7.0 Over nutrition and non-communicable diseases

Soon after independence, India established systems for assessment of per-capita income, purchasing power, poverty, under nutrition and micronutrient deficiencies. Data from these were used to assess interstate differences and time trends in these indices. However a similar system for tracking over nutrition and risk of non-communicable diseases (NCD) was not established till nineties; even now the coverage under these are not as extensive as the coverage under the nutrition surveys. In view of this, for documenting time trends in prevalence of non-communicable diseases related to over-nutrition, the country has to depend on research studies carried out in different parts of the country. The differences in methodology of data collection, criteria used for case definition and parameters reported make the task of comparison between studies and drawing conclusions regarding time trends a rather difficult exercise. However from the existing data, it is clear that there has been an increase in prevalence of diabetes, hypertension and cardiovascular diseases over the last two decades especially in urban affluent segments of population. These diseases appear a decade earlier, often in association with abdominal obesity as a part of metabolic syndrome. Prevalence of these diseases is lower in poorer segments and in rural areas, but case fatality rates may be higher in them because of poor access to health care.

National Cancer Registry Programme (NCRP) (Indian Council of Medical Research, 1983) established hospitals based and population based cancer registries in mid eighties and has been generating data on time trends and regional differences in cancer incidence, prevalence and mortality. Data from NCRP shows that India has the lowest cancer rates in the world in spite of relatively high tobacco use (nearly half of the cancers in men are tobacco related). In spite of the increasing longevity there has not been any increase in over all cancer incidence over the last two decades. However, there have been changes in incidence of cancers in different sites eg decrease in prevalence of cancer cervix and increase in cancer breast.

As NCDs are emerging as major public health problems in India, Indian Council of Medical Research (ICMR) under took an assessment of disease burden due to NCD in 2004 using DISMOD II model (ICMR, 2004). The major data sources utilised for this exercise were

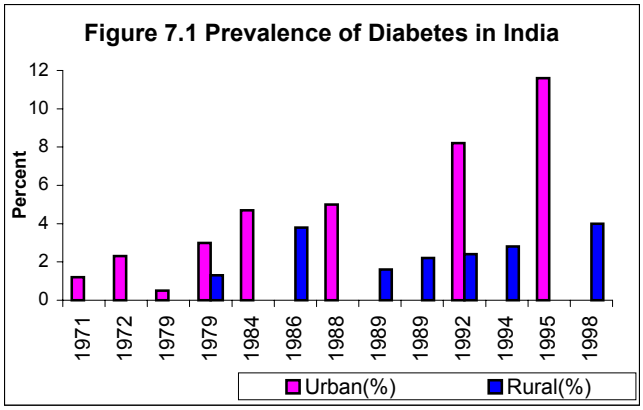
- medical certification of causes of disease (MCCD)
- survey of causes of death (rural)
- cancer registry data
- review of 180 published articles,10 published reports, five unpublished reports and one personal communication dealing with diabetes, hypertension, ischemic heart disease, stroke and cancers

This publication provides the national level estimates of disease burden due to NCD in the first five years of the new millennium.

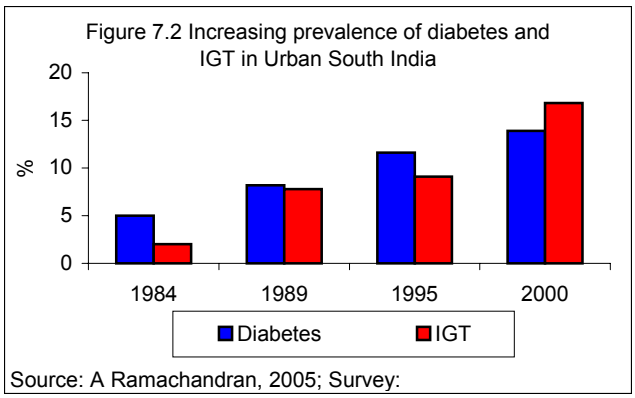
Available data on time trends in prevalence of hypertension, diabetes, ischemic heart disease, stroke and cancers over the last two decades, ICMR estimates of the diseases burden due to NCD and the relationship between nutritional status and NCD are reviewed in this section.

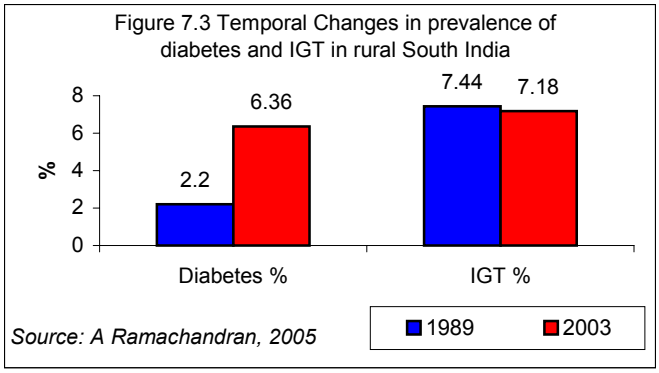
7.1 Diabetes and impaired glucose tolerance

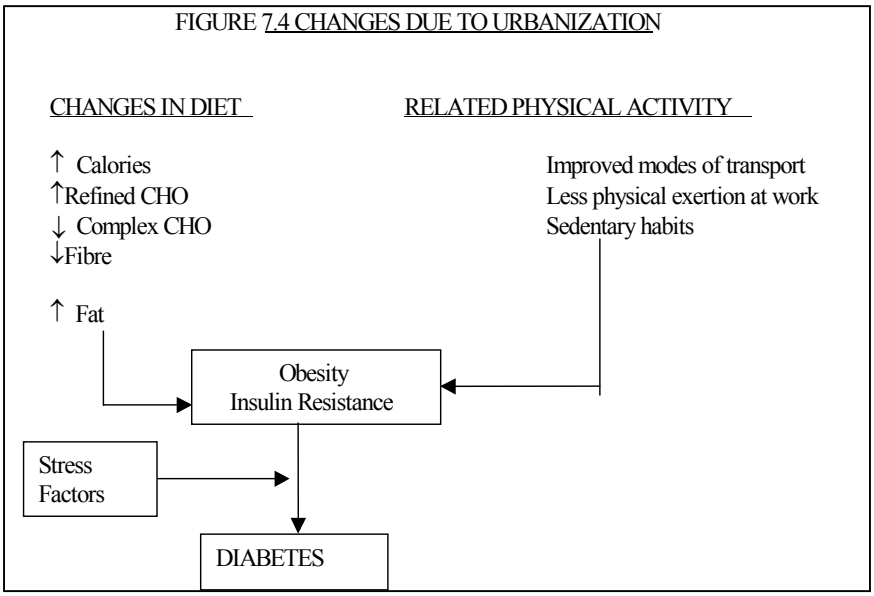
Community based studies on prevalence of diabetes in urban and rural areas have been conducted in all regions of the country (Figure 7.1); all these studies show that over the last three decades there has been progressive increase in prevalence of diabetes both in urban and rural areas.



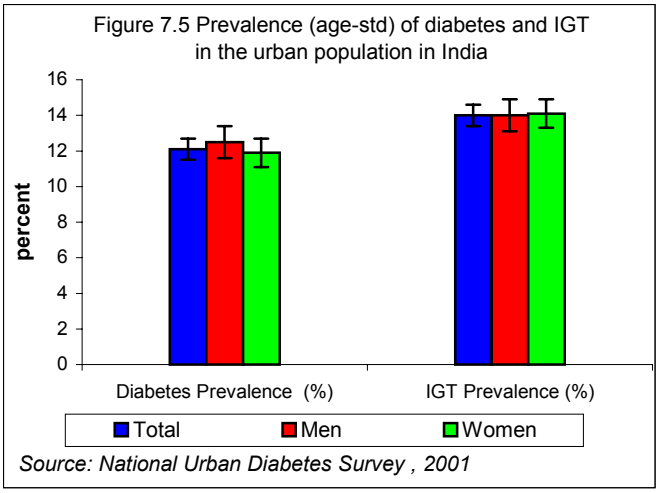
Data from the Chennai on time trends in prevalence of diabetes and impaired glucose tolerance (IGT) in urban and rural urban population (Figure 7.2, 7.3) shows that over the last two decades there has been a progressive steep increase in prevalence of diabetes and IGT in urban and rural areas (Ramachandran A, 2005). Prevalence is higher in urban areas. Potential factors associated with higher urban prevalence of diabetes are shown in Figure 7.4.



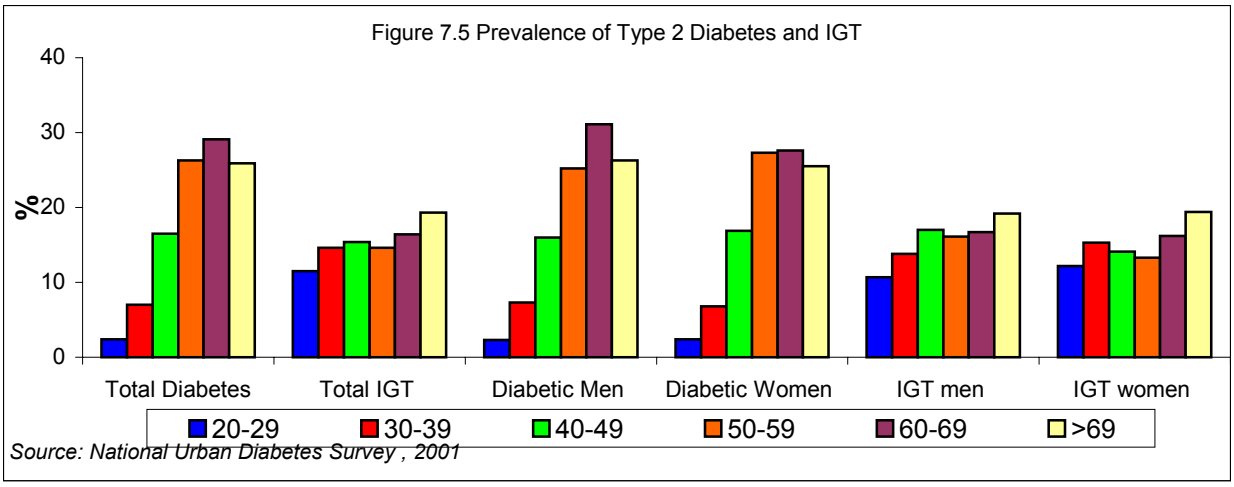




In 2000 Diabetes Epidemiology Study group in India initiated, a multicentre community based study using stratified



random sampling method in Bangalore, Chennai, Mumbai, Delhi, Kolkata and Hyderabad to assess the prevalence of diabetes and IGT. Oral Glucose Tolerance Test (OGTT) was done in 11216 (5288 men; 5928 women) persons aged 20 years or above (representative sample drawn from all socio-economic strata). Information on socio-economic status, physical activity and anthropometric data were collected in all (National Urban Diabetes Survey, 2001). Age-standardized prevalence of diabetes and impaired glucose tolerance is shown in Figure 7.5. There was progressive increase



in prevalence of diabetes and IGT with age (Figure 7.6). Subjects under 40 years of age had a higher prevalence of impaired glucose tolerance than diabetes (12.8 percent vs 4.6 percent, $p<0.0001$). In India diabetes is usually not listed as predisposing cause of death in death certificates; data from hospital-based studies suggest that major causes of death in patients with diabetes are infections, renal failure, IHD and stroke.

Summary results of ICMR's estimates of disease burden due to diabetes in 1998 and 2004 are presented in Table 7.1. Number of cases will increase from 58.34 million in

Table 7.1 Projections of disease burden due to diabetes

	1998			2004		
	Urban	Rural	Total	Urban	Rural	Total
Population(in000)	262,152	708,781	970,933	319,727	746,031	1,065,758
No. of cases of diabetes(000)	30,939	27,409,	58,348	37,734	28,849	66,583
No. of deaths due to diabetes	51,251	44,299	95,550	62,506	46,627	109,133
No. of YLL	529,959	484,983	1,014,942	646,351	510,471	1,156,822
No. of DALY	1,016,866	971,890	1,988,756	1,240,195	1,022,968	2,263,163
Source: Assessment of burden of non-communicable diseases, ICMR 2004						

1996 to 66.58 million in 2004 (37.73 million in urban and 28.85 million in rural). By 2004, diabetes accounts for 100 thousand deaths in a year, is responsible for 1.15 million Years Of Life Lost (YLL) due to disease and 2.26 million Disability Adjusted Life Years (DALYs) (ICMR, 2004)

WHO burden of disease study (2000) estimated that DALY attributable to diabetes is 2.7 million; ICMR estimates for 2004 correspond closely to this estimate (ICMR, 2004).

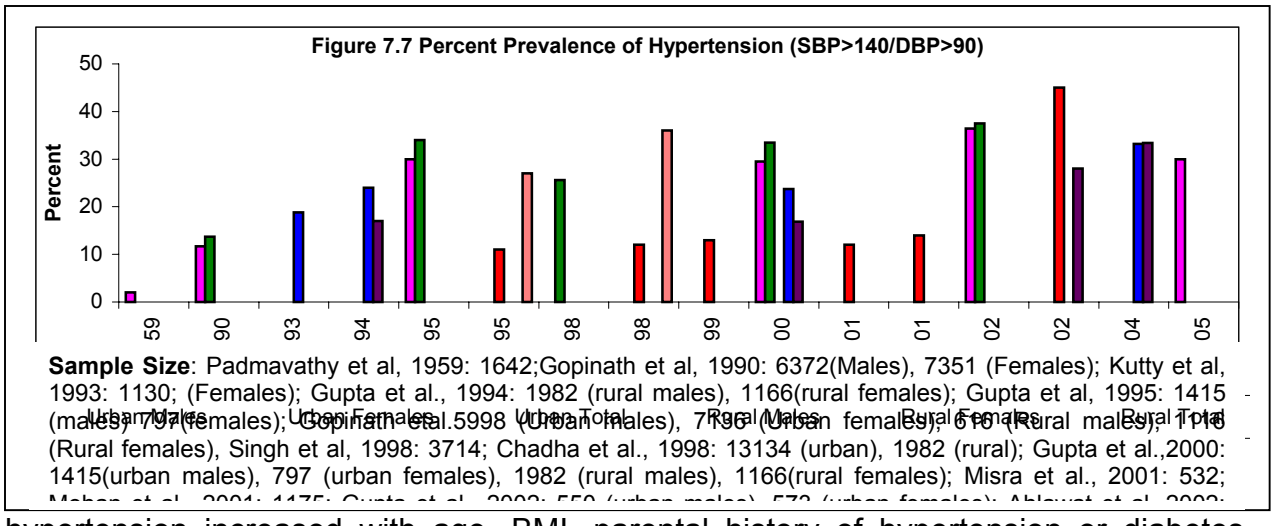
7.2 HYPERTENSION

Hypertension is probably the most common non-communicable disease. It is the most common factor responsible for Ischemic Heart Diseases (IHD) and cerebro-vascular accidents. In early seventies reported prevalence of hypertension was low ranging between 2-5 percent of adult population. However over years reported hypertension rates have increased and currently in urban adults range between 5-15 percent. Yagnik et al (Yagnik CS. 1998) have shown that even from early childhood some Indian children are prone to develop hypertension. Gopinath et al (Gopinath et al., 1994) investigated in 10200 Delhi school children (male 5709 and female 4506) aged between 5-14 years and showed that hypertension existed even among them. Prevalence of hypertension increased with age, BMI, parental history of hypertension or diabetes. Community based study of hypertension (systolic BP >140 and diastolic BP more than 85) in 6543 persons in 15-25 age group in Delhi in 1985-87 showed over all prevalence of hypertension was 3.9/1000 (Reddy KS. 1998) (Table 7.2).

Table 7.2 Age and sex-wise prevalence rate of hypertension /1000

	Male			Female			Total		
Age (in Yr)	No examined	Hypertensives	PR±SE	No examined	Hypertensives	PR±SE	No examined	Hypertensives	PR±SE
15-19	1744	47	26.9±4.0	1874	27	14.4±3.7	3618	74	20.5±2.0
20-24	1342	80	59.6±8.2	1583	48	30.3±6.7	2925	128	43.8±6.6
Total	3086	127	41.2±5.0	3457	75	21.7±4.0	6543	202	30.9±3.6

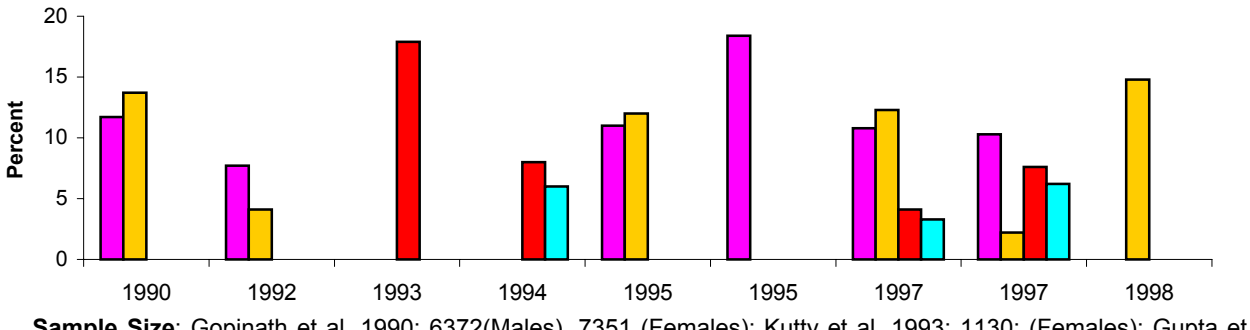
PR, Prevalence rate /1000, SE, Standard Error;Source: Gopinath et al, 1994
Survey: Urban Delhi;Sample Size: 6543



Sample Size: Padmavathy et al, 1959: 1642;Gopinath et al, 1990: 6372(Males), 7351 (Females); Kutty et al, 1993: 1130; (Females); Gupta et al., 1994: 1982 (rural males), 1166(rural females); Gupta et al, 1995: 1415 (males) 797(females); Gopinath etal.5998 (Urban males), 7196 (Urban females), 616 (Rural males), 1116 (Rural females), Singh et al, 1998: 3714; Chadha et al., 1998: 13134 (urban), 1982 (rural); Gupta et al.,2000: 1415(urban males), 797 (urban females), 1982 (rural males), 1166(rural females); Misra et al., 2001: 532;

Some of the major community based studies on hypertension over the last two decades is shown in Figure 7.7 and 7.8. It is obvious that over the past two decades there has been an increase in the prevalence of hypertension among men and women living in urban and rural areas. Prevalence in rural areas is lower than urban areas.
ICMR undertook an assessment of burden of disease due to hypertension (systolic BP> 140 mmHg and / or diastolic BP >90 mmHg) based on studies carried out between 1995 and 2002 in different regions in urban and rural areas (Figure 7.7) Meta analysis of data indicated that for the country prevalence rate of hypertension was 157.4/1000 (ICMR, 2004).

Figure 7.8 Percent Prevalence of Hypertension (SBP>160/DBP>90)

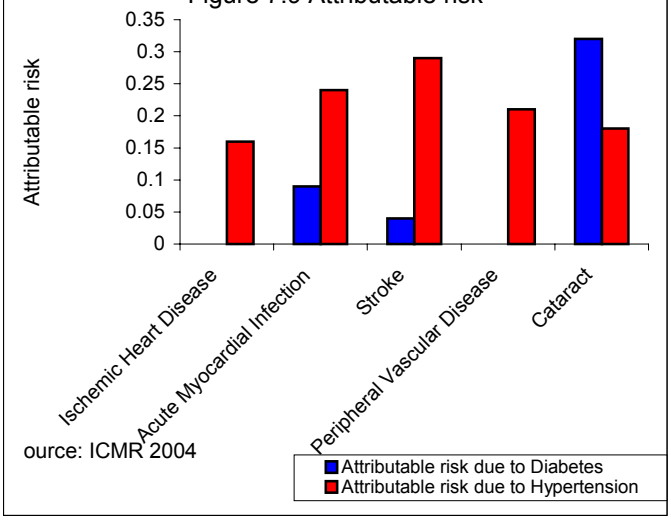


Sample Size: Gopinath et al, 1990: 6372(Males), 7351 (Females); Kutty et al, 1993: 1130; (Females); Gupta et al., 1994: 1982 (rural males), 1166(rural females); Gupta et al, 1995: 1415 (males) 797(females); Gopinath etal 5998 (Urban males), 7136 (Urban females), 616 (Rural males), 1116 (Rural females), Singh et al, 1998: 3714;

7.2.2 Health Consequences of Hypertension

ICMR estimated the data on odds ratio/risk ratio of NCDs associated with hypertension; 16percent of ischaemic heart disease, 21 percent of peripheral vascular diseases, 24 percent of Acute Myocardial Infarctions (AMI) and 29 percent strokes could be attributed to hypertension (ICMR, 2004). ICMR computed population attributable risk due to diabetes and hypertension for a range of non-communicable diseases (Figure 7.9). Since both hypertension and diabetes often coexist the actual risk of various non-communicable diseases due to both these might be higher than the risk for either individually.

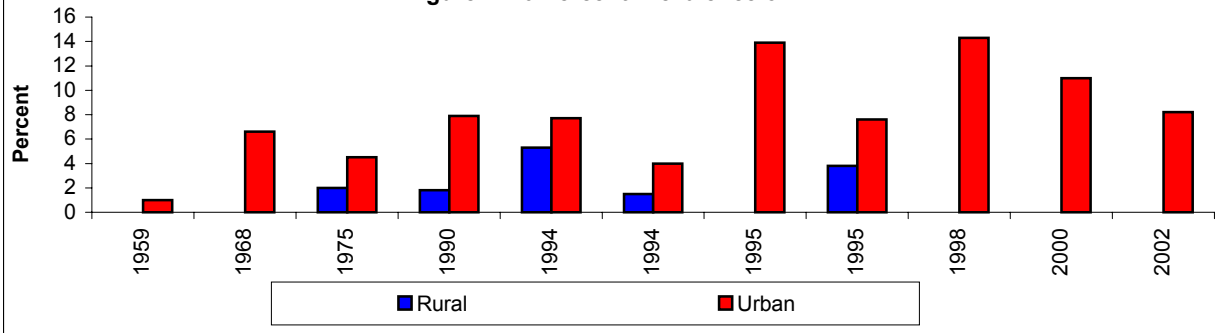
Figure 7.9 Attributable risk



7.3 Ischaemic Heart Diseases

Ischaemic heart diseases (IHD) are becoming an important cause of death in India. Some of the major studies on prevalence of IHD in urban and rural areas from different parts of India and from the studies used in the meta-analysis are shown in Figure 7.10.

Figure 7. 10 Percent Prevalence of IHD



Sample Size: Padmavathy et al, 1959: 1642; Sarvotham et al, 1968: 1331; Gupta et al,1975: 1504; Chaddha et al, 1990: 13,723; Begon et al, 1995: 460; ICMR, New Delhi: 3019; ICMR, Vellore: 2649; Gupta et al, 1995: 2212; Ramachandran et al, 1998: 953; Mohan et al, 2000: 1175; Gupta et al, 2002: 1123.

Over the last three decades there has been a progressive increase in prevalence of IHD; the increase has been steeper during the last decade especially in urban areas. This has been mainly attributed to life style changes, which have affected people in urban areas more than in rural areas (ICMR, 2004).

The ICMR (ICMR, 2004) undertook a meta- analysis of the results of studies carried out in 1990s and upto 2000 in which IHD was diagnosed on the basis of

- history of documented angina or infarction and previous diagnosed CHD
- affirmative response to Rose Questionnaire,
- ECG changes namely Minnesota codes 1-1,4-1,5-9,5-2 or 9-2.

Table 7.3 Age specific prevalence rate derived from the studies selected for I.H.D

	Urban						Rural					
	Male			Female			Male			Female		
Age Group	Sample Size	No. Of cases	PR/ 1000	Sample Size	No. of cases	PR /1000	Sample Size	No. of cases	PR/ 1000	Sample Size	No. of cases	PR/ 1000
20-24	125	1	8.0	147	1	6.8	285	5	17.5	191	2	10.5
25-29	1374	27	19.6	1677	44	26.2	512	7	13.7	624	9	14.4
30-34	1584	27	17.1	2091	48	22.9	888	11	12.4	1302	14	10.8
35-39	1459	63	43.2	1796	87	48.4	1011	19	18.8	1376	22	15.9
40-44	1418	67	47.3	1549	102	65.8	836	15	17.9	1033	24	23.2
45-49	1093	91	83.2	1234	130	105.4	724	15	20.7	954	37	38.8
50-54	1053	98	93.1	1162	130	111.9	675	21	31.11	722	36	49.9
55-59	985	160	162.4	1054	161	152.8	937	25	26.7	825	42	50.9
60+	835	145	173.6	941	165	175.4	591	42	71.1	519	35	67.4

Source: Assessment of burden of non-communicable diseases, ICMR 2004. PR/1000-Prevalence Rate per 1000

Age specific prevalence rates of IHD among males and females obtained by pooling the data of these five studies (separately for urban and rural areas) is given in the Table 7.3. There is a steep increase in prevalence of IHD in both sexes in forties. Prevalence rates in women are comparable to or higher than prevalence rates in men.

Indices of burden of diseases for IHD in India are presented in Table 7.4. Estimated prevalence rates were 64.4/1000 in urban and 25.3/1000 in rural population. The projections of burden of disease due to IHD in India for the years 1998 and 2004 are given in Table 7.5. Number of cases of IHD is estimated to increase from 34.78 million in 1998 to about 39.43 million (20.58 million cases in urban areas and 18.85 million in rural areas) by 2004. In 2004 , the total number of DALYs attributable to IHD is estimated to be 16 million (ICMR, 2004).

Table 7.4 Indices of Burden of Diseases for IHD

	Ischemic Heart Disease	
	Urban	Rural
Prevalence rate/1000	64.4	25.3
Death rate/1000	0.8	0.4
YLL per 100,000	728.7	351.5
DALY per 100,000	2703.4	986.2

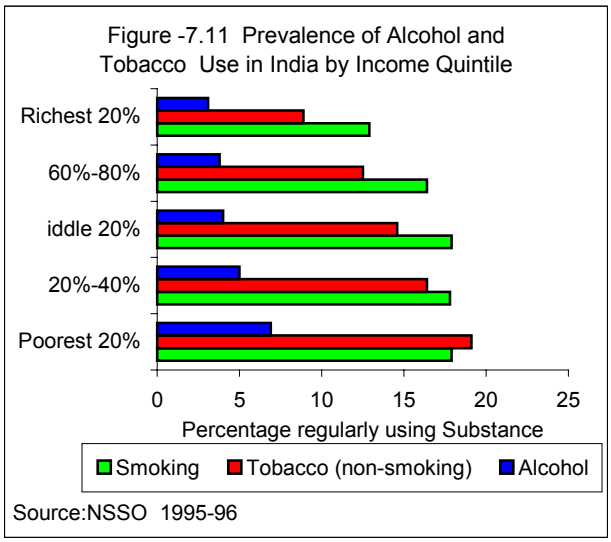
Source: Assessment of burden of non-communicable diseases, ICMR 2004

Table 7.5 Projections of disease burden due to I.H.D

	1998			2004		
	Urban	Rural	Total	Urban	Rural	Total
Population (in thousands)	262,152	708,781	970,933	319,727	746,031	1,065,758
No. of cases of IHD	16,874,724	17,910,896	34,785,620	20,580,827	18,852,203	39,433,030
No. of deaths due to IHD	207,548	256,014	463,562	255,782	298,412	554,194
No. of YLL	1,991,451	2,470,149,	4,461,600	2,329,851	2,622,299	4,952,150
No. of DALY	7,388,453	6,930,974	14,319,427	8,643,450	7,357,358	16,000,808

Source: Assessment of burden of non-communicable diseases, ICMR 2004

It is often assumed that ischemic heart disease affects mainly the well to do. However there are several studies, which suggest that, poor are vulnerable for IHD. A community based cross sectional survey looked at prevalence of coronary heart disease and coronary risk factors in Rajasthan in relation to educational level in 3148 residents aged over 20 (1982 men, 1166 women) residing in three villages (Gupta etal., 1994). The prevalence of coronary heart disease (diagnosed by electrocardiography) showed an inverse relation with education in both sexes; prevalence of coronary risk factors smoking and hypertension was higher among uneducated. NSSO (NSSO, 1975-2000) surveys have documented higher prevalence of prevalence of tobacco use among the poorer segments of the



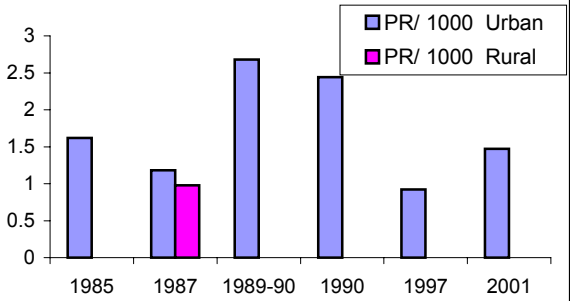
population (Figure- 7.11). Lack of physical exercise and stress of life are common among the urban poor with sedentary jobs. It is there fore not surprising that there is a high prevalence of hypertension and IHD among poor also. Results of some of the studies carried out in Delhi show that that prevalence of hypertension and IHD is high among poorer segments of population in urban areas Some of the data indicate that untreated / poorly controlled severe of hypertension and IHD was higher among low income groups perhaps because of poor access to health care; some of the data also indicate that IHD associated with morality rates are higher among the poor (Srinath Reddy-personal communication). It is therefore important to recognize that in the Indian context it is not the urban affluent alone that is at risk of hypertension, and IHD. Programmes aimed at life style modification of all segments of population are of critical importance for prevention of IHD. Simultaneously facilities for screening population groups for detection of IHD and for management of those with IHD have to be built up.

7.4 STROKE

WHO defined stroke as ‘ rapidly developed clinical signs of focal disturbances of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin. The 24 hours threshold in the definition excludes Transient Ischaemic Attacks (TIA). Stroke is the acute severe manifestation of cerebro-vascular disease and is one of the leading causes of mortality and morbidity in developed countries.

ICMR under took a meta analysis of stroke from well-designed studies with adequate sample size (Figure 7.12). Weighted average of stroke prevalence rate was 1.54/1000. Estimated prevalence of stroke is lower in India as compared to developed countries. However with increasing longevity it may increase proportionally .The prevalence rates, stroke specific mortality rates, case fatality rates, all cause mortality rates, and age distribution of population (1998) were given as an input for DISMOD analysis of data for stroke.

Figure 7.12 Prevalence of Stroke



Source: Assessment of burden of non-communicable diseases, ICMR 2004, Sample Size: Kapoor et al, 1985: 26450; Gauri Devi et al, 1987: 18618 (Urban), 8160 (Rural); Das et al, 1989-90: 17526; Koul et al, 1990: 37226; Dhamija et al, 1997: 24949; Banerjee et al, 2001: 50293

Table 7.6 Indices of Burden of Diseases for Stroke	
Prevalence rate/1000	1.54
Death rate/1000	0.6
YLL per 100,000	496.3
DALY per 100,000	597.6

The figures for YLL per hundred thousand are 496.3, and DALY per hundred thousand is 597.6 (Table 7.6)

Table 7.7 Projections of disease burden due to Stroke		
	1998	2004
Population (in thousands)	970,933	1,065,758
No. of cases of stroke	14,95,237	16,41,267
No.of deaths due to stroke	5,93,362	6,39,455
No. of YLL	48,18,740	52,89,357
No. of DALY	58,02,295	63,68,970
Source: Assessment of burden of non-communicable diseases, ICMR 2004		

Projections of burden of disease due to stroke in India for the years 1998 and 2004 are given in Table 7.7. The total number of stroke cases in India in year 2004 is expected to be 1.64 million. The total number of DALYs attributable to stroke are estimated to be 6.37 million for the year 2004 in India.

7.5 Cancers

National Cancer Registry Programme (NCRP) (ICMR, 1990-2005) of India estimated that annually there are 7,00,000 new cases of cancer and that there are about 2 million

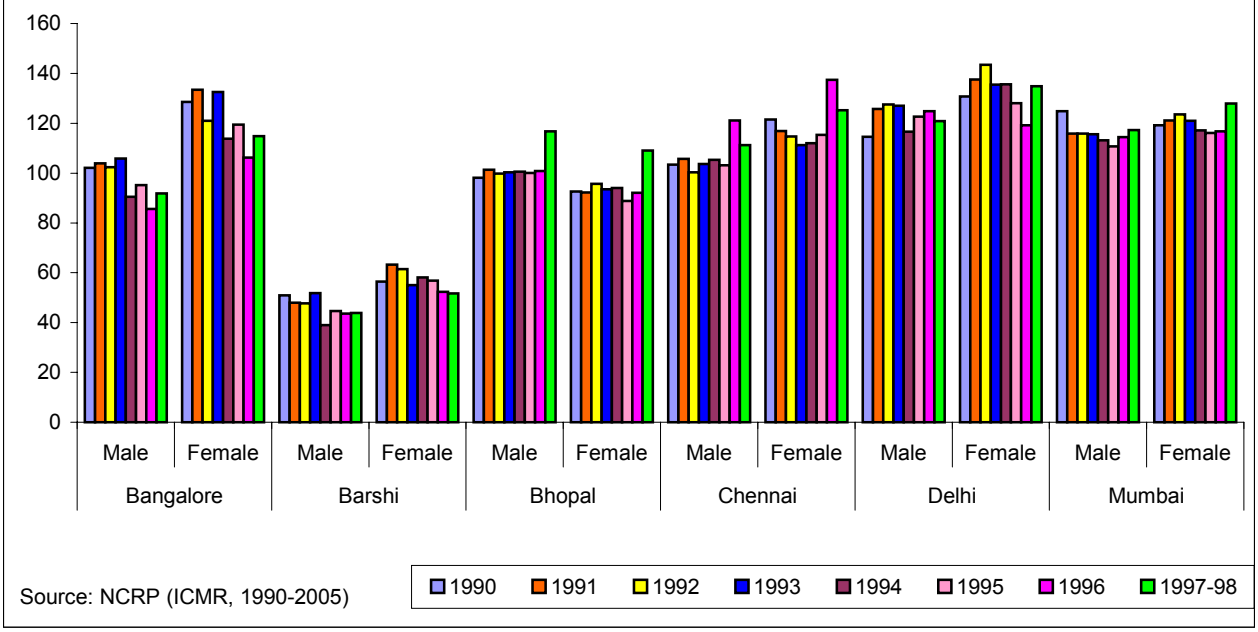
Table7.8 Cumulative incidence rate, cumulative risk and possibility of one in number of persons developing cancer of all sites (ICD9: 140-208); Calculation based on age specific rates from 0-64 and 0-74 years of age

Registry	**Cumulative rate (percent)**		**Cumulative risk (percent)**		**Possibility of one in no. of persons developing cancer**	
	Males	**Females**	**Males**	**Females**	**Males**	**Females**
0-64 yrs						
Bangalore	8.06	10.80	7.75	10.24	13	10
Barshi	4.05	5.04	3.97	4.91	25	20
Bhopal	10.49	10.80	9.96	10.24	10	10
Chennai	10.11	11.69	9.62	11.03	10	9
Delhi	10.45	12.21	9.92	11.49	10	9
Mumbai	9.37	11.17	8.94	10.57	11	9
0-74 yrs						
Bangalore	11.08	13.39	10.49	12.53	10	8
Barshi	5.10	5.86	4.97	5.69	20	18
Bhopal	15.34	12.50	14.22	11.75	7	9
Chennai	13.19	14.35	12.35	13.37	8	7
Delhi	13.97	15.23	13.04	14.13	8	7
Mumbai	13.98	14.82	13.04	13.77	8	7
Source: NCRP 2005						

cases of cancer in the country. In India age adjusted cancer incidence varies between 91.9-120.9/ 100,000 in urban males and 108.7-134.8/100,000 in urban females. Cumulative incidence rate in selected population based cancer registries in India is given in Table 7.8. Over all cancer incidence in India is among the lowest in the world. Incidence of cancers reported by the urban cancer registries are similar to cancer incidence among Indians in Singapore and are substantially lower than cancer rates reported in other countries. Cancer epidemiologists have been exploring the protective role of habitual Indian diet with high fiber, phytate and spices including turmeric in the observed low prevalence of malignancies in India. Cancer associated with tobacco use account for 36-55percent of all of cancers in men and 10-16percent of cancers in women. Anti tobacco education and reduction in tobacco use can result in further substantial reduction in cancer rates in India. Data on time trends in prevalence of cancers (all sites) from the six population based cancer registries is shown in Figure

7.13. It is obvious that unlike CVD and diabetes, there has not been any increase in over all cancer prevalence over time.

Figure 7.13 Time trends in Percent Prevalence of Cancer rates per 100,000 population



Source: NCRP (ICMR, 1990-2005)

Bombay cancer registry has population based data on incidence of cancer from sixties (Yeole, 2001). Analysis of time trends from sixties till 1999 confirm that though there has been massive changes in prevalence of some cancers (reduction in cancer cervix, increase in cancer breast) there has been no increase in overall prevalence of cancers over the last five decades.

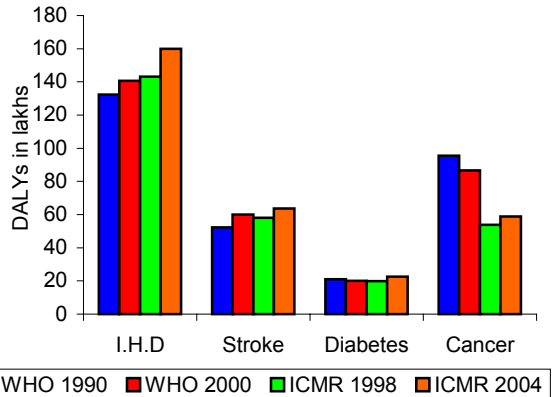
ICMR estimate of burden of disease due to cancer (all sites) based on data from population based cancer registries of NCRP are given in Table 7.9. The number of cases of cancer in 2004 is expected to be 820,000. The total number of DALYs due to cancer in India in the year 2004 is estimated as 5.9 million. This estimate is low as compared to the estimate of 8.6 million DALY reported by WHO Burden of Disease Study (2000) (Figure 7.14). For obtaining

Table 7.9 Projection of Burden of disease due to Cancer in 2004

	Male	Female
Population (in thousands)	550,404	515,354
No. of cases of cancer	390,809	428,545
No. of death	138,622	121,192
No. of YLL	13,96,508	16,17,787
No. of DALY	25,48,392	33,48,444

Source: Assessment of burden of non-communicable diseases, ICMR 2004

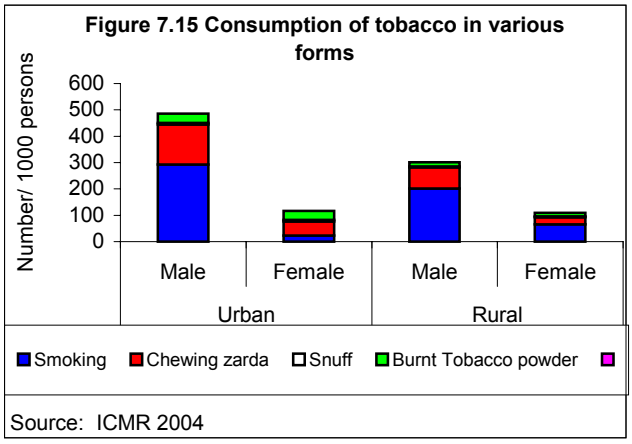
Figure 7.14 WHO and ICMR estimates/projections of Burden of Disease



Source: ICMR 2004

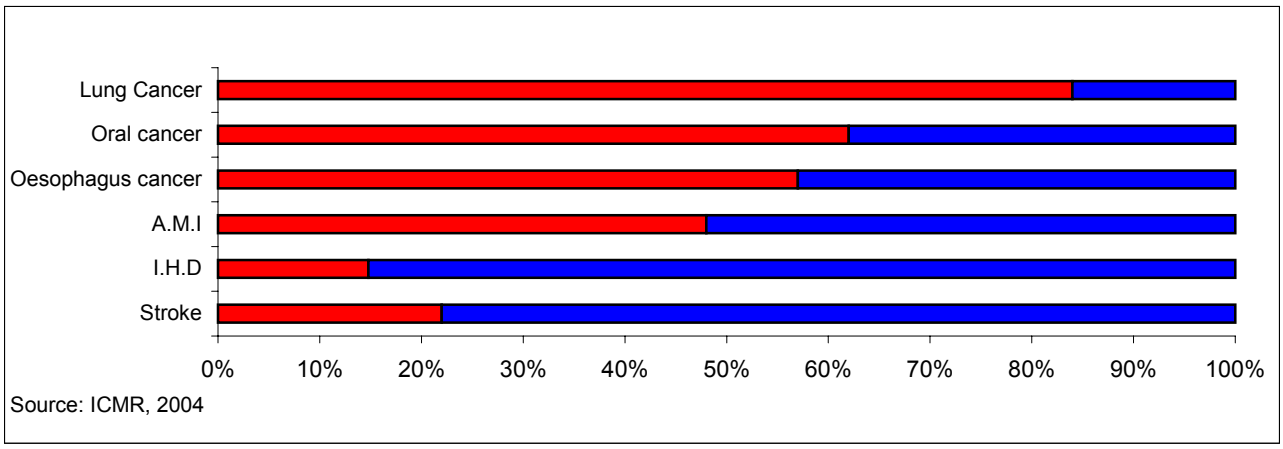
cancer disease burden estimates ICMR has used the mortality rates obtained by pooling the data of all six population based registries. However, if cancer mortality rates reported by Chennai Registry (which are highest cancer mortality) were used the figures become comparable to the figures reported by WHO Burden of disease study.

7.5.1 Tobacco as a risk factor for NCD in India



Data on Tobacco use in the country is available from 50th round NSSO (NSSO, 1975-2000) survey is shown in Figure 7.15. Prevalence rates of tobacco use in urban areas are 43 percent among males and 7 percent among females. In rural areas the prevalence rates for tobacco use are 64.4 percent among males and 15.5 percent among females. The overall prevalence rates of tobacco use in the country (rural+ urban) are 35.5 percent.

Risk ratio associated with tobacco use for non-communicable diseases are presented in Figure 7.16; 15percent of IHD cases, 48percentof AMI, 22percent of stroke cases, are



attributable to use of tobacco.. Tobacco use is the major factor responsible for Lung cancer, oral cancers and cancer oesophagus. Tobacco control a strategy is therefore will result in significant reduction of these NCD.

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