

### 1.1 Population and Cancer Incidence

The major contribution of Population Based Cancer Registries (PBCRs) is to provide cancer incidence rates, compare cancer incidence and patterns across other registries and in different subgroups of population in the respective areas.

PBCRs systematically collect information on all reportable neoplasms occurring in a geographically defined population from multiple sources of cancer registration. The systematic ascertainment of cancer incidence from multiple sources can provide an unbiased profile of the cancer burden in the population and how it is changing over time. The comparison and interpretation of population based cancer incidence data support population-based actions aimed at reducing the cancer burden.

Cancers reported for all anatomical sites of cancer as per International Classification of Diseases (ICD-10:C00-C97) are included in this chapter.

#### Geographical area and population at risk

The growth rate of the population between the census years 2001 and 2011 has been used (through the Difference Distribution Method of Takiar and Shobana, 2009) to estimate the mid-year populations (five-year age group and total) for the years of the report, viz., 2012 to 2016. The same has been followed for 27 PBCRs. The 2001 census has not been accepted by the Govt. of Nagaland. The population for Nagaland PBCR has therefore been estimated using 1991 and 2011 census to get the mid-year population of 2012-2016. Factors such as net migration, birth rate and death rate have not been considered.

The data from PBCR Hyderabad has been included for the first time in this report. PBCR Hyderabad covers the entire district of Hyderabad.

Table 1.1 shows the number of male and female population covered by 28 PBCRs and provides information from 32 geographical areas. The average population covered per year ranged from 1.39 lakhs in Pasighat PBCR from Arunachal Pradesh to 173.0 lakhs in Delhi registry. The sex ratio showed that Mumbai PBCR has the lowest ratio with 865 females to that of 1000 males. The percentage of rural population reporting in North eastern PBCRs was higher when compared to other PBCRs. There are 12 purely urban PBCRs, 1 purely rural and 15 PBCRs covering both urban and rural populations in differing proportions.

**Table 1.1** Population profile of 28 PBCRs under NCRP with Average Annual Person Years and Area of Residence: 2012-2016

SI No	Registry, State	Area (Sq.km.)	Males	Females	Total	Urban (%)	Rural (%)	Sex Ratio (per 1000)
<b>NORTH</b>								
1	Delhi, Delhi NCT	1157	9207329	8100344	17307673	100.0	0.0	880
2	Patiala district, Punjab	3325	1061516	951495	2013011	40.3	59.7	896
<b>SOUTH</b>								
3	Hyderabad district, Telangana	217	2035004	1958731	3993735	100.0	0.0	963
4	Kollam district, Kerala	2491	1246085	1406494	2652579	45.0	55.0	1129
5	Thi'puram district <sup>#</sup> , Kerala	2192	1585619	1738609	3324228	53.7	46.3	1096
6	Bangalore, Karnataka	741	4552663	4216563	8769226	100.0	0.0	926
7	Chennai, Tamil Nadu	170	2376013	2376899	4752912	100.0	0.0	1000
<b>EAST</b>								
8	Kolkata, West Bengal	185	2317736	2159343	4477079	100.0	0.0	932
<b>WEST</b>								
9	Ahmedabad urban, Gujarat	364	3270940	2951374	6222314	100.0	0.0	902
10	Aurangabad, Maharashtra	148	679169	636426	1315595	100.0	0.0	937
11	Osmanabad & Beed, Maharashtra	18262	2312853	2115972	4428825	18.7	81.3	915
12	Barshi rural, Maharashtra	3713	269505	242016	511521	0.0	100.0	898
13	Mumbai, Maharashtra	603	6743382	5835378	12578760	100.0	0.0	865
14	Pune, Maharashtra	613	2868568	2598211	5466779	100.0	0.0	906
<b>CENTRAL</b>								
15	Wardha district, Maharashtra	6309	678494	644397	1322891	32.5	67.5	950
16	Bhopal, Madhya Pradesh	350	1070229	992484	2062713	100.0	0.0	927
17	Nagpur, Maharashtra	237	1337922	1298800	2636722	100.0	0.0	971
<b>NORTH EAST</b>								
18	Manipur state	22327	1576453	1557045	3133498	29.2	70.8	988
	Imphal West district	519	267271	278024	545295	62.3	37.7	1040
19	Mizoram state	21087	591920	585845	1177765	52.1	47.9	990
	Aizawl district	3576	211475	217604	429079	78.6	21.4	1029
20	Sikkim state	7096	335541	300327	635868	25.2	74.8	895
21	Tripura state	10492	1959179	1888916	3848095	26.2	73.8	964
22	West Arunachal*, Arunachal Pradesh	42095	431626	415804	847430	25.8	74.2	963
	Papumpare district	3462	99623	100462	200085	54.9	45.1	1008
23	Meghalaya*, Meghalaya	14262	1012757	1016291	2029048	24.9	75.1	1003
	East Khasi Hills district	2748	440455	449646	890101	44.4	55.6	1021
24	Nagaland*, Nagaland	2390	376585	352257	728842	49.3	50.7	935
25	Pasighat*, Arunachal Pradesh	10193	70769	68765	139534	25.4	74.6	972
26	Cachar district, Assam	3786	940216	906827	1847043	18.2	81.8	964
27	Dibrugarh district, Assam	3381	698860	678461	1377321	18.4	81.6	971
28	Kamrup urban, Assam	336	653267	635246	1288513	100.0	0.0	972

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

\* Nagaland covers Kohima and Dimapur districts

\* Pasighat covers East Siang and Upper Siang

\* West Arunachal covers Tawang, West Kameng, East Kameng, Upper Subansiri, Lower Subansiri, Kurung Kumey, Papumpare and West Siang

<sup>#</sup> Thi'puram district represents Thiruvananthapuram district in all the tables and figures.

**Table 1.2** Total Number of Cancer Cases Registered in 28 PBCRs under NCRP

SI No	Registry	Males		Females		Total (N)
		n	%	n	%	
NORTH						
1	Delhi (2012-2014)	31032	51.6	29065	48.4	60097
2	Patiala district (2012-2016)	5394	47.0	6077	53.0	11471
SOUTH						
3	Hyderabad district (2014-2016)	5143	44.4	6453	55.6	11596
4	Kollam district (2012-2016)	9930	50.4	9780	49.6	19710
5	Thi'puram district (2012-2016)	13506	48.5	14327	51.5	27833
6	Bangalore (2012-2014)	13221	45.5	15828	54.5	29049
7	Chennai (2012-2016)	14468	46.3	16803	53.7	31271
EAST						
8	Kolkata (2012-2015)	10186	52.7	9151	47.3	19337
WEST						
9	Ahmedabad urban (2012-2016)	14579	56.9	11025	43.1	25604
10	Aurangabad (2012-2016)	1923	49.0	2001	51.0	3924
11	Osmanabad & Beed (2012-2015)	3635	44.9	4467	55.1	8102
12	Barshi rural (2012-2016)	726	47.2	813	52.8	1539
13	Mumbai (2012-2015)	26256	48.9	27458	51.1	53714
14	Pune (2012-2016)	9687	47.2	10818	52.8	20505
CENTRAL						
15	Wardha district (2012-2016)	2389	48.5	2537	51.5	4926
16	Bhopal (2012-2015)	3567	49.8	3589	50.2	7156
17	Nagpur (2012-2016)	5952	49.6	6047	50.4	11999
NORTH EAST						
18	Manipur state (2012-2016)	3702	45.1	4500	54.9	8202
	Imphal West district (2012-2016)	1137	43.1	1500	56.9	2637
19	Mizoram state (2012-2016)	4323	53.6	3736	46.4	8059
	Aizawl district (2012-2016)	2180	53.4	1900	46.6	4080
20	Sikkim state (2012-2016)	1172	50.9	1131	49.1	2303
21	Tripura state (2012-2016)	6559	57.2	4914	42.8	11473
22	West Arunachal (2012-2016)	1222	51.1	1171	48.9	2393
	Papumpare district (2012-2016)	472	47.2	528	52.8	1000
23	Meghalaya (2012-2016)	4688	62.3	2832	37.7	7520
	East Khasi Hills district (2012-2016)	2884	62.5	1729	37.5	4613
24	Nagaland (2012-2016)	1403	58.6	992	41.4	2395
25	Pasighat (2012-2016)	321	51.4	303	48.6	624
26	Cachar district (2012-2016)	4663	54.2	3943	45.8	8606
27	Dibrugarh district (2012-2016)	2535	53.1	2238	46.9	4773
28	Kamrup urban (2012-2016)	6223	56.5	4790	43.5	11013

Reporting year data given in parentheses

In Table 1.2, the top five PBCRs to register maximum number of cases were Delhi (60097), Mumbai (53714), Chennai (31271), Bangalore (29049) and Thiruvananthapuram district (27833) PBCRs. Most of the registries in north eastern part of the country registered higher proportion of cancers in males, except at Manipur, Imphal West district, and Papumpare

district in Arunachal Pradesh. Registered females cancers were higher in other regions except in Delhi, Kollam district, Kolkata and Ahmedabad urban.

**Table 1.3 Incidence Rates: Crude Rate (CR), Age Adjusted Rate (AAR) and Truncated Rate (TR (35-64yrs)) per 100,000 population for All Sites of Cancer in 28 PBCRs under NCRP**

SI No	Registry	Males			Females		
		CR	AAR	TR	CR	AAR	TR
NORTH							
1	Delhi (2012-2014)	112.3	147.0	232.2	119.6	141.0	279.0
2	Patiala district (2012-2016)	101.6	108.2	196.4	127.7	124.6	271.4
SOUTH							
3	Hyderabad district (2014-2016)	84.2	101.6	172.2	109.8	136.0	278.3
4	Kollam district (2012-2016)	159.4	127.7	198.0	139.1	107.1	205.7
5	Thi'puram district (2012-2016)	170.4	137.8	211.5	164.8	127.3	242.8
6	Bangalore (2012-2014)	96.8	122.1	181.7	125.1	146.8	283.6
7	Chennai (2012-2016)	121.8	119.9	185.2	141.4	132.8	260.5
EAST							
8	Kolkata (2012-2015)	109.9	91.2	145.2	105.9	89.2	175.9
WEST							
9	Ahmedabad urban (2012-2016)	89.1	98.3	183.2	74.7	76.7	158.0
10	Aurangabad (2012-2016)	56.6	70.9	121.6	62.9	75.1	158.5
11	Osmanabad & Beed (2012-2015)	39.3	39.5	71.5	52.8	49.4	108.2
12	Barshi rural (2012-2016)	53.9	50.6	80.5	67.2	61.0	126.5
13	Mumbai (2012-2015)	97.3	108.4	155.1	117.6	116.2	207.6
14	Pune (2012-2016)	67.5	83.0	120.0	83.3	94.0	177.7
CENTRAL							
15	Wardha district (2012-2016)	70.4	64.5	109.7	78.7	69.9	148.9
16	Bhopal (2012-2015)	83.3	101.0	180.0	90.4	106.9	223.3
17	Nagpur (2012-2016)	89.0	91.1	158.6	93.1	89.8	188.2
NORTH EAST							
18	Manipur state (2012-2016)	47.0	62.8	91.0	57.8	71.1	129.6
	Imphal West district (2012-2016)	85.1	95.3	125.5	107.9	110.9	198.2
19	Mizoram state (2012-2016)	146.1	207.0	357.7	127.5	172.3	313.2
	Aizawl district (2012-2016)	206.2	269.4	485.5	174.6	214.1	377.5
20	Sikkim state (2012-2016)	69.9	88.7	131.5	75.3	97.0	175.2
21	Tripura state (2012-2016)	67.0	80.9	145.9	52.0	58.3	127.3
22	West Arunachal (2012-2016)	56.6	101.1	199.9	56.3	96.3	215.7
	Papumpare district (2012-2016)	94.8	201.2	372.7	105.1	219.8	499.0
23	Meghalaya (2012-2016)	92.6	176.8	386.0	55.7	96.5	201.1
	East Khasi Hills district (2012-2016)	131.0	227.9	494.5	76.9	118.6	242.5
24	Nagaland (2012-2016)	74.5	124.5	223.8	56.3	88.2	193.6
25	Pasighat (2012-2016)	90.7	120.4	207.6	88.1	116.2	260.3
26	Cachar district (2012-2016)	99.2	129.0	233.4	87.0	104.8	234.2
27	Dibrugarh district (2012-2016)	72.5	91.9	155.9	66.0	76.8	170.7
28	Kamrup urban (2012-2016)	190.5	213.0	339.7	150.8	169.6	320.8

Reporting year data given in parentheses

## Crude Rate (CR)

In Table 1.3, the first five highest CR per 100,000 population among males was observed in Aizawl district (206.2), followed by Kamrup urban (190.5), Thiruvananthapuram district (170.4), Kollam district (159.4) and Mizoram state (146.1).

Similarly, among females, the first five highest CR was observed in Aizawl district (174.6) followed by Thiruvananthapuram district (164.8), Kamrup urban (150.8), Chennai (141.4) and Kollam district (139.1).

The registries covering geographic areas of North eastern parts of the country and South Western coastal areas have showed higher crude incidence rates in both males and females. The finding of higher CRs in north eastern states conforms to higher incidence rates found in earlier NCDIR-NCRP reports. Determined by the population pyramid, registries in South Western coastal areas showed higher proportions of older age groups which gives a pointer towards higher rates of CRs as compared to AARs found in the area.

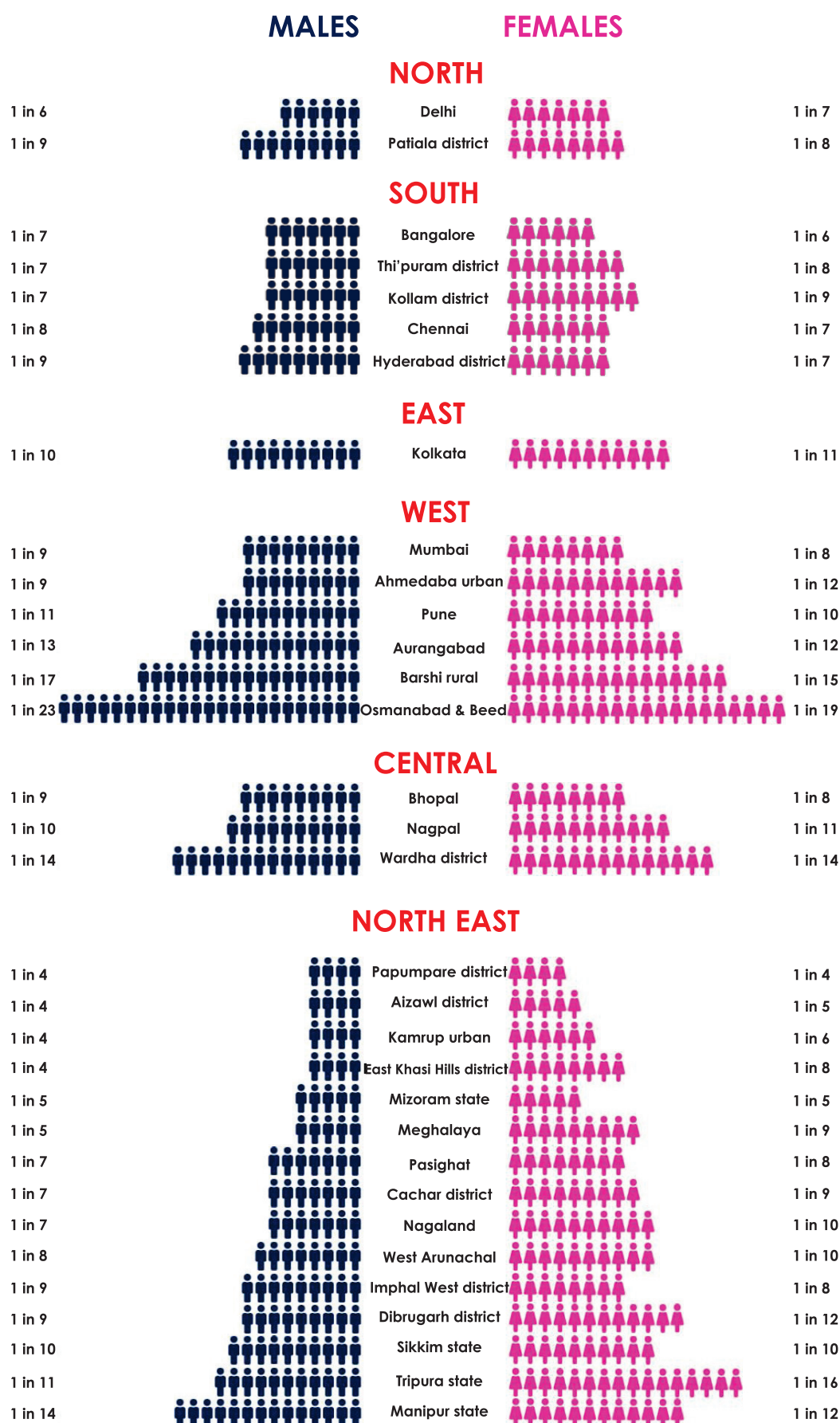
## Age Adjusted Rates (AAR)

The AAR per 100,000 population in males ranged from 39.5 in Osmanabad & Beed district in Maharashtra to 269.4 in Aizawl district of Mizoram state followed by East Khasi Hills district (227.9) in Meghalaya. In females, it ranged from 49.4 in Osmanabad & Beed district to 219.8 in Papumpare district under West Arunachal PBCR followed by Aizawl district (214.1).

## Truncated Rates (TR)

In males, the TR per 100,000 population ranged from 71.5 in Osmanabad & Beed district to 494.5 in East Khasi Hills district followed by Aizawl district (485.5). Similarly, in females, it ranged from 108.2 in Osmanabad & Beed district to 499.0 in Papumpare district of Arunachal Pradesh.

**Figure 1.1** Cumulative Risk of developing Cancer of Any Site in 0-74 years of Age in 28 PBCRs under NCRP





1 out of every 4 males in the Papumpare district, Aizawl district, Kamrup urban and East Khasi Hills district were likely to develop cancer in the age group 0-74 years. In Papumpare district, 1 in 4 females had chances of developing cancer in the age group 0-74 years. Most registries in North Eastern region showed more male preponderance in risk, whereas registries other than North Eastern showed more female preponderance in risk.

In Osmanabad and Beed district, 1 in 23 and 1 in 19 males and females, respectively could develop cancer in the age group 0-74 years. It was observed that the risk of developing cancer among males and females was similar within most of the registries.

## 1.2 Number and Relative Proportion for all sites of Cancer in Hospital Based Cancer Registries

Hospital Based Cancer Registries (HBCRs) compile information on the cases diagnosed and/or treated in a particular institution. They provide readily accessible information on the subjects with cancer, the treatment they received and its result, thus contributing to patient care. HBCRs register malignant cases irrespective of the residential status of the patient.

Of the 236 HBCR centres registered in NCRP 58 centres were selected which had completed data transmission and quality checks for one or more years during the period-2012-2016 for inclusion in the report. The data of many of these (42 out of 58) hospitals is included for the first time under the NCDIR-NCRP network.

**Table 1.4 Number (n) and Relative Proportion (%) of New Cases reported for All Sites of Cancer in 58 HBCRs under NCRP**

SI No	Registry (Year)	Males		Females		Total N
		n	%	n	%	
NORTH						
1	Postgraduate Institute of Medical Education and Research, Chandigarh (2012-2016)	16786	55.5	13432	44.5	30218
2	Sher-I-Kashmir Institute of Medical Sciences, Srinagar (2012-2016)	9433	57.9	6864	42.1	16297
3	Medanta Cancer Centre, Gurgaon (2012-2016)	4197	54.3	3527	45.7	7724
4	Max Super Speciality Hospital, New Delhi (2013-2016)	4773	49.7	4827	50.3	9600
5	Dr. B.R. Ambedkar Institute Rotary Cancer Hospital, New Delhi (2012, 2014-2015)	14649	55.4	11771	44.6	26420
6	Regional Cancer Centre Kamala Nehru Memorial Hospital, Allahabad (2014-2016)	7011	50.8	6793	49.2	13804
7	Fortis Memorial Research Institute, Gurgaon (2014-2016)	5105	54.8	4214	45.2	9319
8	Indira Gandhi Institute of Medical Sciences, Patna (2014-2016)	4391	51.1	4209	48.9	8600
9	Regional Cancer Centre Indira Gandhi Medical College, Shimla (2014-2016)	3045	53.6	2633	46.4	5678
10	Government Medical College, Jammu (2014-2016)	2846	55.0	2329	45.0	5175

SI No	Registry (Year)	Males		Females		Total N
		n	%	n	%	
11	Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow (2014-2016)	2889	56.9	2186	43.1	5075
12	Rajiv Gandhi Cancer Institute, New Delhi (2012-2013)	7764	56.3	6020	43.7	13784
13	Max Super Speciality Hospital, PPG, Delhi (2015-2016)	1212	49.3	1244	50.7	2456
14	Mahavir Cancer Sansthan and Research Centre, Patna (2015)	4040	46.2	4707	53.8	8747
15	Asian Institute of Medical Sciences, Faridabad (2016)	568	51.8	528	48.2	1096
16	BPS Government Medical College for Women, Sonapat (2016)	184	71.9	72	28.1	256

## EAST

17	Apollo Hospital, Bhubaneswar (2012-2016)	653	61.2	414	38.8	1067
18	Tata Medical Center, Kolkata (2015-2016)	4856	52.6	4384	47.4	9240
19	Acharya Harihar Regional Cancer Centre, Cuttack (2015-2016)	3549	45.9	4177	54.1	7726
20	Chittaranjan National Cancer Institute, Kolkata (2016)	2948	51.6	2768	48.4	5716

## WEST

21	Pravara Rural Hospital & Rural Medical College, Loni (2016)	360	43.2	473	56.8	833
22	Tata Memorial Hospital- Mumbai (2012-2014)	46621	57.4	34639	42.6	81260
23	The Gujarat Cancer & Research Institute, Ahmedabad (2014-2016)	35292	61.3	22266	38.7	57558

## SOUTH

24	Regional Cancer Centre, Thiruvananthapuram (2012-2016)	30066	49.3	30918	50.7	60984
25	Cancer Institute(WIA),Chennai (2012-2016)	20902	47.2	23358	52.8	44260
26	Amrita Institute of Medical Sciences & Research Centre, Kochi (2012-2016)	10231	55.7	8127	44.3	18358
27	Malabar Cancer Centre, Kannur (2012-2016)	8190	53.8	7038	46.2	15228
28	Vydehi Institute of Medical Sciences, Bengaluru (2012-2016)	4212	52.7	3773	47.3	7985
29	International Cancer Centre, Neyyoor (2012-2016)	1177	46.2	1373	53.8	2550
30	Rural Development Trust, Bathalapalle (2012-2016)	484	25.2	1437	74.8	1921
31	Kidwai Memorial Institute of Oncology, Bengaluru (2012-2015)	15291	44.9	18789	55.1	34080
32	St. Johns Medical Hospital, Bangalore (2013-2016)	1911	51.0	1838	49.0	3749
33	JIPMER, Regional Cancer Centre, Puducherry (2014-2016)	5755	42.2	7878	57.8	13633



SI No	Registry (Year)	Males		Females		Total N
		n	%	n	%	
34	Govt Arignar Anna Memorial Cancer Hospital & Research Institute, Kanchipuram (2014-2016)	1754	36.0	3123	64.0	4877
35	Shakunatala Memorial Hospital & Research Centre, Hubli (2014-2016)	190	53.5	165	46.5	355
36	HCG Bangalore Institute of Oncology, Bangalore (2012-2013)	2633	46.1	3073	53.9	5706
37	HCG NMR Cancer Centre, Hubli (2015-2016)	705	48.5	749	51.5	1454
38	Mandya Institute of Medical Sciences, Mandya (2015-2016)	216	50.2	214	49.8	430
39	A.J. Hospital & Research Centre, Mangalore (2014-2015)	207	57.2	155	42.8	362
40	SDM College of Dental Sciences and Hospital, Dharwad (2014-2015)	198	78.3	55	21.7	253
41	Indo-American Cancer Institute & Research Centre, Hyderabad (2012)	3137	40.3	4652	59.7	7789
42	Government Medical College, Thrissur (2014)	1724	53.8	1478	46.2	3202
43	Narayana Hrudayalaya Health City, Bangalore (2016)	843	56.5	649	43.5	1492
44	Erode Cancer Centre, Thindal, Erode (2012)	493	43.2	648	56.8	1141
45	Father Muller Medical College Hospital, Mangalore (2016)	426	45.6	508	54.4	934
46	General Hospital, Ernakulum (2012)	344	51.0	330	49.0	674
47	MES Medical College & Hospital, Perinthalmanna (2016)	281	53.2	247	46.8	528

**CENTRAL**

48	Regional Cancer Centre, Raipur (2012-2016)	4797	43.1	6324	56.9	11121
49	Gandhi Medical College, Bhopal (2012-2015)	2776	50.8	2690	49.2	5466
50	Cancer Hospital & Research Institute, Gwalior (2014-2016)	5192	59.5	3534	40.5	8726
51	RST Regional Cancer Hospital, Cancer Relief Society, Nagpur (2012-2016)	6632	50.8	6416	49.2	13048

**NORTH EAST**

52	Dr. B. Borooah Cancer Institute, Guwahati (2012-2016)	23638	57.8	17269	42.2	40907
53	Cachar Cancer Hospital, Silchar (2012-2016)	4806	58.0	3483	42.0	8289
54	Assam Medical College - Dibrugarh (2012-2016)	2803	49.1	2910	50.9	5713
55	Regional Cancer Centre, Agartala (2014-2016)	3111	57.5	2296	42.5	5407

SI No	Registry (Year)	Males		Females		Total N
		n	%	n	%	
56	North East Cancer Hospital & Research Institute, Guwahati (2014-2016)	2321	62.6	1384	37.4	3705
57	Regional Institute of Medical Sciences, Imphal (2014-2016)	1272	44.6	1583	55.4	2855
58	Mizoram State Cancer Institute (Civil Hospital), Aizawl (2014-2016)	1503	53.0	1332	47.0	2835
<b>TOTAL</b>		<b>353393</b>	<b>52.9</b>	<b>314273</b>	<b>47.1</b>	<b>667666</b>

Reporting year data given in parentheses

Among the total 667666 cases registered; 52.9% were males and 47.1% were females. The highest number of new cases for all sites of cancer were reported in Tata Memorial Hospital, Mumbai for both males and females. The second highest numbers were reported from The Gujarat Cancer & Research Institute, Ahmedabad for males and Regional Cancer Centre, Thiruvananthapuram for females.