

Chapter 1

POPULATION AND CANCER INCIDENCE

Population Based Cancer Registries (PBCR) monitor the frequency of new cancer every year in well defined populations over time by collecting information on cancer cases from different sources (treatment facilities, clinicians and pathologists and death certificates). The cancer incidence rates are compared between different registries and within different subgroups of population in the respective areas to decipher patterns specific to a region.

This report on the occurrence of cancer in a defined population provides a framework for assessing and controlling the impact of cancer in the community.

Geographical Area and Population at Risk

Table 1.1 shows the number of male and female population covered by 25 PBCRs and provides information from 30 geographical areas. The average population covered per year ranged from 4 lakhs in Aizawl District of Mizoram State to 179 lakhs in Delhi Registry. Table 1.1 also gives the calendar year(s) (1 January to 31 December) of contribution of data by each PBCR.

Cancer Incidence - All Sites (ICD-10: C00-C97)

Cancer incidence refers to new cases of cancer diagnosed in a given population during a specified time period. The annual average incidence and mortality rates per 100,000 population are provided in this report.

The Definitions, Statistical Terms and Methods used in calculations have been outlined in an earlier report (NCRP, 2006).

As in the previous report (NCRP, 2010) the growth rate of the population between the census years 1991 and 2001 has been used (through the Difference Distribution Method of Takiar and Shobana, 2009) to estimate the midyear populations (five year age group and total) for the years of the report, viz., 2009 to 2011. This is because the 2011 five year age group wise census figures have not been published by the Office of Registrar General and Census Commissioner of Govt of India. The above has been followed for all the PBCR areas indicated in the report, except Nagaland as the 2001 census has been rejected by the Govt of Nagaland. The population for Nagaland PBCR (Kohima and Dimapur) has therefore been estimated using 1991 and 2011 census to get the mid-year population of 2009 to 2011. The 2001 five year age group structure was applied in the estimations.

Table 1.2 shows the number of cases registered during the respective periods by gender in different registries. The top five PBCRs to register maximum number of cases were Delhi (29027), Mumbai (22864),

Table 1.1: Estimated Population of all PBCRs

Registry	Area (sq.km.)	Male	Annual Average	Female	Annual Average	Total Pop.	Annual Average
Bangalore (2008-2009)	741.0	7688566	3844283	7000275	3500138	14688841	7344421
Barshi Rural (2009-2010)	3713.4	562752	281376	512114	256057	1074866	537433
Barshi Expanded (2009)	18205.4	2166606	2166606	2012864	2012864	4179470	4179470
Bhopal (2009-2010)	284.9	2062209	1031105	1859153	929577	3921362	1960681
Chennai (2009)	170.0	2434715	2434715	2377826	2377826	4812541	4812541
Delhi (2008-2009)	891.1	19777794	9888897	16124654	8062327	35902448	17951224
Mumbai (2009-2010)	603.0	15696321	7848161	12589362	6294681	28285683	14142842
Cachar District (2009-2010)	3786.0	1721308	860654	1645918	822959	3367226	1683613
Dibrugarh District (2009-2011)	3381.0	2048037	682679	1960145	653382	4008182	1336061
Kamrup Urban District (2009-2011)	267.1	1958077	652692	1741716	580572	3699793	1233264
Manipur State (MR) (2009-2010)	22327.0	2561235	1280618	2553822	1276911	5115057	2557529
<i>Imphal West District</i> (2009-2010)	519.0	504861	252431	517164	258582	1022025	511013
<i>MR - Excl. Imphal West</i> (2009-2010)	21808.0	2056374	1028187	2036658	1018329	4093032	2046516
Mizoram State (MZ) (2009-2010)	21087.0	1141810	570905	1082386	541193	2224196	1112098
<i>Aizawl District</i> (2009-2010)	3576.0	413858	206929	398742	199371	812600	406300
<i>MZ - Excl. Aizawl</i> (2009-2010)	17511.0	727950	363975	683643	341822	1411593	705797
Sikkim State (2009-2011)	7096.0	1131983	377328	986896	328965	2118879	706293
Ahmedabad - Rural (2009-2010)	7677.0	1752683	876342	1575426	787713	3328109	1664055
Ahmedabad - Urban (2009-2010)	299.7	5172941	2586471	4551576	2275788	9724517	4862259
Aurangabad (2009-2010)	51.0	1325044	662522	1214042	607021	2539086	1269543
Kolkata (2008-2009)	185.0	5087505	2543753	4341063	2170532	9428568	4714284
Kollam (2009-2010)	2491.0	2623557	1311779	2883637	1441819	5507194	2753597
Nagpur (2008-2009)	236.9	2520030	1260015	2400393	1200197	4920423	2460212
Pune (2009-2010)	344.2	5493728	2746864	4925469	2462735	10419197	5209599
Thiruvananthapuram (2009-2011)	300.0	1730580	576860	1835310	611770	3565890	1188630
Meghalaya (2010-2011)*	14262.0	1890541	945271	1889572	944786	3780113	1890057
<i>East Khasi Hills</i> (2010-2011)	2748.0	803443	401722	815709	407855	1619152	809576
Tripura State (2010)	10491.7	1883375	1883375	1791895	1791895	3675270	3675270
Nagaland (2010)*	1968.0	332883	332883	305838	305838	638721	638721
Wardha (2010-2011)	6309.0	1480113	740056.5	1378937	689468.5	2859050	1429525

* Meghalaya covers East Khasi Hills, West Khasi Hills, Jaintia Hills and Ri Bhoi districts

* Nagaland covers Kohima and Dimapur districts

Table 1.2: Total Number of Cases Registered for all PBCRs*(Calendar years of data shown in parentheses for each registry)*

Registry	Male	Female	Total Cases
Bangalore (2008-2009)	6026	7389	13415
Barshi Rural (2009-2010)	273	302	575
Barshi Expanded (2009)	797	968	1765
Bhopal (2009-2010)	1487	1441	2928
Chennai (2009)	2619	2796	5415
Delhi (2008-2009)	15189	13838	29027
Mumbai (2009-2010)	11091	11773	22864
Cachar District (2009-2010)	1579	1263	2842
Dibrugarh District (2009-2011)	1438	1050	2488
Kamrup Urban District (2009-2011)	2508	1908	4416
Manipur State (MR) (2009-2010)	1393	1478	2871
<i>Imphal West District</i> (2009-2010)	377	418	795
<i>MR - Excl. Imphal West</i> (2009-2010)	1016	1060	2076
Mizoram State (MZ) (2009-2010)	1376	1107	2483
<i>Aizawl District</i> (2009-2010)	696	597	1293
<i>MZ - Excl. Aizawl</i> (2009-2010)	680	510	1190
Sikkim State (2009-2011)	627	585	1212
Ahmedabad - Rural (2009-2010)	995	726	1721
Ahmedabad - Urban (2009-2010)	4533	3460	7993
Aurangabad (2009-2010)	504	540	1044
Kolkata (2008-2009)	5127	4786	9913
Kollam (2009-2010)	3375	3128	6503
Nagpur (2008-2009)	2047	2253	4300
Pune (2009-2010)	2876	3051	5927
Thiruvananthapuram (2009-2011)	2483	2649	5132
Meghalaya (2010-2011)	1520	859	2379
<i>East Khasi Hills</i> (2010-2011)	944	563	1507
Tripura State (2010)	1051	785	1836
Nagaland (2010)	218	110	328
Wardha (2010-2011)	760	822	1582

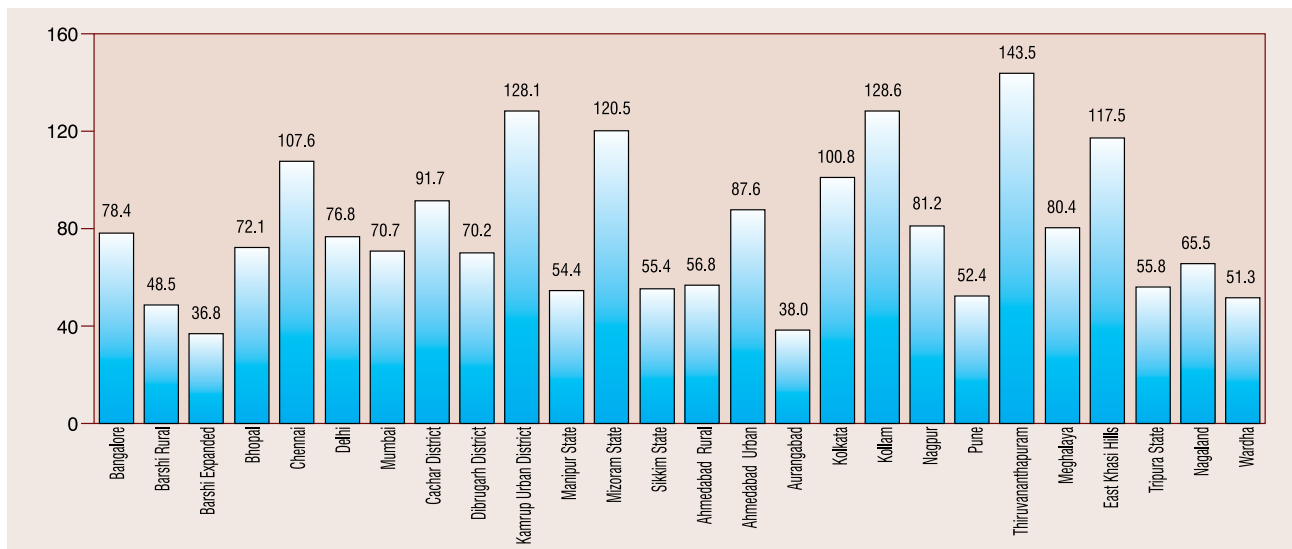
Table 1.3: Crude Rate (CR), Age Adjusted (AAR) and Truncated (TR) Incidence Rates per 100,000 population in different PBCRs

Registry	Male			Female		
	CR	AAR	TR	CR	AAR	TR
Bangalore (2008-2009)	78.4	113.7	165.4	105.6	137.2	270.8
Barshi Rural (2009-2010)	48.5	51.8	102.0	59.0	62.6	148.9
Barshi Expanded (2009)	36.8	43.7	97.5	48.1	56.6	149.1
Bhopal (2009-2010)	72.1	105.9	190.0	77.5	105.6	225.1
Chennai (2009)	107.6	118.0	200.0	117.6	123.8	262.7
Delhi (2008-2009)	76.8	125.2	216.3	85.8	120.6	261.6
Mumbai (2009-2010)	70.7	98.4	152.2	93.5	105.5	209.2
Cachar District (2009-2010)	91.7	129.0	251.0	76.7	98.0	216.2
Dibrugarh District (2009-2011)	70.2	99.4	186.3	53.6	71.8	166.2
Kamrup Urban District (2009-2011)	128.1	185.2	279.6	109.5	156.3	296.9
Manipur State (MR) (2009-2010)	54.4	74.7	139.4	57.9	73.9	153.4
<i>Imphal West District</i> (2009-2010)	74.7	94.3	171.3	80.8	90.3	171.1
<i>MR - Excl. Imphal West</i> (2009-2010)	49.4	69.5	130.6	52.0	68.9	148.0
Mizoram State (MZ) (2009-2010)	120.5	189.5	357.0	102.3	153.7	303.5
<i>Aizawl District</i> (2009-2010)	168.2	273.4	526.8	149.5	227.8	445.5
<i>MZ - Excl. Aizawl</i> (2009-2010)	93.4	145.6	267.5	74.6	112.1	225.3
Sikkim State (2009-2011)	55.4	82.6	120.2	59.3	94.2	173.0
Ahmedabad - Rural (2009-2010)	56.8	74.2	147.7	46.1	51.6	117.3
Ahmedabad - Urban (2009-2010)	87.6	117.5	209.3	76.0	87.1	184.6
Aurangabad (2009-2010)	38.0	59.6	119.9	44.5	62.1	143.3
Kolkata (2008-2009)	100.8	92.8	158.0	110.2	99.4	221.1
Kollam (2009-2010)	128.6	118.5	205.0	108.5	91.6	192.3
Nagpur (2008-2009)	81.2	96.4	181.3	93.9	103.0	228.6
Pune (2009-2010)	52.4	74.3	112.0	61.9	75.7	152.0
Thiruvananthapuram (2009-2011)	143.5	132.6	212.9	144.3	123.2	246.2
Meghalaya (2010-2011)	80.4	157.3	352.6	45.5	83.7	183.1
<i>East Khasi Hills</i> (2010-2011)	117.5	216.0	479.7	69.0	114.1	249.0
Tripura State (2010)	55.8	78.8	150.9	43.8	56.1	130.6
Nagaland (2010)	65.5	126.1	239.2	36.0	70.2	144.6
Wardha (2010-2011)	51.3	57.8	124.8	59.6	64.0	153.1

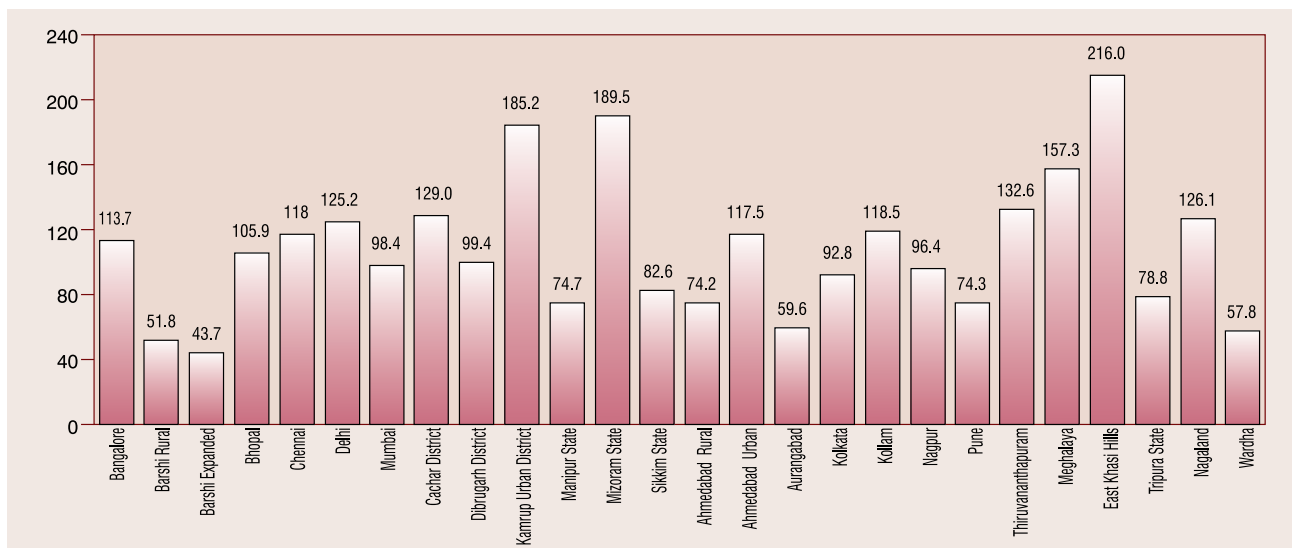
**Fig. 1.1(a): Average Annual Crude Rate, Age Adjusted and Truncated Incidence Rates
All Sites of Cancer (ICD-10): C00-C96**

Males

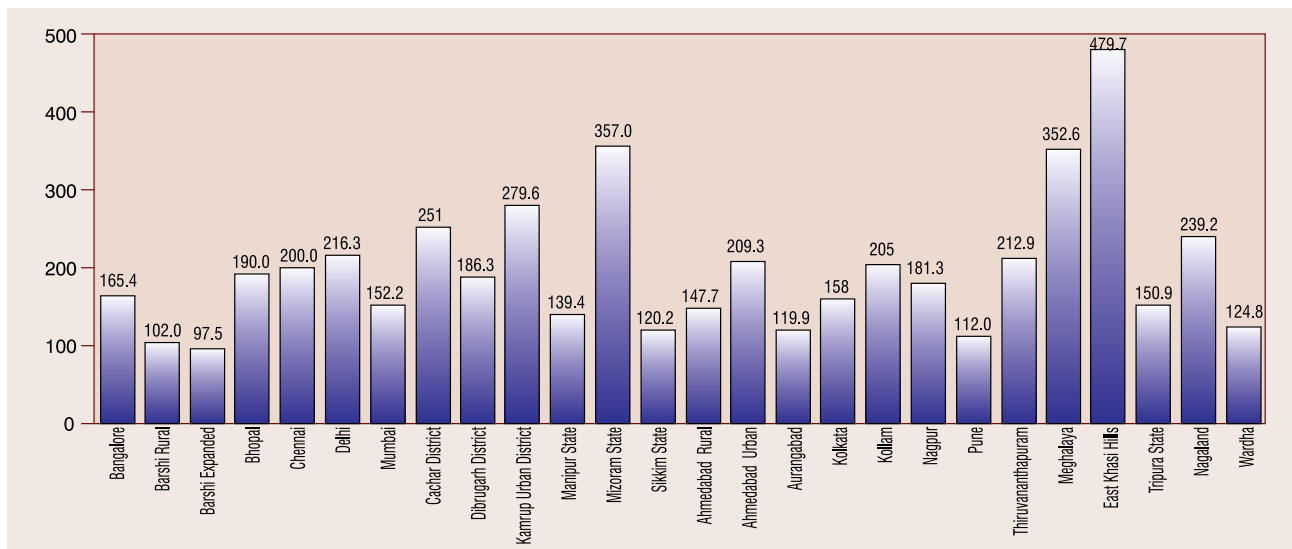
Crude Rate



Age Adjusted Rate



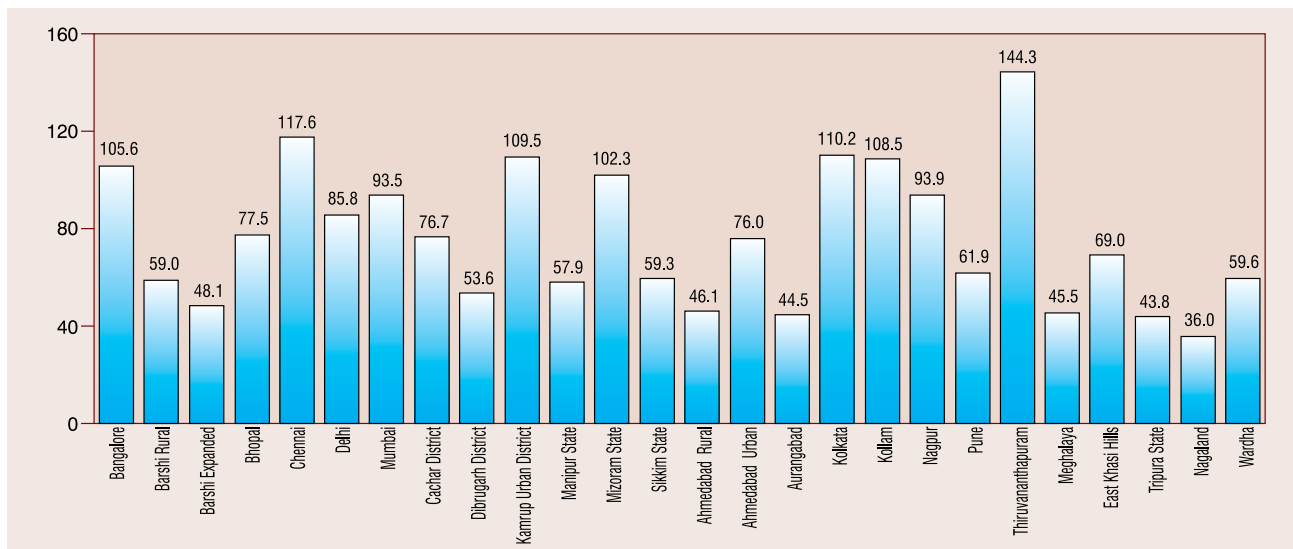
Truncated Rate



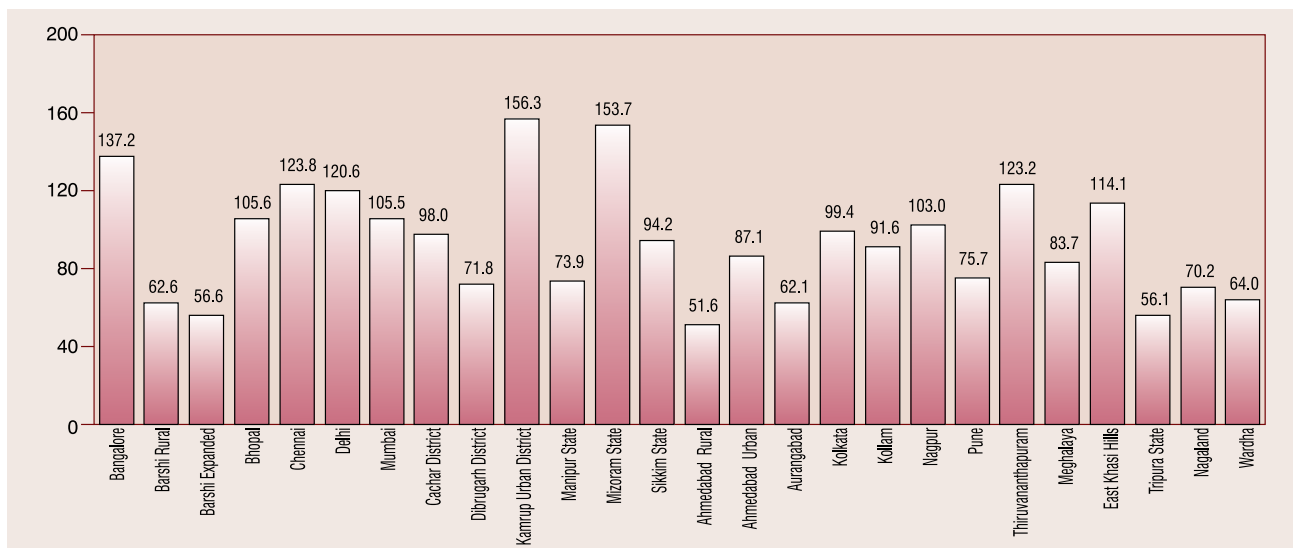
**Fig. 1.1(b): Average Annual Crude Rate, Age Adjusted and Truncated Incidence Rates
All Sites of Cancer (ICD-10): C00-C96**

Females

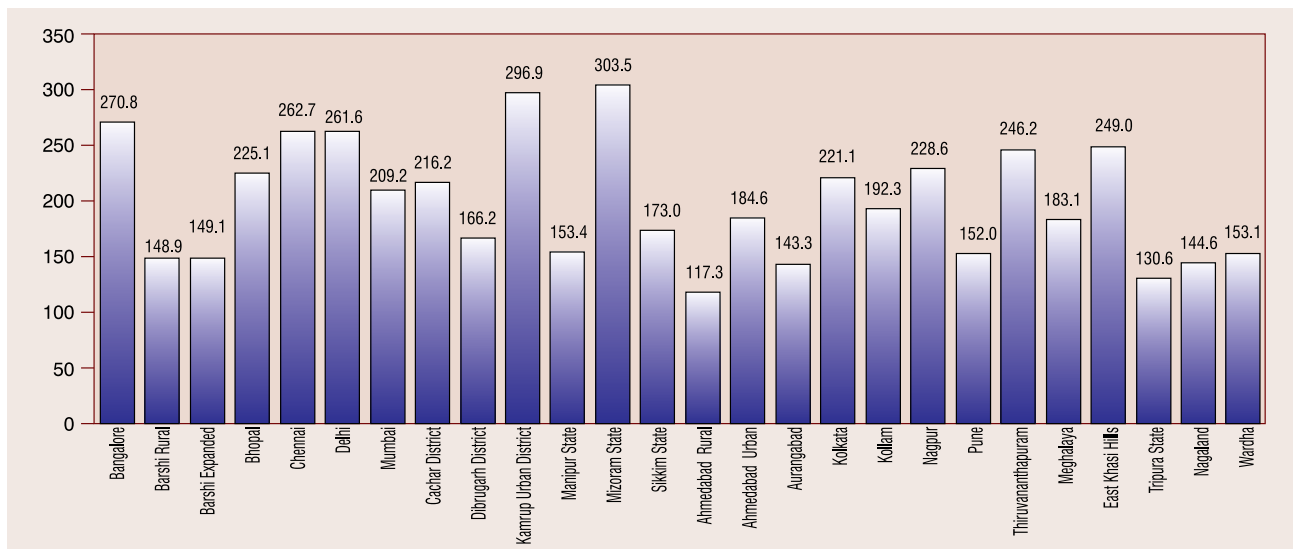
Crude Rate



Age Adjusted Rate

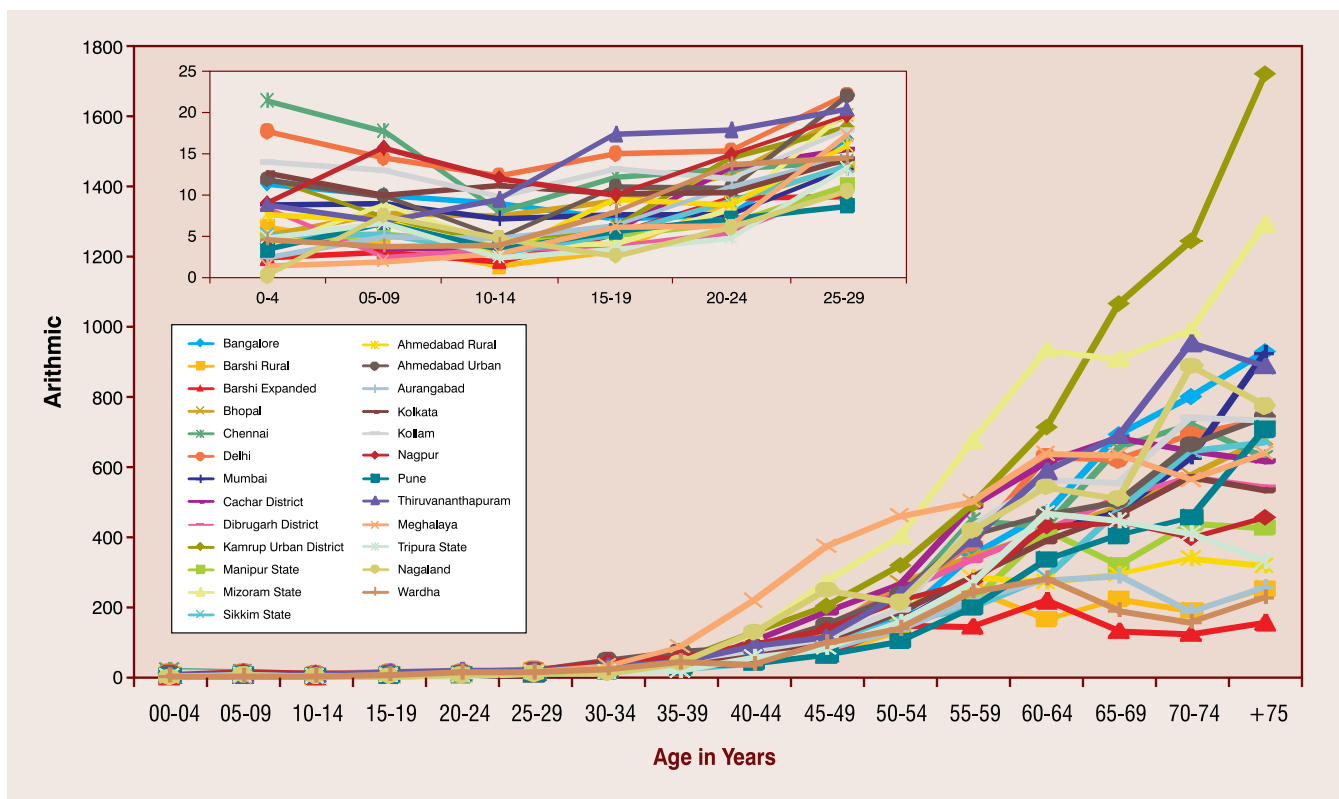
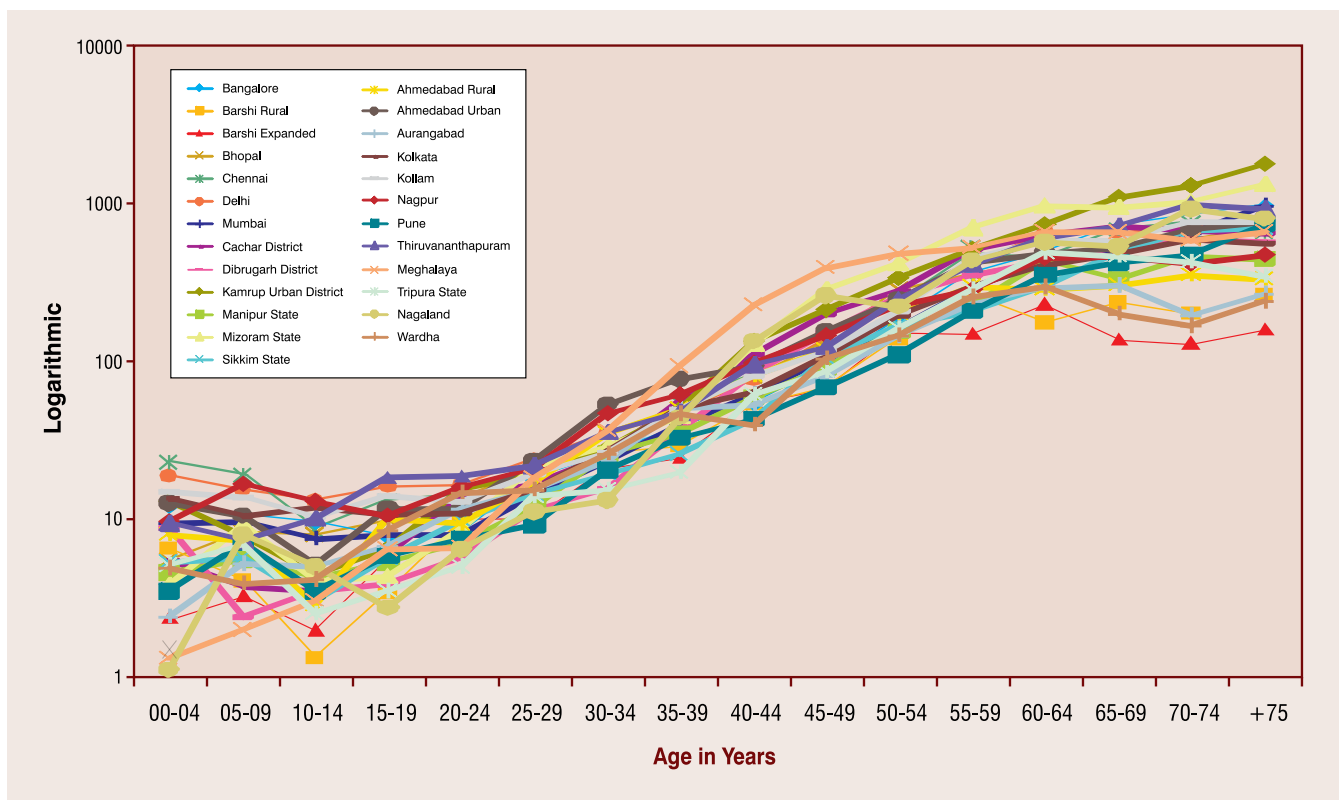


Truncated Rate



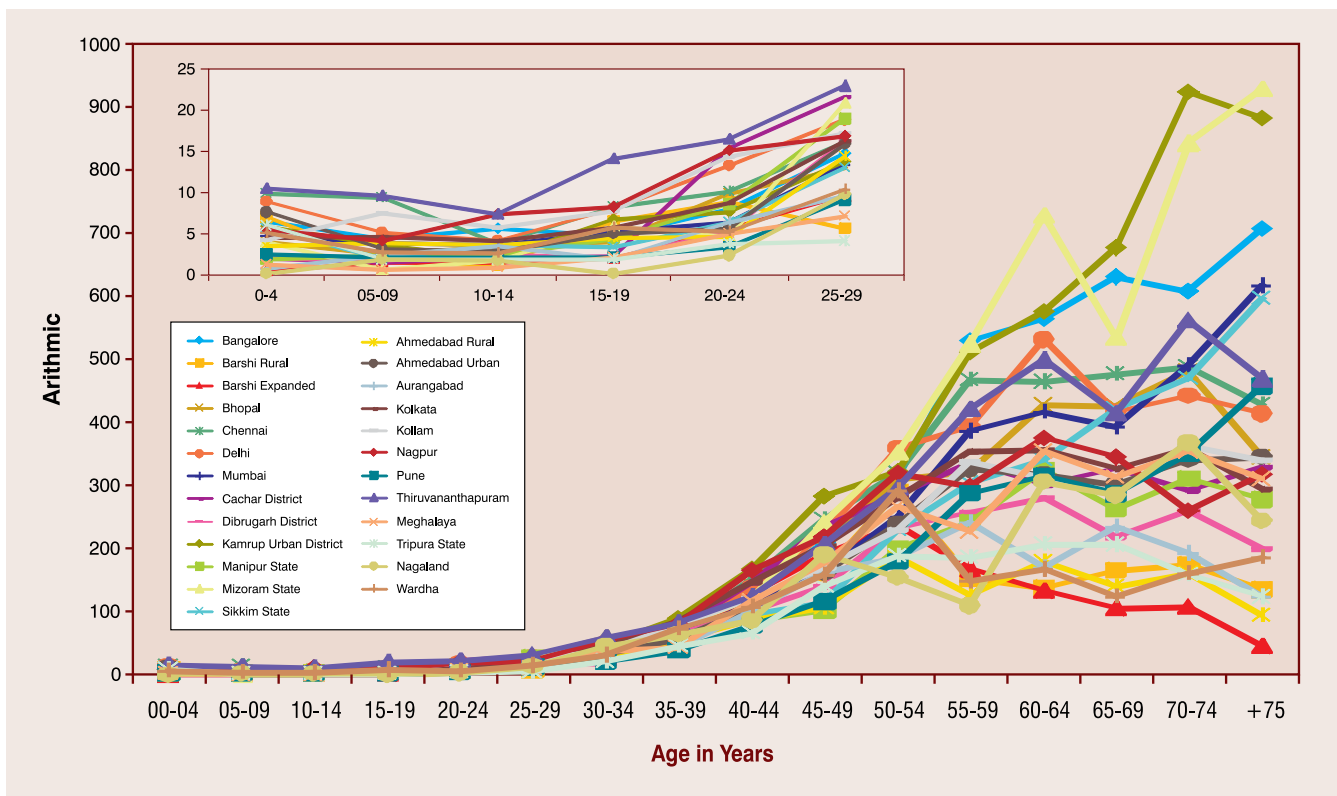
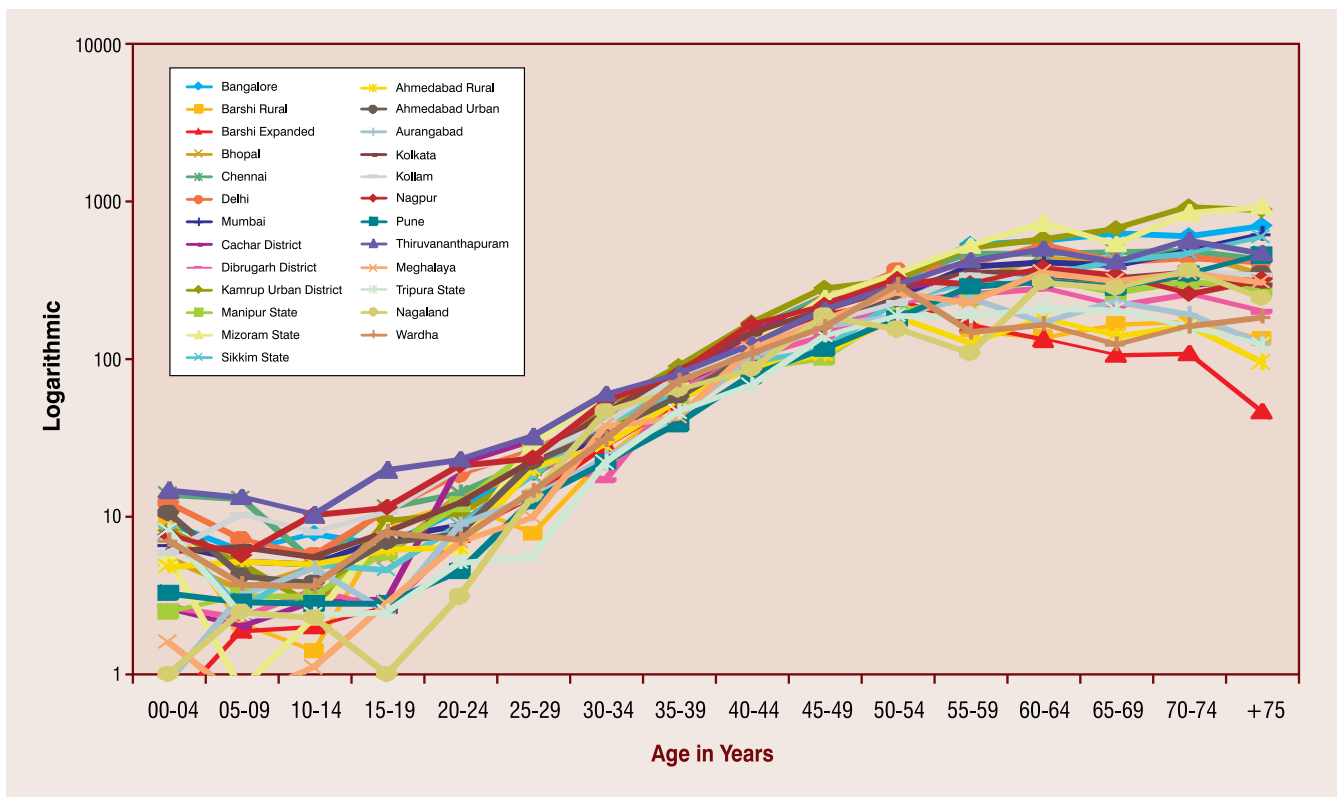
**Fig. 1.2(a): Average Annual Age Specific Cancer Incidence Rates
All Sites of Cancer for all PBCRs**

Males



**Fig. 1.2(b): Average Annual Age Specific Cancer Incidence Rates
All Sites of Cancer for all PBCRs**

Females



Bangalore (13415), Kolkata (9913) and Ahmedabad Urban (7993). Cancer cases in males were more than females in Cachar District, Dibrugarh District, Kamrup Urban, all the registry areas in Mizoram State, Ahmedabad Rural, Ahmedabad Urban, all the registry areas of Meghalaya, Tripura State and Nagaland. Slight variation was observed in numbers between the sexes in the registries at Barshi Rural, Bhopal, Chennai, Delhi, Mumbai, all the registry areas in Manipur State, Sikkim State, Aurangabad, Nagpur, Pune, Thiruvananthapuram and Wardha. Female cancer cases were more than males in Bangalore and Barshi Expanded.

Table 1.3 and fig. 1.1 provide the Crude Rate (CR), Age Adjusted Rates (AAR) and Truncated Rates (TR).

Crude Rate (CR)

The first five highest CR per 100,000 population among males was observed in Aizawl District (168.2) followed by Thiruvananthapuram (143.5), Kollam (128.3), Kamrup Urban District (128.1) and Mizoram State (120.5). Similarly among females the first five highest CR was observed in Aizawl District (149.5) followed by Thiruvananthapuram (144.3), Chennai (117.6), Kolkata (110.2) and Kamrup Uran District (109.5). Aizawl District followed by Thiruvananthapuram showed the highest CR in both males and females.

Age Adjusted Rates (AAR)

AAR per 100,000 population in males ranged from 43.7 in Barshi Expanded to 273.4 in Aizawl District of Mizoram State followed by East Khasi Hills District (216.0) of Meghalaya. In females it ranged from 51.6 in Ahmedabad Rural to 227.8 in Aizawl District of Mizoram State.

Truncated Rates (TR)

In males, the TR per 100,000 population ranged from 97.5 in Barshi Expanded to 526.8 in Aizawl District followed by East Khasi Hills District (479.7) of Meghalaya. Similarly, in females, it ranged from 117.3 in Ahmedabad Rural District to 445.5 in Aizawl District of Mizoram State.

Cumulative Rate and Risk

Day (1987) proposed the Cumulative rate as another age standardised incidence rate. The Cumulative risk is the probability that an individual will be diagnosed with cancer during a certain age period in the absence of any competing cause of death and assuming that the current trends prevail over the time period. For practical purposes, Cumulative rate is a good approximation of Cumulative risk over the defined period of time.

Age Specific Incidence Rates

The gravity of the problem can be assessed from the graph of average annual age specific incidence rates for all sites of cancer using arithmetic means. The log scale was used to measure trends.

Figures 1.2(a) and 1.2(b) show that age specific incidence rates increase with increase in age in all registries. Further, after 45 years of age, the average annual age specific incidence rates increased in males. In females, the increase was observed after 30 years of age.

Table 1.4: Cumulative Incidence Rate, Cumulative Risk and Possibility of one in number of persons developing Cancer of any Site (ICD-10): C00-C97 for all PBCRs (2009-2011)
Calculation based on age specific rates from 0-64 and 0-74 years of age

Registry	Cumulative Rates (%)				Cumulative Risk (%)				Possibility of one in number of persons developing cancer			
	0-64 Years		0-74 Years		0-64 Years		0-74 Years		0-64 Years		0-74 Years	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Bangalore (2008-2009)	6.2	9.6	13.6	15.8	6.0	9.2	12.8	14.6	17	11	8	7
Barshi Rural (2009-2010)	3.7	4.9	5.8	6.6	3.7	4.8	5.6	6.4	27	21	18	16
Barshi Expanded (2009)	3.5	4.8	4.8	5.9	3.4	4.7	4.7	5.7	29	21	21	17
Bhopal (2009-2010)	6.9	7.7	12.2	12.3	6.6	7.5	11.5	11.6	15	13	9	9
Chennai (2009)	7.3	9.2	14.2	14.0	7.1	8.8	13.2	13.1	14	11	8	8
Delhi (2008-2009)	8.1	9.2	14.7	13.5	7.8	8.8	13.6	12.6	13	11	7	8
Mumbai (2009-2010)	5.6	7.4	11.1	11.8	5.4	7.1	10.5	11.1	18	14	10	9
Cachar District (2009-2010)	8.9	7.5	15.5	10.6	8.5	7.2	14.4	10.0	12	14	7	10
Dibrugarh District (2009-2011)	6.5	5.7	11.9	8.1	6.3	5.5	11.3	7.8	16	18	9	13
Kamrup Urban District (2009-2011)	9.9	10.3	21.5	18.3	9.5	9.8	19.3	16.7	11	10	5	6
Manipur State (MR) (2009-2010)	5.1	5.5	8.9	8.4	5.0	5.4	8.5	8.1	20	19	12	12
<i>Imphal West District (2009-2010)</i>	6.3	6.2	11.6	10.3	6.1	6.0	10.9	9.8	16	17	9	10
<i>MR - Excl. Imphal West (2009-2010)</i>	4.7	5.3	8.1	7.8	4.6	5.2	7.8	7.5	22	19	13	13
Mizoram State (MZ) (2009-2010)	12.6	10.8	22.1	17.7	11.9	10.2	19.9	16.2	8	10	5	6
<i>Aizawl District (2009-2010)</i>	18.5	15.8	31.3	26.4	16.9	14.6	26.9	23.2	6	7	4	4
<i>MZ - Excl. Aizawl (2009-2010)</i>	9.5	8.0	17.2	12.9	9.1	7.7	15.8	12.1	11	13	6	8
Sikkim State (2009-2011)	4.3	6.2	9.9	10.6	4.2	6.0	9.5	10.1	24	17	11	10
Ahmedabad - Rural (2009-2010)	5.3	4.1	8.5	5.6	5.2	4.0	8.1	5.4	19	25	12	18
Ahmedabad - Urban (2009-2010)	7.6	6.5	13.5	9.7	7.4	6.3	12.6	9.2	14	16	8	11
Aurangabad (2009-2010)	4.4	4.8	6.7	7.0	4.3	4.7	6.5	6.7	23	21	15	15
Kolkata (2008-2009)	5.8	7.7	11.0	11.1	5.7	7.4	10.4	10.5	18	14	10	10
Kollam (2009-2010)	7.6	6.8	14.1	10.1	7.4	6.6	13.2	9.6	14	15	8	10
Nagpur (2008-2009)	6.7	8.0	10.8	11.0	6.4	7.7	10.3	10.4	16	13	10	10
Pune (2009-2010)	4.1	5.3	8.4	8.5	4.1	5.2	8.1	8.2	25	19	12	12
Thiruvananthapuram (2009-2011)	7.9	9.0	16.1	13.9	7.6	8.6	14.9	13.0	13	12	7	8
Meghalaya (2010-2011)	11.7	6.2	17.7	9.6	11.1	6.0	16.2	9.1	9	17	6	11
<i>East Khasi Hills (2010-2011)</i>	16.0	8.5	24.7	13.4	14.8	8.1	21.9	12.5	7	12	5	8
Tripura State (2010)	5.5	4.4	9.8	6.3	5.4	4.3	9.3	6.1	19	23	11	16
Nagaland (2010)	8.2	4.9	15.2	8.2	7.8	4.8	14.1	7.8	13	21	7	13
Wardha (2010-2011)	4.6	5.1	6.3	6.5	4.5	5.0	6.1	6.3	22	20	16	16

Cumulative Risk (%) in 0-64 years

This cumulative risk (%) gives an idea about a person developing cancer during the life period of 0-64 years of age. Among males, the cumulative risk ranged from 3.4% in Barshi Expanded to 16.9% in Aizawl District of Mizoram State closely followed by East Khasi Hills (14.8%) of Meghalaya. Hence 16.9% of males in the age group of 0-64 years in Aizawl District are likely to develop cancer in their life time and the males in the age group of 0-64 years in Barshi Expanded at 3.4% are the least at risk.

Among females, the cumulative risk ranged from 4.0% in Ahmedabad Rural to 14.6% in Aizawl District of Mizoram State. This means in Aizawl District, on an average about 14.6% of females in the 0-64 age group are likely to develop cancer in their life time whereas in Ahmedabad Rural the risk is 4.0%.

Cumulative Risk (%) in 0-74 years

Among males, the cumulative risk (%) in the 0-74 year age group ranged from 4.7% in Barshi Expanded to 26.9% in Aizawl District of Mizoram state followed by East Khasi Hills District of Meghalaya at 21.9%. Among females, the cumulative risk percentage in the 0-74 age group ranged from 5.4% in Ahmedabad Rural District to 23.2% in Aizawl District of Mizoram State. In both males and females, the cumulative risk (%) in the 0-74 years age group was almost double that seen in 0-64 years age group.