI, 2006).

2.1.2 Healthcare expenditure at aggregate level: Data on *Public health care expenditure* at macro level is collected from the various reports on National Accounts Statistics (Ministry of Statistics & Programme Implementation, 2011, 2011a) that compile data from various sources from the state budget documents and central Ministries/Departments. The *private sector health expenditure* includes Out of Pocket (OOP) expenditure incurred by households for availing health care services, health

expenditure through insurance mechanism and expenditure by corporate bodies on their employees and families. In the present study, OOP that merely contributes major part of private health care expenditure is considered as private health spending.

2.1.3 Age-specific per capita health expenditure: We estimate per capita health expenditure for five years age groups by summing up age-specific per capita expenditure for different components of health care namely, inpatient, outpatients, health insurance premium, antenatal, delivery, post-natal care, child immunisation and family planning and have been calculated using 60th round of National Sample Survey (NSSO, 2006). This survey covered 73,868 households spread across all the states and union territories of India. Information on the utilisation of health care services by households for both hospitalised and non-hospitalised treatments by type of service provider, nature of ailment and a number of related characteristics have been collected through this survey. The reference period for data collection was 15 days for non-hospitalised cases and 365 days for hospitalised cases and all other components.

We estimate per capita health expenditure (PCHE) by five years broad age groups for the different health components such as, in-patients, outpatients, maternal and child health (antenatal, institutional delivery, postnatal and immunisation), family planning as given in the framework of National Health Account of Ministry of Health & Family Welfare (MoHFW, 2009). First, we estimate expenditure per person reporting ailment and per person hospitalised by five years age groups. Then estimate health expenditure for the year 2004 by multiplying the average in-patient and outpatient expenditures with the estimated number of in-patients and outpatients. Further, we follow the similar procedure for estimating each component (ANC, PNC, Delivery, and Immunisation) of OOP except expenditure on family planning. For per capita health on family planning, we use aggregate levels expenditure given in National Account Statistics (2004-05) and then allocate it by the age-specific contraception prevalence rates taken from National Family Health Survey-3 (NFHS-3, 2005-06). The aggregate per capita expenditure for the year 2004 is arrived at 8.15 billion Indian rupees and its summation at 914.89 billion, which is again adjusted with 955.60 billion (MoHFW, 2009), finally, per capita household expenditure is 851 rupees for the year 2004-05. We follow the similar pattern for the states of India, and use cubic spline to smooth the age-specific PCHE.

2.1.4 Gross Domestic Product (GDP): GDP at factor cost at year 2004-05 prices is taken from Macro Economic Aggregate and Population from National Account Statistics Back Series 2011 (Ministry of Statistics and Programme Implementation, 2011).

***2.2 Methods*:** First, we analyse the trends of healthcare expenditure per capita and as share of GDP for the period of post economic reform 1993 onwards and disaggregated by public-and private sources. We estimate age-specific healthcare expenditure per capita for India and states. To measure the

implication of age-profile of health spending and age structural transition on future healthcare expenditure, we calculate the Age Composition Index from the following formulae:

$$\text{AgeCopIndex}_{t} = \frac{\sum_i \text{Pop}_{it} \times \text{HCE}_{it}}{P_t}$$

Where, HCE_{it} is per capita health spending in i^{th} age group at time t, we assume age profile will remain same as in 2004-05 over the projection period.

Johnston et al (1999) and CBO (2007) used this age-compositional index to project future healthcare cost using the following formula:

$$\text{HCE per capita}_t = \text{HCE per capita}_{t-1} \times \frac{\text{AgeCopIndex}_{t}}{\text{AgeCopIndex}_{t-1}} \times (1 + x_t)$$

$$\text{Where, } x_t = \frac{\text{Health cost per capita}_t}{\text{health cost per capita}_{t-1}} \times \frac{\text{AgeCopIndex}_{t}}{\text{AgeCopIndex}_{t-1}} - 1$$

Is the historical excess growth of health spending per-capita, in other words, this excess growth exclude age-compositional effects on healthcare cost.

In similar way, age-compositional effects on GDP can be defined as: $\text{AgeCopIndex}_{t} = \frac{\sum_i \text{Pop}_{it} \times \text{GDP}_{it}}{P_t}$

GDP_{it} is per capita GDP contributed by i^{th} age group at time t, we have assumed age profile will remain same as in 2004-05 over the projection period. Age profile of GDP is calculated by the product of age-specific working population proportion and aggregate GDP.

Finally, paper presents the future growth of age-compositional index for healthcare expenditure and GDP. We assume, age profile of health per capita cost and GDP per capita will remain same as estimated in 2004-05 over the projection period. In addition, age profile of public health expenditure is assumed same as that of private.

All expenditure and income data has been taken at 2004-05 price to remove effect of inflation on the historical growth. We get private HCE and GDP per capita at 2004-05 prices from ministerial report (MoSPI, 2011 2011a). However, the wholesale Price Index are used to calculate HCE from public sources at 2004-05 prices.

3. FINDINGS AND DISCUSSION:

3.1 India's changing population age structure: According to UN World Population long-term projections (The 2012 revision), the population of India will continue to grow, and is expected to reach by 1.62 billion by 2050. Old age proportion to total population shall increase from 7.7 in 2010 to 18.3 in 2050. Moreover, the age structural transition is greatly varied by gender and, 60 years and above aged female's population growth is higher than that for the male. Sex ratio among elderly of above age 60 years will increase from 1066 to 1130 females per thousand males during 2000-50.

Population age structural transitions from 2001 to 2026 by states of India can be notice from Table-. Kerala constitutes the highest percentage of elderly with 10.6 percent in 2001, followed by, Tamil Nadu (9 percent), Himachal Pradesh (8.8 percent), Punjab (8.7 percent), Maharashtra (8.3 percent) and Orissa (7.8 percent). By 2026, Kerala remains at first rank with 18.3 percent of elderly followed by, Tamil Nadu (17.1 percent), Himachal Pradesh (14.7 percent), Karnataka and Punjab (14.5 percent), Andhra Pradesh and West Bengal (14.2 percent). Population of 15-59 years age will increase with the highest pace in Bihar, followed by, Rajasthan, Haryana and Uttar Pradesh. Moreover, the highest decline in below age 15 years population is expected in the state of Kerala followed by, Uttar Pradesh, Tamil Nadu, Delhi, Madhya Pradesh, Chhattisgarh and Uttarakhand.

3.2 Overview of the health care spending (1993-2009): Financing health is one of the critical determinants of health outcomes in a country. Public support in terms of financing health has a key role in policy implications for greying population. In India, health expenditure from all the sources was 4.25 percent (0.84% from public, 3.32% from private, & 0.1% from external flow) of Gross Domestic Product (National Health Account, 2009) during 2004–05. Of the total health expenditure, the share of private sector was the maximum with 78.05 percent on while from the public sector it was 19.67 percent.

Table-2: Trends of health care expenditure in India, 1993-2009.

		Public[2]		Private[3]				HE as % GDP		
Year (Base year, 2004)	Population (Cr)[1]	HE (Cr)	HE per capita	HE (Cr)	HE per capita	GDP[4] (Cr)	GDP per capita	Public	Private	Total
1993-94	89	15597	175	32278	362	1522343	17067	1.0	2.1	3.1
1994-95	91	16522	182	35956	395	1619694	17799	1.0	2.2	3.2
1995-96	93	16017	173	40023	431	1737740	18726	0.9	2.3	3.2
1996-97	95	16639	176	44393	469	1876319	19834	0.9	2.4	3.3
1997-98	96	18275	190	49240	511	1957031	20301	0.9	2.5	3.4
1998-99	98	20394	207	54635	556	2087827	21239	1.0	2.6	3.6
1999-00	100	22542	225	61246	612	2246276	22440	1.0	2.7	3.7
2000-01	102	22755	223	62436	613	2342774	22991	1.0	2.7	3.6
2001-02	104	21891	210	73760	709	2472052	23770	0.9	3.0	3.9
2002-03	106	23954	227	78209	741	2570690	24344	0.9	3.0	4.0
2003-04	107	24550	229	82889	773	2777813	25912	0.9	3.0	3.9
2004-05	109	26313	242	95560	878	2971464	27286	0.9	3.2	4.1
2005-06	111	34446	311	105244	952	3254216	29423	1.1	3.2	4.3
2006-07	112	40679	363	115900	1033	3566011	31783	1.1	3.3	4.4
2007-08	114	48685	428	127648	1122	3898958	34261	1.2	3.3	4.5
2008-09	115	58681	509	140595	1218	4162509	36070	1.4	3.4	4.8
2009-10	117			154900	1324	4493743	38408		3.4	

Note: Cr. is one crore=10000000, figures are in Indian rupees. All expenditures are at 2004-05 price.

Sources:[1] CSO , [2] , [3] MOSPI (2011): Statement 8-9, [4]MOSPI (2011): Statement 1,2,3

Past trends of health spending in the post-economic reform period of 1992-93 (Table-1) suggest that although, health spending as a percentage of GDP is quite low in India, it is showing a gradual increase 1992 onwards. At the price of 2004-05, per capita health expenditure has been increased from INR 537 (INR 175 from public & INR 362 from private) to INR 1727 (INR 509 from public & INR 1218 from private) during 1993-2008. Health spending share in GDP has risen from 3.1 to 4.8 percent (1.0 to 1.4% for public & 2.1 to 3.4 % for private) during the same period.

There is a significant gap between household and public health spending throughout the period. However, in recent years public expenditure has shown a higher increase owing to inception of National Rural Health Mission programme by central government in 2005. The average annual excess growth of HCE per capita to GDP per capita has been 3 percent during 1992-2008.

3.3 Age pattern of per capita health care expenditure: Figure-1 shows the age profile of per capita and real health expenditure in India. Per capita heath spending is the highest for the age group 0-4 (INR 947) and reduces to INR 343 for the age group 10-14, afterwards it increases steadily and is the highest level for the age group 70-74 (INR 4907). On the other hand, overall health expenditure is higher for the younger ages and lowers down with the age advancement from 15 to 74, afterwards declines rapidly. Overall health spending is at the highest level for the age group of 0-4 followed by, 25-29 and 45-49. The higher per capita health expenditure in older ages revealing positive association of age and poor health status and consequently more health spending in old age than young ages. This may need a simultaneous future growth of health spending as the higher prevalence of morbidity among elderly causes elevated health expenditure, which turns into more requirement of money under the assumption that the elderly will seek treatment equally to younger.

Figure-1: Age pattern of Health Expenditure, 2004-05

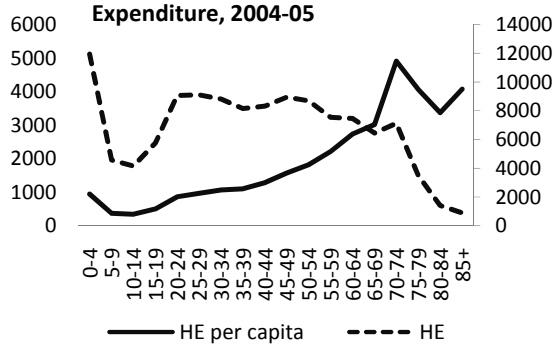
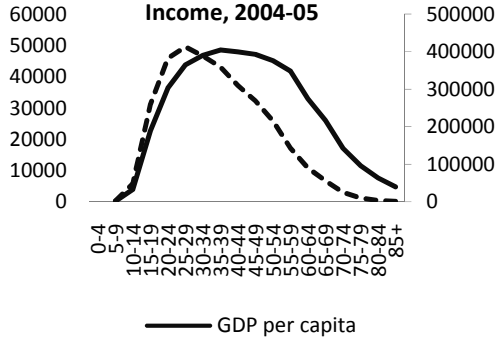


Figure-2: Age profile of labour Income, 2004-05



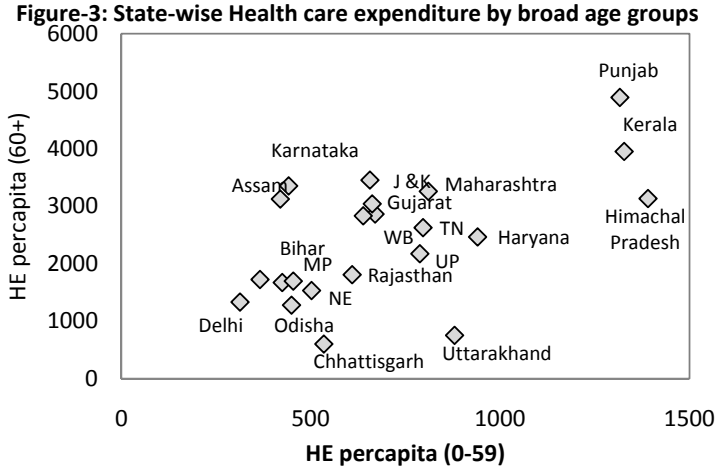
We distribute GDP into all age groups according to age-specific work participation rates and define it as age-specific labour income or GDP per capita from age groups. The product of age-specific labour income with the age-specific population is the overall GDP attributed by these age groups. Figure-2

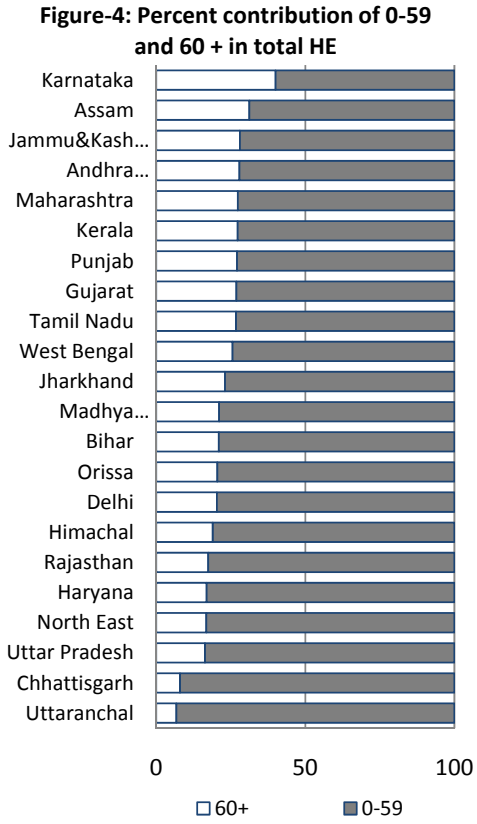
reveals that labour income is the highest from the age group of 35-39 (INR 48518), which declines afterwards. However, the age group 25-29 has the highest contribution (INR 412572 Cr.) to the overall GDP. Considering this age pattern as the base for projections of GDP per capita, the future age structural transition can be implicated by assuming same age-specific work participation rates in forthcoming years.

3.4 Health expenditure by states: The age specific HE per-capita is calculated in all of the states (*see appendix*). In almost all of the states (except Uttarakhand), the positive relationship between HE per-capita and age is observed. The higher HE in older ages can be result of higher levels of morbidity or higher percentage of treatment seeking behaviour. Interestingly, most of the states are showing the increasing age-compositional effects on health spending during 2005-25 (*see appendix A 2*). Among all states, Assam and Punjab have shown the highest increase during the same period. However, the states of Uttar Pradesh, Rajasthan, Odisha and Jharkhand have shown the lower age-compositional effect on health spending.

During 2004-05, HE per-capita among elderly in Punjab is more than three thousands INR, followed by, Kerala, J&K, Karnataka, Maharashtra, Himachal Pradesh, and Gujarat where it is higher than three thousand rupees (figure-3). On the other hand, the lowest per capita health spending is observed to be in Chhattisgarh (INR 600), followed by Uttarakhand, Odisha and Delhi. For the population below age sixty, it was at the highest in Himachal Pradesh, followed by Kerala and Punjab and the lowest was in Delhi, Jharkhand, Assam and Bihar.

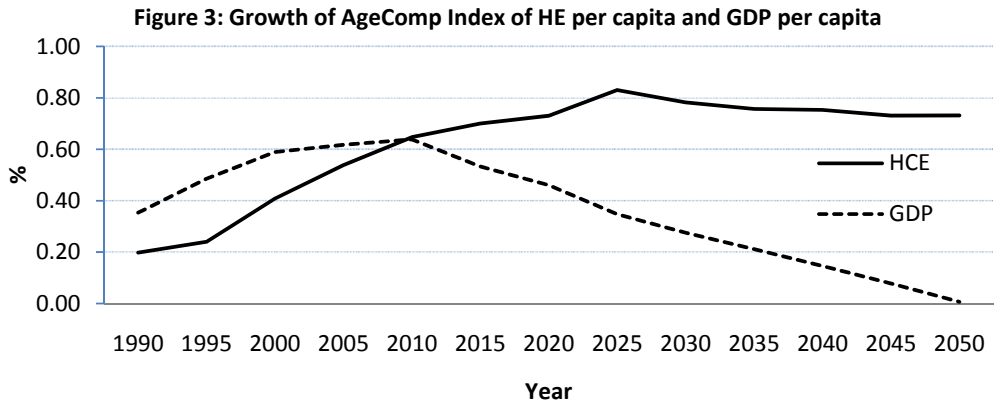
Figure-3: State-wise Health care expenditure by broad age groups





Age specific distribution of HE per-capita is presented in figure-4. The states of Karnataka and Assam have higher contribution of health expenditure on older ages (30 percent) in total health spending, on the other hand, Uttarakhand and Chhattisgarh have the lowest (10 percent) contribution of elderly expenditure in total health spending.

***3.5 Implications of age structural transition on future healthcare spending*:** We calculate ageing adjustment to health spending (*AgeCompIndex*) by holding everything, except age structure constant from one year to the next. The projected growth of ageing adjustment to health expenditure per capita and GDP per capita growth are shown in figure-3. Ageing effect on health spending shall increase from 0.5 percent in 2005 to 0.8 percent in 2025 and afterwards it becomes stagnant. On the other hand, as elderly contributes lesser than working age groups, on the other hand, Indian population contributes a large young age population that promote to higher GDP. Future increase of elderly proportion may affects future GDP negatively. Therefore, age structural transition effect to GDP per capita growth are showing steadily decline from 0.6 percent in 2005 to 0.4 percent in 2025 and 0.01 percent in 2050.



***3.6 Sensitivity to change in per-capita health cost by age*:** Our projections assume the per capita healthcare cost and productivity by age in forthcoming years will be same as observed in 2004-05 (figure-1). If elderly health conditions improve with the medical technology advancement, environmental conditions and nutritional levels in the future they may live healthier remaining years of life that may lead to shift health spending to very older ages and lower the total health spending. Johnston and Teasdale (1999) also concluded that increase in life expectancy would reduce the projected per capita costs for those aged 65 years and over. On the other hand, health conditions of elders may worsen in the future which may lead to higher health spending. The available literature suggest that with the longevity improvements in India, health conditions of aged has worsened (Andrews, 2001), therefore, if this trend follow in future (table 1), India's possible future HCE will be at a higher level. Health seeking behaviour by age may also change over the period and elderly usually are at disadvantage in seeking treatment in compare to young population in a less economy setting. Increasing awareness, income and savings should result in equality of treatment seeking behaviour by age, which further shall support in enhancing overall future health spending in India.

We test the longevity hypothesis at state level data and find the state wise health expenditure positively correlated with the life expectancy at age sixty. The states with higher longevity are showing higher contribution of health expenditure, Punjab and Kerala are emerging with the highest growth of health spending.

3.7 Sensitivity to changes in population projections: Our projections of age-compositional index are based on medium variant population projections, however, if we project these by taking low fertility and mortality assumptions (relatively older projected population), it will promote marginally to health spending. On the other hand, under this scenario, present young population is large which will continue to encourage higher GDP, and consequently, ageing effects on health spending are only visible after 2045. In the second scenario that is, with high fertility and mortality assumption (relatively young population in the future), ageing effects will be very minimal.

4. CONCLUSIONS:

Health care expenditure in a country can be determined by the health status, socio-economic factors and demographic factors, cost of treatment, pharmaceutical, medical technology, health insurance and public policy. Health spending as percentage of GDP is quite low in India, however, showing the increasing trends over the past. The HE per-capita has increased from INR 175 to INR 509 in public and INR 362 to INR 1218 in private sources during 1993-2008. As the percentage of GDP, HE has rose from 3.1 in 1993-94 to 4.8 percent in 2008-09. In recent years, public health spending as percentage of GDP has boosted up relatively faster than private source.

Age profile clearly shows relatively higher health expenditure in older ages unveiling positive association of age and poor health status. Since India's population is large in younger ages therefore, total health expenditure is higher among young ages and slightly lowers down with the age advancement. Population ageing will encourage growth of future health spending, though its effects are low. As excess growth of HCE which may be attributed to pharmaceutical and medical advancement and productivity is quite high (8 percent). Ageing adjustment to HCE was 0.5 in 2005 that will increase to 0.8 in 2025 and thereafter will be stagnant. Further, this adjustment will receive a high growth during 2020-25.

Age structural changes are widely varied by sex, place of residence and in the diverse states of India. Therefore, with the age structural transition, growing need and availability of support system for greying population has a key role in policy for old aged people. The main policy concern, in the anticipation of steady increase in absolute number of population aged 60 and over years, is in providing social assistance and long term care, which may go far beyond the carrying capacity of the working age population. Public support in terms of financing health, pension and other social security should increase to meet the age structural prospects in the country.

The present paper has determined the role of age structural transition and age profile of health spending on future health spending. The study the shows the prospects of age-compositional index under the possible scenarios and discuss the longevity improvements effects on the future health spending. Different scenarios suggest that health spending is incredibly sensitive to change in per capita cost by age, however, future health spending is found to be less sensitive to population change. We discuss the longevity improvements may not reduce the future healthcare cost by shifting the cost in very old age, as the other factors such as changing morbidity pattern and treatment seeking behaviour by age may encounter these effects. Moreover, we conclude public share on health spending is quite low which should enhance to incorporate population ageing in India.

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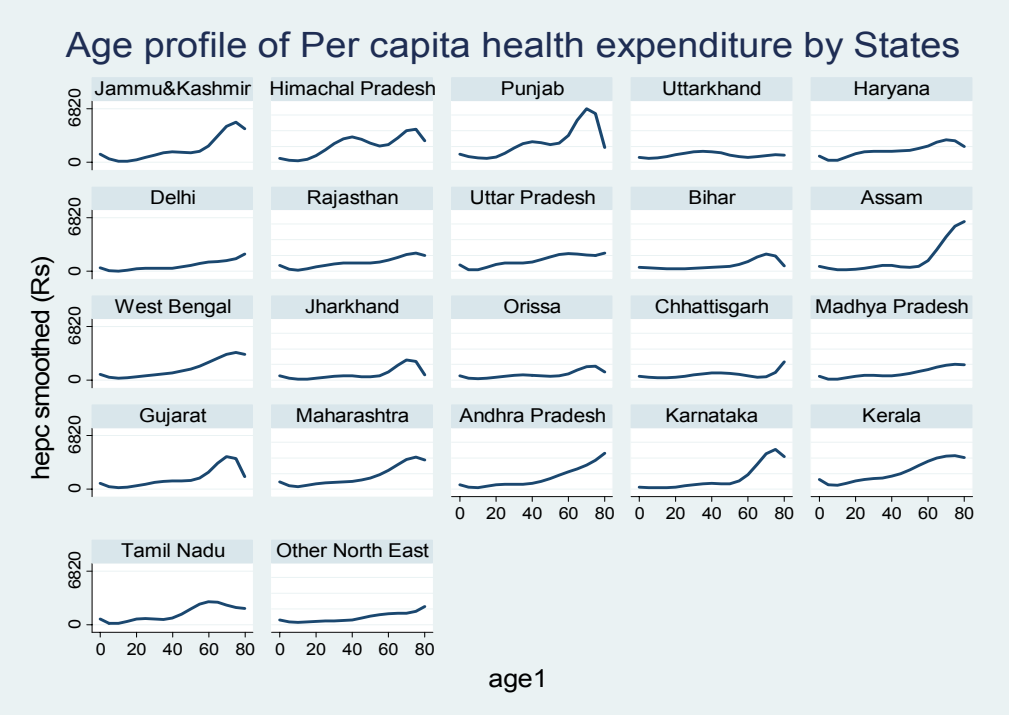
Appendix



Note: Northeastern (excluding Assam) states are combined

A : Per capita health expenditure (OOP) by age and by its components

Per Capita expenditure by age group											
Age group	**In-Patient**	**Out-Patient**	**insurance/ premium**	**Abortion**	**Immunisation**	**Delivery**	**Anti-natal**	**Post-natal**	**Family Planning**	**Medical attendant at death**	**Total**
0-4	71	592	3		39						705
5-9	33	244	2								279
10-14	41	205	2								249
15-19	78	250	3			62.5	50.5	21.0	6.5		472
20-24	138	290	4			71.4	69.9	21.5	25.8		620
25-29	141	362	6			42.9	38.0	12.4	44.2		647
30-34	144	499	11			17.8	21.9	5.9	58.0		757
35-39	202	539	11			5.8	5.4	1.7	66.5		832
40-44	236	638	15			2.5	2.1	0.9	75.2		970
45-49	288	742	13			1.0	1.1	0.4	84.3		1131
50-54	350	902	23								1275
55-59	344	1270	15								1629
60-64	420	1555	12								1988
65-70	474	1749	8								2231
70-74	876	2559	6								3441
75-79	582	2333	6								2922
80-84	625	1787	5								2417
85+	512	2580	14								3106
Total expenditure											
calculated	188,819,804	628188112	7,987,267		4,919,407	20,822,444	19,115,186	6,508,963	27,004,694		903,365,877
reported (NHA)	218,333,032	614774538		40,220	4,851,318	31,925,528	12,543,534	5,808,715	26,279,373	15,446,918	930,003,176