

Longevity and shift in morbidity pattern among states in India

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Abstract: The present paper has explored the possible shift in age-sex structure and morbidity pattern among the population of India and states by 2051. “Morbidity and health care” schedule of NSSO 60th round survey, projected population and SRS reports have been used for analysis purpose. LEB for males and females will increase by 10 and 11years respectively during 2006-51. Proportion of elderly will increase at a rapid pace younger population will decline rather slowly. Age specific morbidity prevalence increases slowly for communicable diseases but the pace is much higher for non-communicable diseases. Disease burden shifts towards NCDs with the change in age structure, which shows some of the states facing NCDs as $\frac{3}{4}$ th of their disease burden. The shift in the disease burden calls for an urgent need for investment in health infrastructure as most of the NCDs are chronic in nature and seeks long term care.

Background:

Improving health around the world today is an important social objective, which has obvious direct payoffs in terms of longer and better lives for millions. There is also a growing consensus that improving health can have equally large indirect payoffs through accelerating economic growth. Population ageing is escorted by the “epidemiological transition” – a shift in the patterns of morbidity and the causes of mortality. India, in the associated epidemiological transition, is facing a dual burden of communicable and non-communicable diseases where nutrition and other life style factors play important roles. With the share of older cohorts increasing relative to that of younger cohorts, infectious and nutritional disorders are replaced by chronic, degenerative and mental illnesses as the leading causes of morbidity and mortality. Many disabling and chronic illnesses such as heart ailments, diabetes, stroke, hearing and visual impairments, dementia as well as the effects of trauma among older people are incurable and require long term care.

The burden of chronic diseases and the incidence of disability increases with the increasing age leading to a major share of older persons dependent on care givers. These result in a higher demand for intensive care in the old age with disability. The chances of disease burden increase and that of recovery to active status decrease as age increase (Kaneda et al., 2004; Zimmer 2005a and Jitapunkul et al., 1999). Given the increasing incidence of disability with age, the ageing of the older population contributes towards increasing the proportion of the older population suffering from disability. A higher incidence of disability among older women implies that feminization of ageing adds further to the burden of disability and women have a lower probability of recovering from disability than men (Danan & Zeng, 2004; Waidmann & Manton 1998). Peters *et al.*, (2001) calculated the burden of disease for India for each disease and also determined the share of each of the non-communicable diseases in the total disease burden.

Population growth and population ageing are two demographic drivers of health care expenditure. As population of the developed world level out, ageing is replacing population growth as the more important of the two. Population ageing, as well as advances in medical knowledge, has led to a dramatic change in the basket of medical condition and diseases, with infectious diseases being replaced by the chronic diseases of old age, especially heart disease, stroke and cancer (Mayhew, 2001). The cost and treatment trajectories of these medical conditions often entail several periods of hospitalization in old age, external assistance with daily living activities, and a concentrated period of long term institutionalized care at the end of life. International studies consistently show that the per capita cost of the health care of the elderly is between six and eight times those for young and middle aged people (Cichon, 1999) and thus there is a built-in ageing

cost escalator.

The basic objective of the present study is to find out the improvement in life expectancy at birth among the Indian population and the change in the proportion of elderly over time. It also enquires into the change in the burden of communicable and non communicable diseases among Indian population by 2051. The total discussions have been done in three sections – the first section deals with the projected results of life expectancy at birth by sex in major states of India and the changes in age-sex structure of population till 2051. The second chapter is associated with the change in disease burden in response to the change in age structure and the final section concludes the findings from each section.

Data and methods: The entire analysis is based on three main sources of data. For analysis of the first section, life expectancy at birth of males and females projected by Retnakumar till 2051 has been used. Data required for population projection have been extracted from annual SRS reports published by Registrar General of India and base year population data from Census of India 2001. The second section is based on the NSSO 60th round (25.0 sub-round) data collected by Central Statistical Organization (CSO). The 60th round was conducted in two sub-rounds of three months each during the period, January to June 2004. Both these rounds collected information on the morbidity profile of nationally representative population, curative aspects of the general health care system in India, the utilization of the health care services provided by the public and private sector, expenditure incurred for treatment of ailments, utilization of maternity and child health care services, and problems of the aged persons.

Projection of population for India and major states (2001-2051):

The Component Method is the universally accepted method of making population projections because growth of population is determined by fertility, mortality and migration rates. Twenty major Indian states have been considered and applied the Component method. They are Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttaranchal, Uttar Pradesh and West Bengal. The data used are 2001 Census and Sample Registration System (SRS). SRS provides time series data of fertility and mortality, which has been used for predicting their future levels.

The smoothed age-sex distribution of 2001 Census provided by Registrar General of India (2006) has been used as the base year population. SRS (Sample Registration System) data has been used for estimating

future pattern of fertility and life expectancies. The Cohort Component Method of projection has been used for projecting population of 20 major states with more than 10 million population. The Cohort Component Method makes specific assumptions about the future levels and patterns of fertility, mortality and migration and applies them with the age-sex structure of the base year population. The technique projection work has been done with the help of SPECTRUM population projection software (DEM PROJ). The mathematical expression of the Component Method is as follows:

$$P_t = P_{t-1} + B_{t-1,t} - D_{t-1,t} + M_{t-1,t};$$

Where; P_t = Population at time t , P_{t-1} = Population at time $t-1$, $B_{t-1,t}$ = Births in interval from time $t-1$ to time t , $D_{t-1,t}$ = Deaths in interval from time $t-1$ to time t , $M_{t-1,t}$ = Net migration in the interval from time $t-1$ to time t .

Age specific morbidity prevalence and burden of diseases:

The analysis of the second section has been carried out using the information from the outpatient care section of NSSO 60th round (25.0 sub round data) where the enquiry on morbidity was conducted with a reference period of 15 days. All spells of ailment suffered by each member, both present as well as deceased; irrespective of their hospitalization status was recorded in this section. But, for the analysis of prevalence, the deceased members have been removed. The prevalence of any ailment or morbidity has been defined as the number of persons ailing within the reference period per 1000 persons exposed to the risk of the ailment from the same group of population. i.e.,

$$\text{Prevalence} = \frac{\text{Number of persons ailing within the reference period}}{\text{Total number of persons exposed to the risk of the ailment from the same group}} * 1000$$

The prevalence has been calculated by different age groups and by sex. This definition does not strictly follows the definition as recommended by the WHO's expert committee on Health statistics. They defined prevalence rate as the ratio between the number of spells of ailment suffered at any time during the reference period and the population exposed to the risk. It measures the *frequency of illness* prevailing during the reference period

Ailment as defined by NSSO is the illness or injury; mean any deviation from the state of physical and mental well being. An ailment may not cause any necessity of hospitalization, confinement to bed or restricted activity. An ailing member is a normal member of the household who was suffering from any

ailment during the reference period. Again, spell of ailment refers to a continuous period of sickness owing to a specific ailment. Forty different types of ailments along with other diagnosed and undiagnosed ailments, suffered by household members have been recorded during the survey. All the ailments have been categorized in three major types: communicable, non communicable and others.

Communicable diseases refer to those diseases that can be transmitted directly from one individual to another individual. Body excretions provide the mode for transmission. Some communicable diseases can be spread by casual contact, some require contact with blood from an infected individual, and the others require intimate contact with an infected individuals body fluids or genitalia. A non-communicable disease is a medical condition or disease which is noninfectious. NCDs are diseases of long duration and generally slow progression. These are often referred to as "chronic diseases" and are distinguished by their non-infectious cause. With the share of older cohorts increasing relative to that of younger cohorts, infectious and nutritional disorders are replaced by chronic, degenerative and mental illnesses as the leading causes of morbidity and mortality. The ailments, categorized as communicable, non communicable and other has been defined as below:

Communicable	Non communicable	Others
Diarrhoea/dysentery, Gastritis/gastric or peptic ulcer, Worm infestation, Amoebiasis, Hepatitis/Jaundice, Tuberculosis, Diseases of kidney/urinary system, Conjunctivitis, Sexually transmitted diseases, Malaria, Eruptive, Mumps, Diphtheria, Whooping cough, Fever of unknown origin, Tetanus and Filariasis/Elephantiasis.	Heart disease, Hypertension, Respiratory including ear/nose/throat ailments, Bronchial asthma, Disorders of joints and bones, Prostatic disorders, Gynaechological disorders, Neurological disorders, Psychiatric disorders, Glaucoma, Cataract, Diseases of skin, Goitre, Diabetes mellitus, Anaemia, Locomotor, Visual including blindness (excluding cataract), Speech, Hearing, and Diseases of Mouth/Teeth/Gum, Cancer and other tumours.	Under-nutrition, Accidents/Injuries/Burns/ Fractures/Poisoning, Other diagnosed ailments and Other undiagnosed ailments

Age specific prevalence of communicable and non communicable diseases has been estimated for India and

20 major states. The shift in the burden of diseases has been estimated for these diseases in the states till 2051, assuming that the prevalence rate will remain the same among age groups over years. The main limitation of this study is that, the prevalence of morbidity is based on the reported ailments, which is again subject to the knowledge and awareness of the particular morbidity and may differ from morbidity prevalence from clinical data.

Results:

Table 1 gives the projected life expectancy at birth of males and females of India and the states. It gives that the LEB will increase approximately about 10 years for males and 11 years for females in India by 2051 from their earlier figures 63.8 and 65.5 for males and females respectively in 2006. LEB for male will be higher in Kerala (79.2), followed by Gujarat (75.0) and Punjab (75.0) and lowest in Assam (72.4). Again LEB for female will also be higher in Kerala (81.0), followed by Gujarat (79.1) and Punjab (78.9) and lowest in Madhya Pradesh (73.8).

Table 1: Projected life expectancy at birth by sex in major states of India, 2006-2051.

	2006		2026		2051	
	Male	Female	Male	Female	Male	Female
India	63.8	65.5	69.8	71.7	73.7	76.7
Andhra Pradesh	64.2	66.8	70.1	72.7	74.7	77.3
Assam	59.8	60.3	67.3	68.3	72.4	74.5
Bihar	63.6	61.7	69.6	69.2	73.5	75.1
Chhattisgarh	64.0	67.2	69.5	73.1	73.4	77.2
Gujarat	64.5	67.1	70.4	74.1	75.0	79.1
Haryana	66.5	67.6	70.8	73.0	74.2	77.4
Himachal Pradesh	67.3	68.6	71.6	73.5	74.7	77.9
Jammu & Kashmir	66.8	67.9	71.1	73.3	74.2	77.7
Jharkhand	64.2	64.7	69.7	71.4	73.6	76.4
Karnataka	64.9	68.4	70.4	73.6	73.8	78.0
Kerala	72.1	76.8	76.1	79.1	79.2	81.0
Madhya Pradesh	59.7	58.9	67.7	66.9	73.1	73.8
Maharashtra	66.7	69.1	71.0	74.0	74.1	77.3
Orissa	60.6	61.2	68.1	70.5	72.5	76.9
Punjab	68.6	71.1	72.2	75.5	75.0	78.9
Rajasthan	62.7	63.8	69.2	70.8	73.1	76.0
Tamil Nadu	66.3	68.5	70.8	72.4	74.2	77.2
Uttar Pradesh	62.1	61.2	68.8	70.5	73.8	76.9
Uttaranchal	64.0	68.0	69.5	73.4	73.4	77.8
West Bengal	65.5	67.0	70.5	72.9	73.9	77.5

Table 2 gives the change in the proportion of the elderly (65+ years) and the younger population (<15 years) in India and twenty major states. The proportion of younger population is gradually declining but that of the older population is increasing rapidly in all the states in India. The proportion of younger population will decline by 45 per cent from 32.3 percent in 2006 to 17.7 percent in 2051. At the same time the share of elderly will increase by 174 percent from 4.9 percent to 13.4 per cent. Among these states, the proportion of younger age population will be lowest in Punjab (12.9 per cent) and highest in Uttar Pradesh (20.3 per cent), followed by Bihar (19.9) and Madhya Pradesh (19.4 per cent). The proportion of elderly will be higher in Kerala (23.1 per cent), followed by Tamil Nadu (20.7) and Punjab (19.5). The rate of decline in younger age population will be highest in Punjab (53.3 per cent), followed by Haryana (51.5 per cent), Andhra Pradesh. The rate of increase in the share of elderly will be highest in West Bengal (262.5 Percent), followed by Andhra Pradesh (250.0 percent) and Karnataka (240.4 Per cent). Again the rate of change will be lowest in Uttar Pradesh (123.8 per cent), followed by Bihar (135.9 per cent), Uttaranchal (140.0 per cent) and Madhya Pradesh (141.9 per cent).

Table 2: Change in the proportion of younger and older population in India and states (2006-2051).

India/States	2006		2026		2051		% change between 2006-2051	
	<15	65+	<15	65+	<15	65+	<15	65+
Andhra Pradesh	28.3	5.2	19.0	8.7	13.9	18.2	-50.9	250.0
Assam	33.7	3.7	25.1	6.1	18.5	12.4	-45.1	235.1
Bihar	38.8	3.9	30.5	5.4	19.9	9.2	-48.7	135.9
Chhattisgarh	33.8	4.7	25.4	6.9	18.8	12.3	-44.4	161.7
Gujarat	30.4	4.7	22.4	7.8	16.6	15.8	-45.4	236.2
Haryana	32.4	4.8	22.2	6.7	15.7	15.1	-51.5	214.6
Himachal Pradesh	27.6	6.2	19.2	8.9	13.6	18.8	-50.7	203.2
Jammu & Kashmir	30.7	4.4	23.5	7.2	17.8	14.7	-42.0	234.1
Jharkhand	35.7	3.6	26.3	6.4	18.9	11.5	-47.1	219.4
Karnataka	28.5	5.2	19.8	8.7	14.5	17.7	-49.1	240.4
Kerala	23.8	7.9	17.2	12.6	13.6	23.1	-42.9	192.4
Madhya Pradesh	36.0	4.3	28.4	5.5	19.4	10.4	-46.1	141.9
Maharashtra	28.6	6.0	19.9	8.5	14.4	17.7	-49.7	195.0
Orissa	29.9	5.5	22.1	7.7	17.2	14.8	-42.5	169.1
Punjab	27.6	6.2	18.6	9.0	12.9	19.5	-53.3	214.5
Rajasthan	37.1	4.2	27.9	5.6	18.7	10.7	-49.6	154.8

Tamil Nadu	24.4	6.5	17.4	10.7	13.7	20.7	-43.9	218.5
Uttar Pradesh	38.0	4.2	31.0	5.2	20.3	9.4	-46.6	123.8
Uttaranchal	34.1	5.0	26.5	6.4	18.7	12.0	-45.2	140.0
West Bengal	29.2	4.8	19.7	8.4	14.5	17.4	-50.3	262.5
India	32.3	4.9	24.5	7.1	17.7	13.4	-45.2	173.5

Prevalence of any morbidity among elderly in the major states of India, 2004

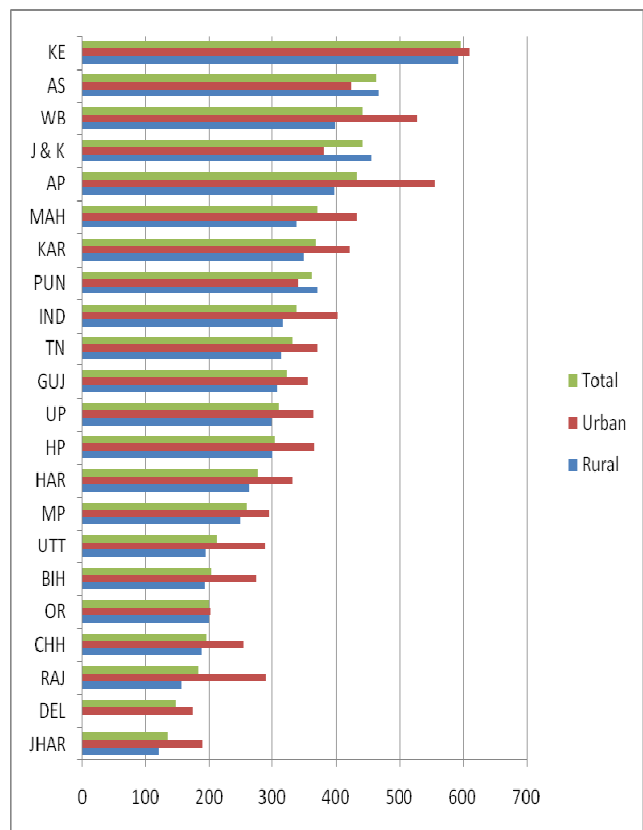
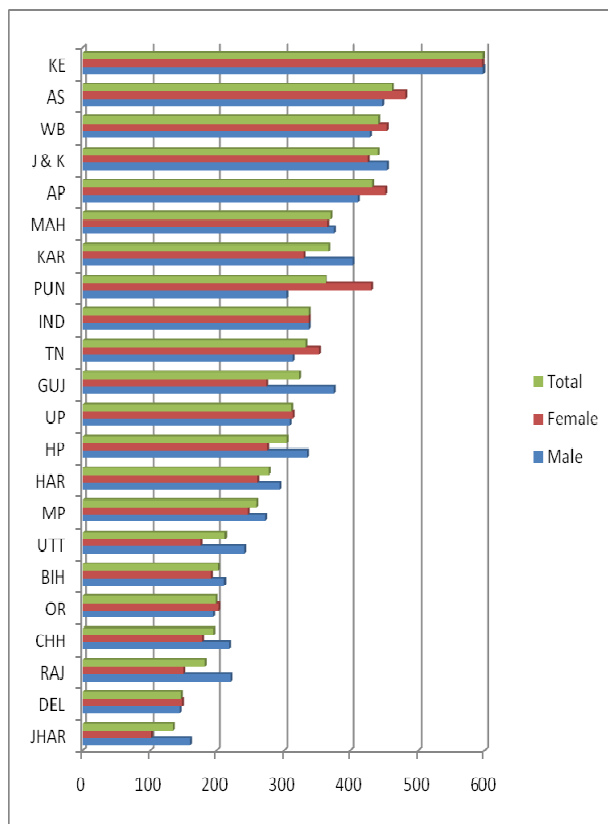
The prevalence of morbidity reported among elderly (65+) in the demographically most advanced state Kerala is highest among the major states. Three out of five elderly in this state suffered from any ailment during the 15 days reference period. In India, the prevalence rate of any morbidity among the older population is 337 per 1000. The reported morbidity is lowest among the elderly in Jharkhand (135 per thousand). Demographically more advanced states mainly have reported higher prevalence of morbidity (Figure 1). This may be due to the fact that the knowledge and awareness is higher among these population groups.

Differentials in prevalence of morbidity among elderly in the major states of India, 2004

Sex difference is prominent in the morbidity prevalence among the elderly across states. In almost all the states, the prevalence rate is higher among males than the females. Prevalence is higher among females in most of the high prevalent states. Kerala is one among the high prevalent states where the sex differential is only marginal. Sex differential in reported morbidity prevalence is relatively higher in Punjab and Gujarat where in Punjab prevalence is higher for women but in Gujarat for men (Figure 1).

In India, the prevalence of morbidity is higher in urban area (402 per thousand) than in rural area (316 per thousand). In almost all the states, prevalence rate is higher in urban areas than rural areas with highest differential in Andhra Pradesh and lowest in Orissa. Among all 21 major states Jammu and Kashmir, Assam and Punjab are the three where prevalence has been reported higher in rural areas than urban areas (Figure 1).

Figure 4.1: Morbidity prevalence rate by sex and place of residence among elderly (65+) in India, 2004



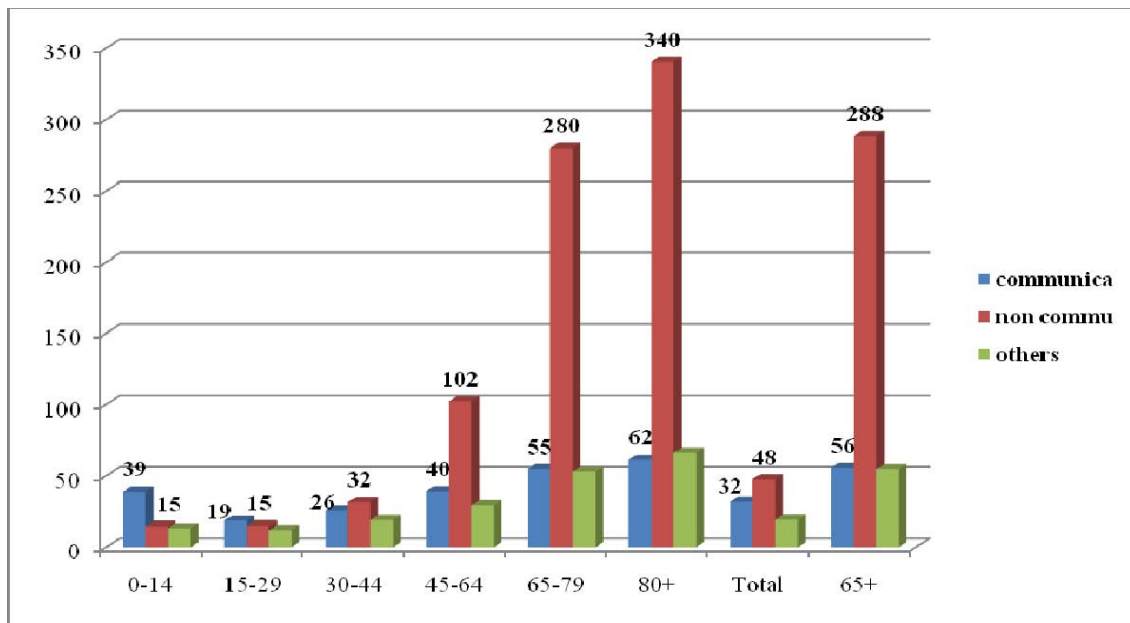
Age profile of communicable and non communicable diseases in the major states of India, 2004:

Population ageing is also escorted by the “epidemiological transition” – a shift in the patterns of morbidity and the causes of mortality. India, in the associated epidemiological transition, is facing a dual burden of communicable and non-communicable diseases where nutrition and other life style factors play important roles. With the share of older cohorts increasing relative to that of younger cohorts, infectious and nutritional disorders are replaced by chronic, degenerative and mental illnesses as the leading causes of morbidity and mortality. Many disabling and chronic illnesses such as heart ailments, diabetes, stroke, hearing and visual impairments, dementia as well as the effects of trauma among older people are incurable and require long term care.

Figure 2 clearly indicates that there is dominance of non communicable diseases in the disease burden among Indian population. In the very early stages of life, prevalence of communicable diseases is higher than non communicable diseases but with the advancement of age prevalence of non communicable diseases becomes much higher. Prevalence of either type of morbidity is lowest among the population of 15-29 years age group. With the increase in age prevalence of both the communicable and non communicable disease increases, but the later increases at a much faster rate. Prevalence of communicable

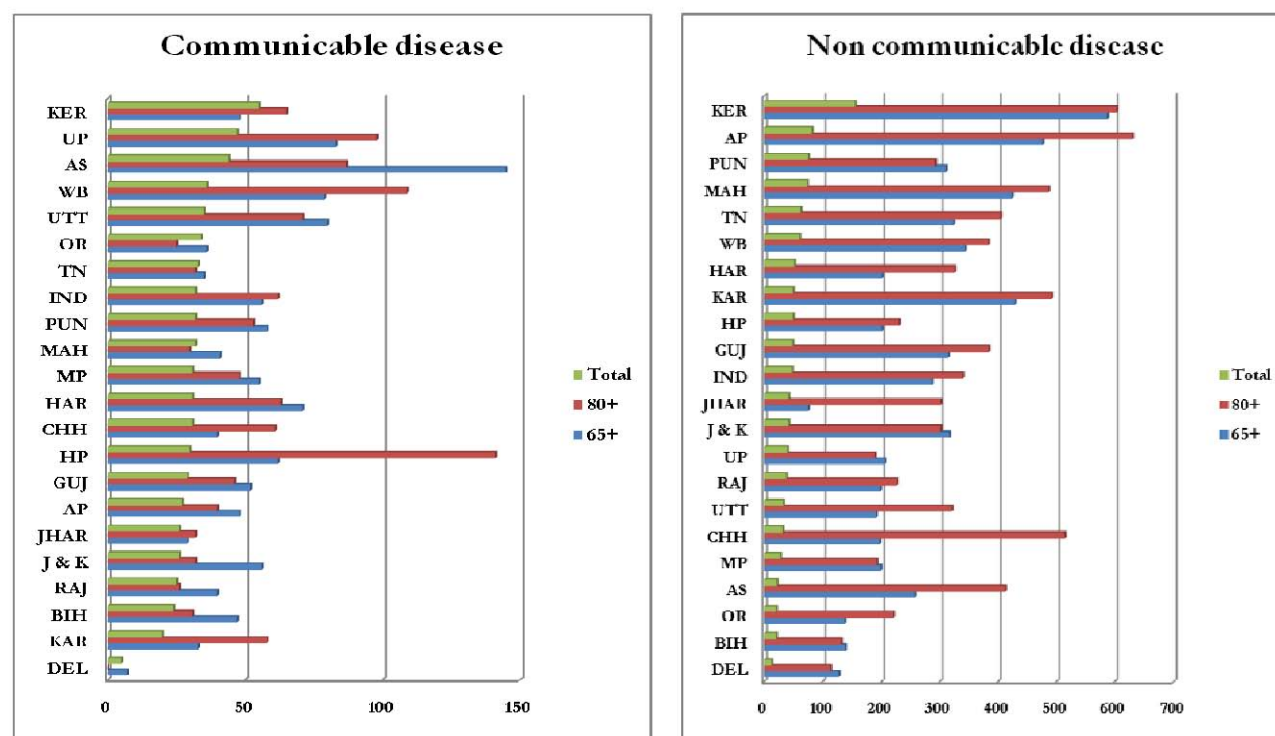
and non communicable diseases among the elderly is 56 and 288, but among the oldest old it becomes 62 and 340 respectively.

Figure 2: Age profile of communicable, non communicable and other types of diseases in India, 20004.



The prevalence of NCDs is higher than the CDs for almost all the major states (Table 4.2). Assam, Bihar, Madhya Pradesh, Orissa, Uttar Pradesh and Uttaranchal are the states with higher prevalence of communicable diseases than NCDs. These are also among the 18 states which gained special focus in the National Rural Health Mission. Uttar Pradesh shows the highest prevalence of CDs (47), followed by Assam (44). However, during the early years of life, prevalence of CDs is much higher than the non communicable diseases. The NCDs become dominant in the disease burden mainly beyond age 45 years and it increases gradually with the increase in age. NCDs prevalence is highest among the oldest old group. The prevalence of non communicable diseases relatively slows down beyond age 80 years though the level remains high. The prevalence of NCDs is highest in Kerala (155), followed by Andhra Pradesh (82), Punjab (76) and Maharashtra (74).

Figure 4.1: Prevalence of communicable and non communicable diseases among elderly (65+) in major states in India, 2004.



Among the elderly (65+), prevalence of non communicable disease is highest in Kerala ((588), followed by Andhra Pradesh (477), Karnataka (430) and Maharashtra (425). Prevalence among the elderly is lowest in Jharkhand (76). But, the prevalence of NCD is highest in Andhra Pradesh (631) among oldest old group followed by Kerala (604), Chhattisgarh (515), Karnataka ((492), Maharashtra (487) and Tamil Nadu (405).

Shift in the burden off diseases among population in India and states,, 2006-2051:

The resuults on tablee 3 shows ththat the sharee of non coommunicablee disease is greater thann the communicable as well as other types of diseases in almost all the states. In India, the share of NCDs will increase from 46 percent in 2006 to 57 percent in 2051. At the same time, the share of CDs will reduce from 34 percent to 25 percent. Around 3/4th of the diseases in Karnataka will be NCDs by 2051. Andhra Pradesh (70.2 percent), Maharashtra (69.3) and Kerala (68.2 percent) are the states where the share of NCDs will be around 70 percent. Assam is the only state among the states taken for analysis where share of communicable diseases are higher than the NCDs. The share of CDs is relatively higher in almost all the EAG states. Not much reduction is observed in other types of diseases over time. The NCDs are mainly chronic in nature and demands for long term care. Therefore, the nation should be prepare for provide required infrastructure to

combat with the situation.

Table 3: Projected burden of Communicable, non communicable and other types of diseases among total population 2006-2051.

State/India	Communicable			Non communicable			Others		
	2006	2026	2051	2006	2026	2051	2006	2026	2051
Andhra Pradesh	20.6	16.6	13.1	58.1	64.3	70.2	21.2	19.1	16.8
Assam	58.6	52.0	45.0	28.8	35.3	42.9	12.6	12.7	12.1
Bihar	45.4	41.4	35.2	35.8	39.9	46.5	18.8	18.7	18.2
Chhattisgarh	40.2	35.5	29.9	39.6	44.9	51.5	20.3	19.6	18.5
Delhi	27.0	15.9	10.0	53.2	67.7	77.7	19.8	16.5	12.3
Gujarat	34.6	28.8	23.1	52.8	58.9	65.2	12.7	12.3	11.7
Haryana	30.5	26.7	23.9	48.4	52.8	58.0	21.2	20.5	18.1
Himachal Pradesh	29.1	26.2	23.3	47.5	51.5	55.8	23.4	22.3	20.9
Jammu & Kashmir	37.3	31.4	25.5	53.1	59.4	66.3	9.6	9.1	8.2
Jharkhand	46.0	41.1	36.5	33.0	37.4	42.0	21.0	21.5	21.5
Karnataka	24.7	19.4	14.4	57.1	64.7	72.2	18.2	15.9	13.4
Kerala	21.5	17.4	14.0	58.5	63.6	68.2	20.0	19.0	17.8
Madhya Pradesh	46.0	42.4	36.0	37.6	41.3	48.3	16.4	16.4	15.7
Maharashtra	25.5	20.9	15.8	55.6	61.8	69.3	18.8	17.3	14.9
Orissa	46.4	42.6	37.0	29.0	33.0	39.8	24.6	24.4	23.2
Punjab	23.8	20.9	17.9	55.8	58.5	62.5	20.4	20.6	19.6
Rajasthan	33.4	30.9	27.2	46.3	49.6	55.5	20.2	19.5	17.4
Tamil Nadu	28.3	23.4	18.5	52.3	58.8	65.3	19.4	17.8	16.2
Uttar Pradesh	43.6	41.3	36.9	35.2	37.3	42.2	21.3	21.4	20.9
Uttaranchal	41.3	37.9	32.6	35.2	38.9	45.5	23.5	23.2	21.9
West Bengal	28.2	24.6	21.3	43.9	50.0	56.1	27.8	25.4	22.7
India	33.7	29.8	25.0	46.4	51.1	57.4	19.8	19.1	17.7

Summary: The LEB will increase approximately about 10 years for males and 11 years for females in India by 2051 and LEB for males as well as females will be higher in Kerala. The proportion of younger population will decline by 45 per cent from 32.3 percent in 2006 to 17.7 percent in 2051. At the same time the share of elderly will increase by 174 percent from 4.9 per cent to 13.4 per cent. Age specific morbidity prevalence shows a slower pace of increase in the prevalence of communicable diseases but the pace is much higher for non communicable diseases. The disease burden shifts towards NCDs compared to

communicable diseases with the change in age structure, which shows some of the states facing NCDs as 3/4th of their disease burden. This shift in the disease burden calls for an urgent need for investment in health infrastructure as most of the NCDs are chronic in nature and seeks long term care.

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