Original Articles

Population-based incidence and patterns of cancer in Kamrup Urban Cancer Registry, India

JAGANNATH D. SHARMA, AMAL C. KATAKI, VIJAY C.R.

ABSTRACT

Background. Cancer is not a notifiable disease in India. The Indian Council of Medical Research (ICMR) initiated the National Cancer Registry Programme in 1982 to measure the burden and pattern of cancer in India. However, no data were available from the northeastern region till 2001 when a WHO-sponsored, ICMR project showed a relatively high frequency of microscopically diagnosed cases of cancer in the region. A population-based cancer registry was established in January 2003 in Guwahati to cover the Kamrup Urban district in the northeastern region of India. We report the data generated in the first 6 years of the registry (2003–08).

Methods. Information on cancer was obtained by voluntary participation of different sources including major hospitals, diagnostic centres, state referral board and birth and death registry centres within the registry area. A total of 6608 cases were registered during the 6-year period (1 January 2003–31 December 2008); 3927 were men and 2681 women.

Results. The age-adjusted incidence rates were 167.9 per 100 000 among men and 133.8 per 100 000 among women. The oesophagus was the leading site of cancer among men, comprising 18.3% of all cancers with an age-adjusted rate of 30.7 per 100 000. Among women, the breast followed by the cervix uteri were the leading sites of cancer. These two cancers comprised 30% of all cancers among women. Tobacco-related cancers accounted for 58.2% of cancers among men and 26.9% of cancers among women.

Conclusion. The patterns observed from the analysis of data from the cancer registry at Guwahati provide comprehensive information on occurrence of cancer and can be valuable for planning cancer control programmes in the region.

Natl Med J India 2013;26:133–41

Dr B. Borooah Cancer Institute, Guwahati 781016, Assam, India
JAGANNATH D. SHARMA Department of Pathology
AMAL C. KATAKI Director

National Cancer Registry Programme (ICMR), Bengaluru, Karnataka, India
VIJAY C.R. Statistician

Correspondence to JAGANNATH D. SHARMA;
dr_j_sarma@rediffmail.com

INTRODUCTION

The Indian Council of Medical Research (ICMR) launched the National Cancer Registry Programme (NCRP) in 1982 to record the burden of cancer in India. However, till 2001 no data on cancer were available from the northeastern region of India. In 2001, a WHO-sponsored ICMR project called 'Development of an Atlas of Cancer in India' was initiated.[1,2] The relatively high frequency of microscopically diagnosed cancer cases observed in this project prompted the ICMR to start a population-based cancer registry (PBCR) in the Kamrup urban district of the northeastern region of India from 2003. Except for sporadic hospital-based reports on the prevalence of cancer, no population-based registry data were available and cancer control activities had been negligible in the region.

Guwahati is the capital of Assam, the most populous state in the northeastern region of India and is the headquarters of the Kamrup district. It is located at 26.11 degree North latitude and 96.46 degree East longitude, approximately 200 metres (656 feet) above mean sea level. The PBCR at Guwahati is located in the pathology department of Dr B. Borooah Cancer Institute (BBCI), the regional cancer centre (RCC) in the northeast and covers the Kamrup Urban district. It has been collecting data on the pattern of cancer of the local population since January 2003. Cancer registration in this registry is as active as in the other PBCRs in India. Staff of the PBCR visits various sources of registration to record information on cancer cases in a common format. Data collection is for both incidence cases and mortality. The data collected over the first 6 years of the registry (2003–08) are presented here.

METHODS

The PBCR covers the Kamrup urban district comprising an area of 261.8 sq. km. The population as per the 2001 Census is 490 772 men and 409 746 women (total population 900 518).[3] Besides BBCI, which is the main source of data from the population of the Kamrup urban district, the other major sources are Guwahati Medical College, pathology laboratories, oncology consultation clinics and the vital statistics department. Patients are also referred for treatment to cancer centres in Kolkata, Delhi and Mumbai and data from these centres are obtained from the registries located in these cities.

At least one social investigator is always present at the patient registration counter of BBCI. Within BBCI, all information on

patients who visit and have a minimum period of stay of one year in the Kamrup urban district is recorded in the standard NCRP core form. Subsequently, these patients are followed up for a diagnosis of malignancy or otherwise. In other hospitals and diagnostic centres, information on diagnosis of cancer cases is recorded from the pathology and radiotherapy departments. Trained members of the PBCR staff periodically visit different places in Guwahati where patients with cancer are registered. The staff also visits the medical record sections and hospital wards for any missed out cases or to complete information of already recorded cases. Wherever possible, the patients are interviewed to obtain demographic information. Coding is done as per the ICD-O-3 (*International classification of diseases for oncology*, 3rd ed)[4] and all neoplasms with a morphological behaviour of '/3' are included in the registry.

Quality checks on the data are done through the specialized software (PBCRDM)[5] provided by the Coordinating Unit of NCRP, Bengaluru, Karnataka. These checks include range, consistency, faculty and doubtful entries. All checks specified by the International Agency for Research on Cancer (IARC)[6] are included in this software. Checks are done both at the time of data entry and during subsequent processing. Similarly, potential lists of duplicate cases as well as potential matches for mortality incidence records are listed through a combination of variables from the software. These are verified manually with the original records.

The population of the registry area by age group was estimated using the 1991 Census (Census of India 1991, Fig. 1).[7] The crude rate during this interval was calculated using the population estimate derived from the difference distribution method.[8] The crude, age-adjusted and truncated incidence rates per 100 000 population were calculated by the direct method using the world standard population.[9] Tobacco-related cancers as defined by the IARC were also assessed.[10]

A comparison of the age-adjusted incidence rates (AARs) of all 25 PBCRs under the NCRP (NCRP, 2006–08) was done with the data from PBCR, Guwahati.[11]

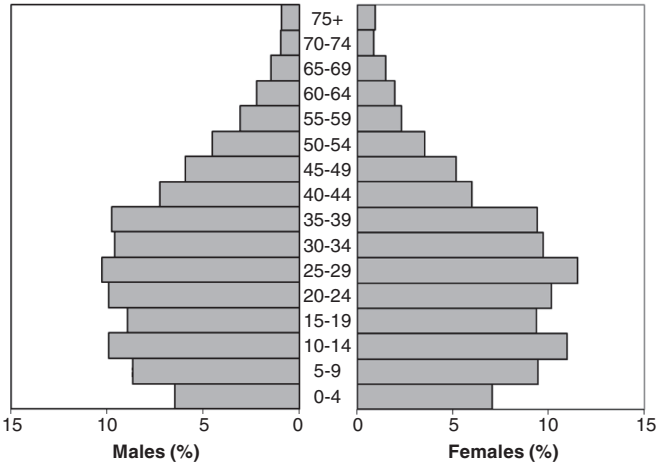

FIG 1. Population pyramid showing age distribution in the Kamrup Urban district during 2003–08

TABLE I. Relative frequencies (%), age-specific incidence rates, average annual crude incidence rates (CRs) and age-standardized incidence rates (AARs) by site among men in the Kamrup Urban district, 2003–08

ICD-10	Site	Total	%	Age (years)								CR	AAR
				0–14	15–24	25–34	35–44	45–54	55–64	65–74	75+		
C15	Oesophagus	718	18.3	0.0	0.2	1.9	10.1	57.7	125.3	173.9	179.0	21.0	30.7
C12–13	Hypopharynx	432	11.0	0.0	0.0	1.6	8.2	30.7	65.6	128.6	103.6	12.6	18.6
C33–34	Lung, etc.	272	6.9	0.1	0.2	0.1	2.1	11.7	44.9	107.2	131.9	7.9	13.5
C01–02	Tongue	245	6.2	0.0	0.2	1.6	5.5	18.1	24.6	76.2	84.8	7.2	10.5
C16	Stomach	210	5.3	0.0	0.0	0.7	3.6	14.2	41.0	42.9	69.1	6.1	9.1
C03–06	Mouth	200	5.1	0.0	0.2	0.3	5.3	12.5	30.6	56.0	56.5	5.8	8.5
C32	Larynx	183	4.7	0.0	0.0	0.3	3.3	12.0	28.4	56.0	59.7	5.3	8.1
C09	Tonsil	165	4.2	0.0	0.0	0.0	3.9	18.1	23.5	26.2	31.4	4.8	6.4
C61	Prostate	133	3.4	0.0	0.0	0.0	0.3	3.1	17.0	48.8	150.7	3.9	7.3
C10	Others, oropharynx	114	2.9	0.0	0.0	0.1	0.9	9.5	20.8	26.2	40.8	3.3	5.1
Z	All sites	3927	100.0	4.7	8.0	20.0	68.2	267.6	601.2	1008.9	1199.7	114.6	167.9

TABLE II. Relative frequencies (%), age-specific incidence rates, average annual crude incidence rates (CRs) and age-standardized incidence rates (AARs) by site among women in the Kamrup Urban district, 2003–08

ICD-10	Site	Total	%	Age (years)								CR	AAR
				0–14	15–24	25–34	35–44	45–54	55–64	65–74	75+		
C50	Breast	445	16.6	0.0	0.5	8.4	31.3	50.9	42.2	65.6	52.8	15.0	18.7
C53	Cervix uteri	345	12.9	0.1	0.5	2.9	17.3	45.0	62.6	57.0	28.1	11.6	16.4
C15	Oesophagus	313	11.7	0.1	0.2	1.1	8.5	31.1	75.9	91.3	84.4	10.6	17.4
C23–24	Gallbladder, etc.	228	8.5	0.0	0.0	2.2	7.7	27.2	47.7	57.0	28.1	7.7	11.7
C56	Ovary, etc.	183	6.8	0.5	1.4	2.2	9.2	18.6	31.3	32.8	14.1	6.2	8.4
C03–06	Mouth	113	4.2	0.1	0.2	0.3	2.8	7.0	20.3	48.5	63.3	3.8	6.6
C16	Stomach	81	3.0	0.0	0.0	1.4	2.8	8.5	12.5	18.5	24.6	2.7	3.9
C33–34	Lung, etc.	78	2.9	0.0	0.2	0.5	1.3	7.8	18.0	22.8	31.7	2.6	4.4
C12-13	Hypopharynx	73	2.7	0.0	0.0	0.2	1.7	8.2	14.9	28.5	14.1	2.5	4.1
C54	Corpus uteri	63	2.3	0.0	0.0	0.0	2.6	6.6	18.0	12.8	7.0	2.1	3.4
Z	All sites	2681	100.0	4.9	7.8	28.1	108.0	269.8	495.2	641.7	510.1	90.4	133.8

RESULTS

A total of 6608 cases were registered during the 6-year period (1 January 2003–31 December 2008) which included 3927 men and 2681 women. The annual average crude rate in men for all sites of cancer was 114.6 and for women 90.4 per 100 000 (Tables I and II). The corresponding AARs were 167.9 for men and 133.8 for women per 100 000. The oesophagus was the leading site of cancer among men comprising 18.3% of all cancers with an AAR of 30.7 per 100 000. Among women, the breast followed by the cervix uteri were the leading sites of cancer. These two cancers comprised 30% of all cancers among women.

Microscopic verification was available in 76.8% of cancers among men and 79.1% of cancers among women (Tables III and IV).

Tobacco-related cancers (TRC) as per IARC

Among men, the Kamrup Urban district had the highest relative proportion of tobacco-related cancers at 58.2% (range 31.9%–58.2%) for sites that are associated with the use of tobacco. Among women too, the Kamrup Urban district had the highest proportion at 26.9% (range 9.5%–26.9%) of all cancers. The lowest proportion of tobacco-related cancers was among women in Barshi at 9.5% of all cancers.

The sites with the highest proportion of tobacco-related cancers among men were the oesophagus (18.3%), hypopharynx (11.0%) and lung (6.9%). The others sites included the tongue, mouth, larynx, oropharynx, bladder, pharynx and lip. Among women too the proportions were in the same order except the mouth at 4.2% replaced hypopharynx as the second commonest site among tobacco-related cancers. The oesophagus was the commonest (11.7%) and lung (2.9%) the third commenest.

Comparison with other PBCRs

A comparison of the data of all sites of cancer shows that the Kamrup Urban district has the third highest AAR of 167.9 per 100 000 among men and 133.8 per 100 000 among women for 2003–08 (Fig. 2). In cancers of the oesophagus, the Kamrup urban district was the second leading registry for men and the leading registry for women (Fig. 3). Similarly in cancers of the gallbladder too, the Kamrup Urban district was the second for men and the first for women (Fig. 4). The Guwahati registry had the highest incidence rate (18.6 per 100 000) of cancers of the hypopharynx among men (Fig. 5). In cancers of the ovary, it was (8.4 per 100 000) next only to Delhi which had an AAR of 8.9 per 100 000 (Fig. 6) and for cancers of the prostate the AAR was 7.3 per 100 000 (Fig. 7).

DISCUSSION

Data from cancer registries on the pattern and incidence of cancer provide important information for treatment planning and monitoring cancer control activities such as prevention and early detection. Mortality data have been used widely to determine priorities for cancer control in different countries. To ensure the completeness of coverage and have good quality data, the PBCR at Guwahati obtained information from multiple sources including the Cancer Atlas and major cancer hospitals in Kolkata (Chittaranjan National Cancer Institute and Cancer Welfare Home, Thakurpukur) and Mumbai (Tata Memorial Hospital).

At the Guwahati registry, the microscopic verification of data among men (76.8%) and among women (79.1%) was relatively lower than at some of the older PBCRs in India. This is because of the high proportion of the diagnoses being based on death certificates only (DCOs; 10.8% in men and 6.2% in women). DCOs do not show any information about the methods used to

TABLE III. Distribution of diagnosis by site, Kamrup Urban district, men, 2003–08

ICD-10	Site	Total	Clinical	Microscopic	X-ray/imaging	DCO	Others
C15	Oesophagus	718	4.0	77.6	6.4	10.0	1.9
C12–13	Hypopharynx	432	5.6	86.8	3.0	4.4	0.2
C33–34	Lung, etc.	272	2.9	67.6	16.5	12.1	0.7
C01–02	Tongue	245	5.3	85.7	5.3	3.7	0.0
C16	Stomach	210	2.9	69.5	11.0	12.9	3.8
C03–06	Mouth	200	4.5	86.5	5.5	3.5	0.0
C32	Larynx	183	7.7	73.2	4.4	14.8	0.0
C09	Tonsil	165	10.3	82.4	3.6	3.6	0.0
C61	Prostate	133	3.8	82.7	9.8	3.0	0.8
C10	Others, oropharynx	114	6.1	83.3	4.4	6.1	0.0
Z	All sites	3927	4.2	76.8	7.2	10.8	0.9

DCO death certificate only

TABLE IV. Distribution of diagnosis by site, Kamrup Urban district, women, 2003–08

ICD-10	Site	Total	Clinical	Microscopic	X-ray/imaging	DCO	Others
C50	Breast	445	4.3	83.8	6.5	4.3	0.9
C53	Cervix uteri	345	5.8	84.9	5.5	3.5	0.3
C15	Oesophagus	313	5.1	85.6	5.1	1.3	2.9
C23–24	Gallbladder, etc.	228	6.1	54.4	28.5	9.6	1.3
C56	Ovary, etc.	183	9.3	68.3	13.7	6.6	2.2
C03–06	Mouth	113	3.5	90.3	5.3	0.9	0.0
C16	Stomach	81	4.9	77.8	7.4	7.4	2.5
C33–34	Lung, etc.	78	7.7	70.5	6.4	11.5	3.8
C12–13	Hypopharynx	73	5.5	82.2	9.6	2.7	0.0
C54	Corpus uteri	63	6.3	79.4	12.7	1.6	0.0
Z	All sites	2681	4.7	79.1	8.8	6.2	1.1

DCO death certificate only

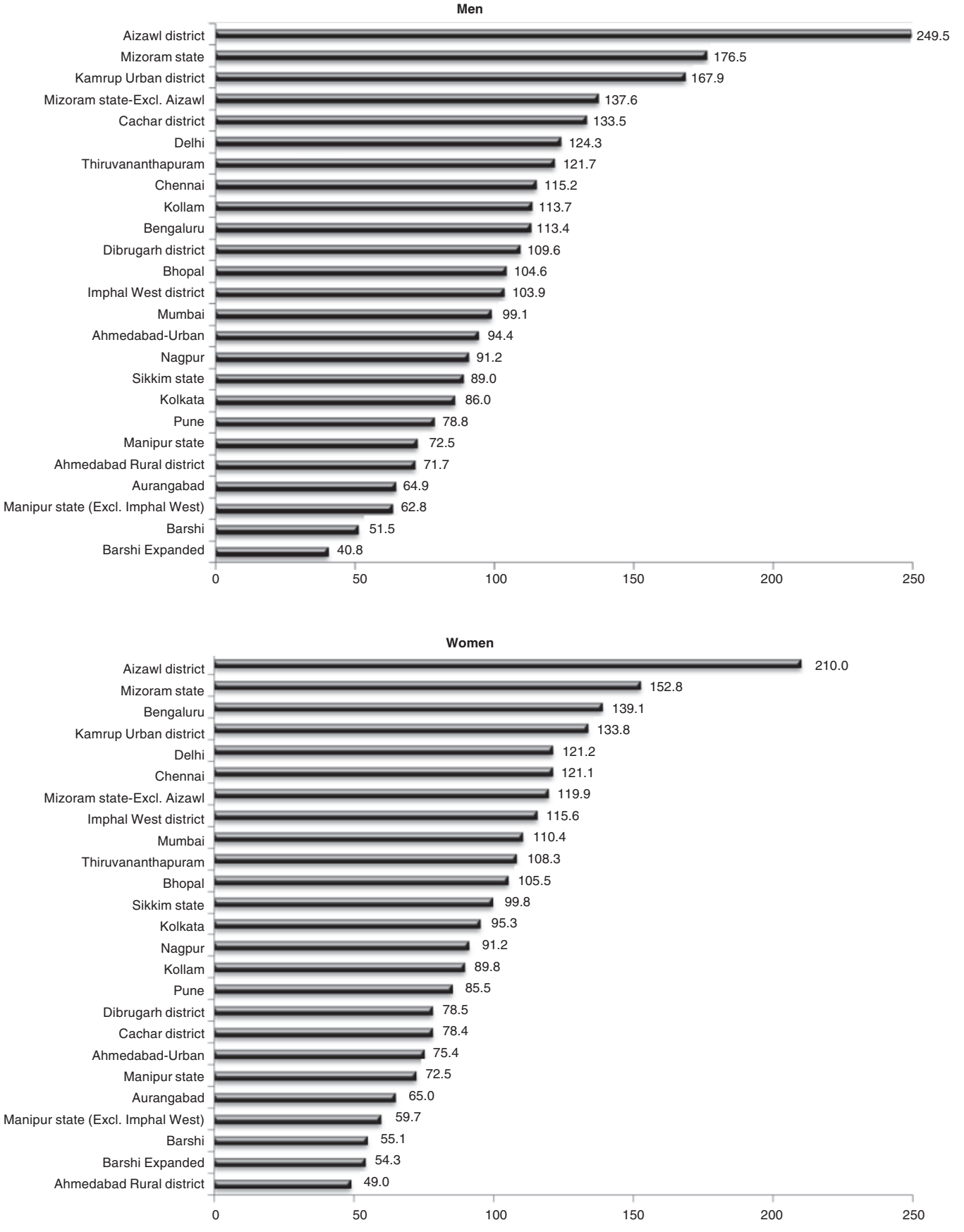

FIG 2. Comparison of age-adjusted incidence rates (AARs) of all population-based cancer registries, all sites (ICD-10: C00-C96) (Excl. excluding)

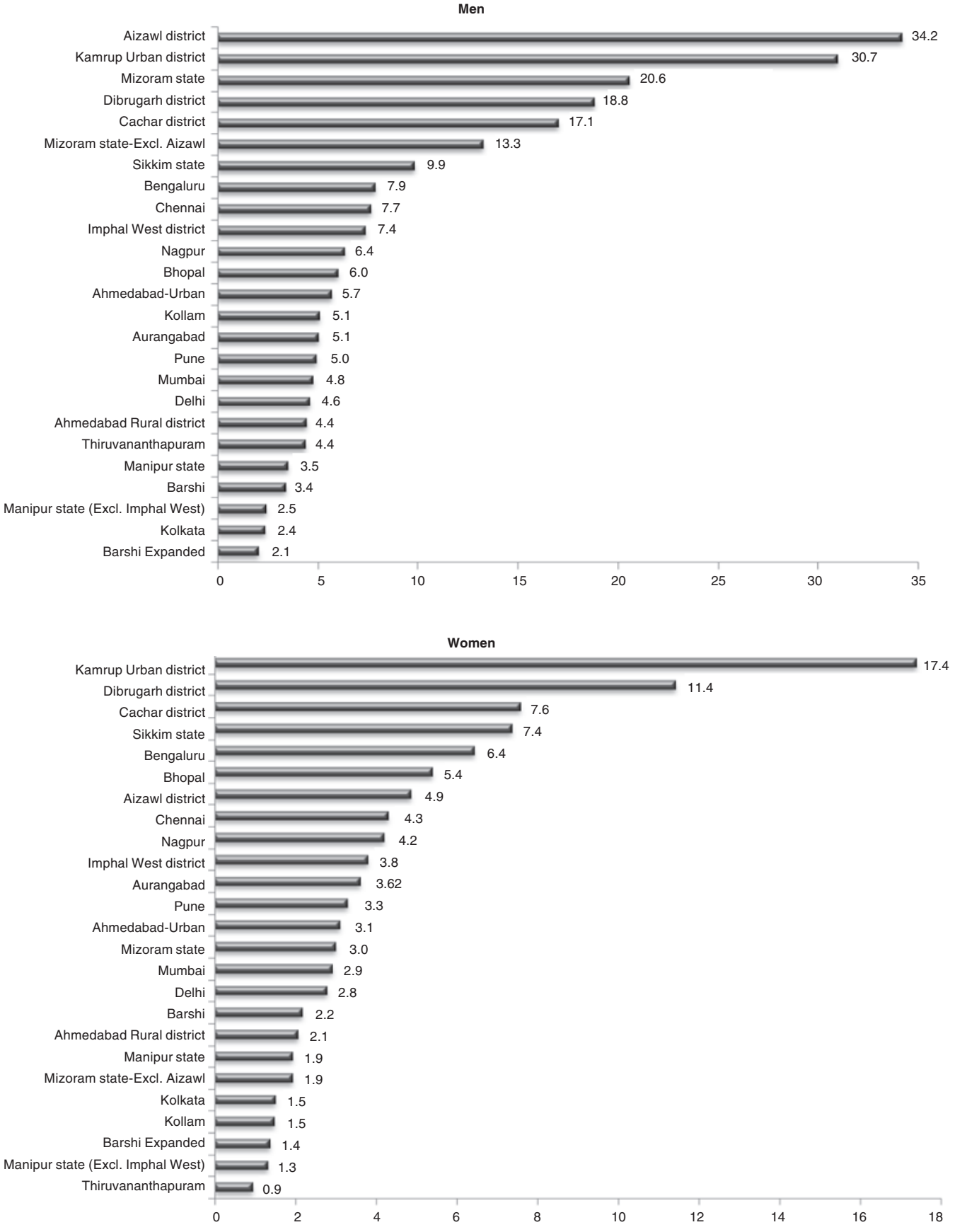

FIG 3. Comparison of age-adjusted incidence rates (AARs) of oesohpageal cancer (C15) at all population-based cancer registries (Excl. excluding)

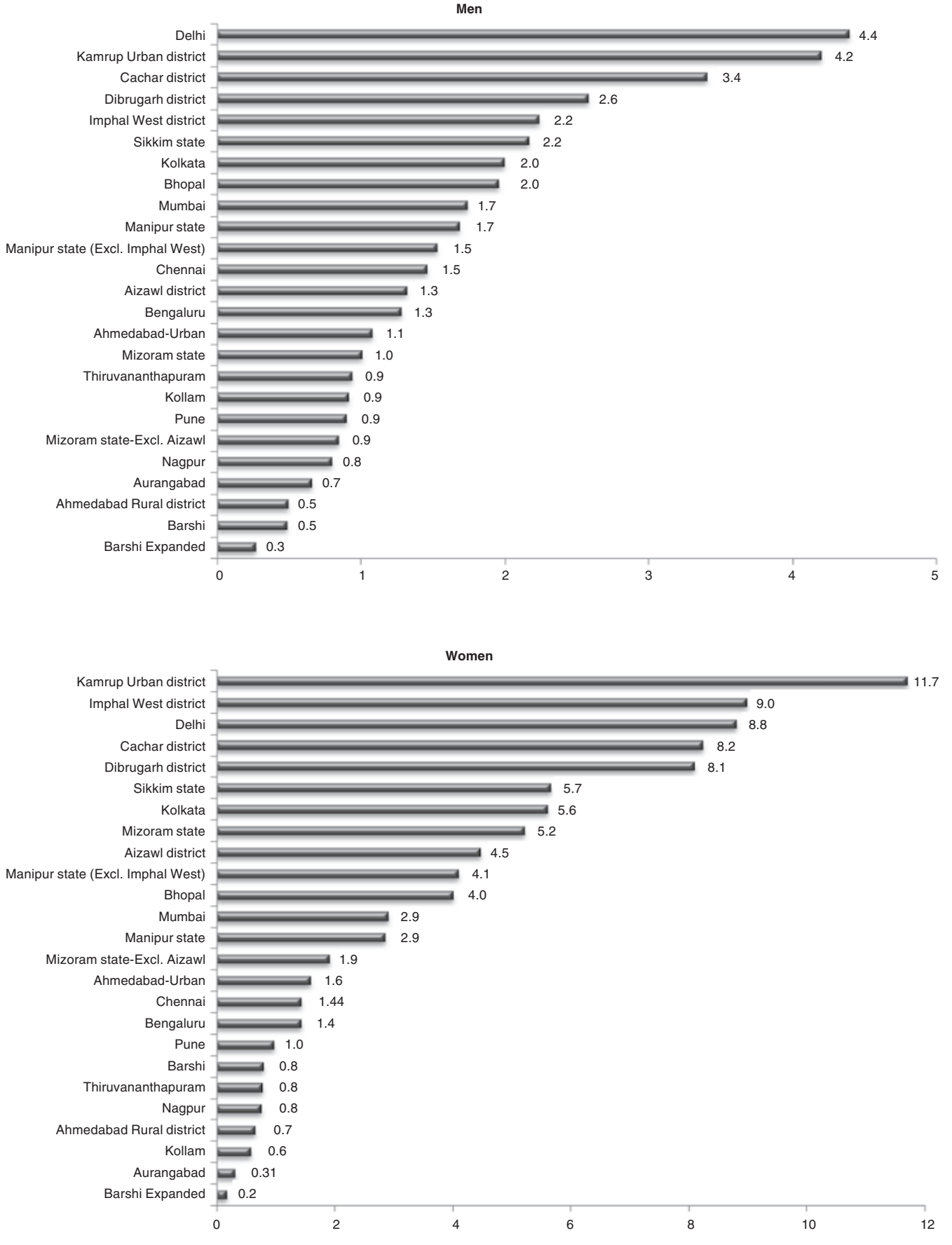

FIG 4. Comparison of age-adjusted incidence rates (AARs) of gallbladder cancer (C23–24) at all population-based cancer registries (Excl. excluding)

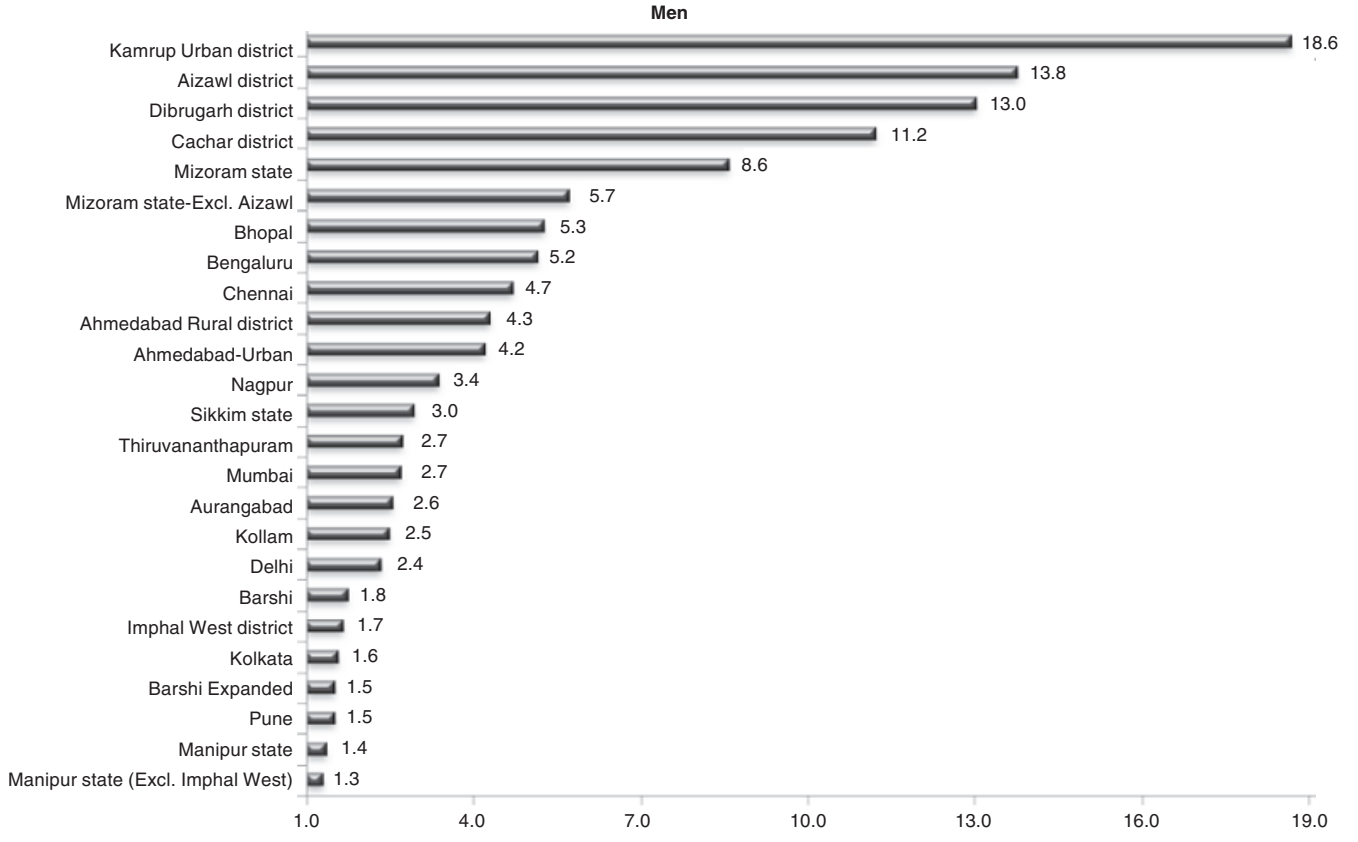

FIG 5. Comparison of age-adjusted incidence rates (AARs) of hypopharyngeal cancer (C12–13) at all population-based cancer registries (Excl. excluding)

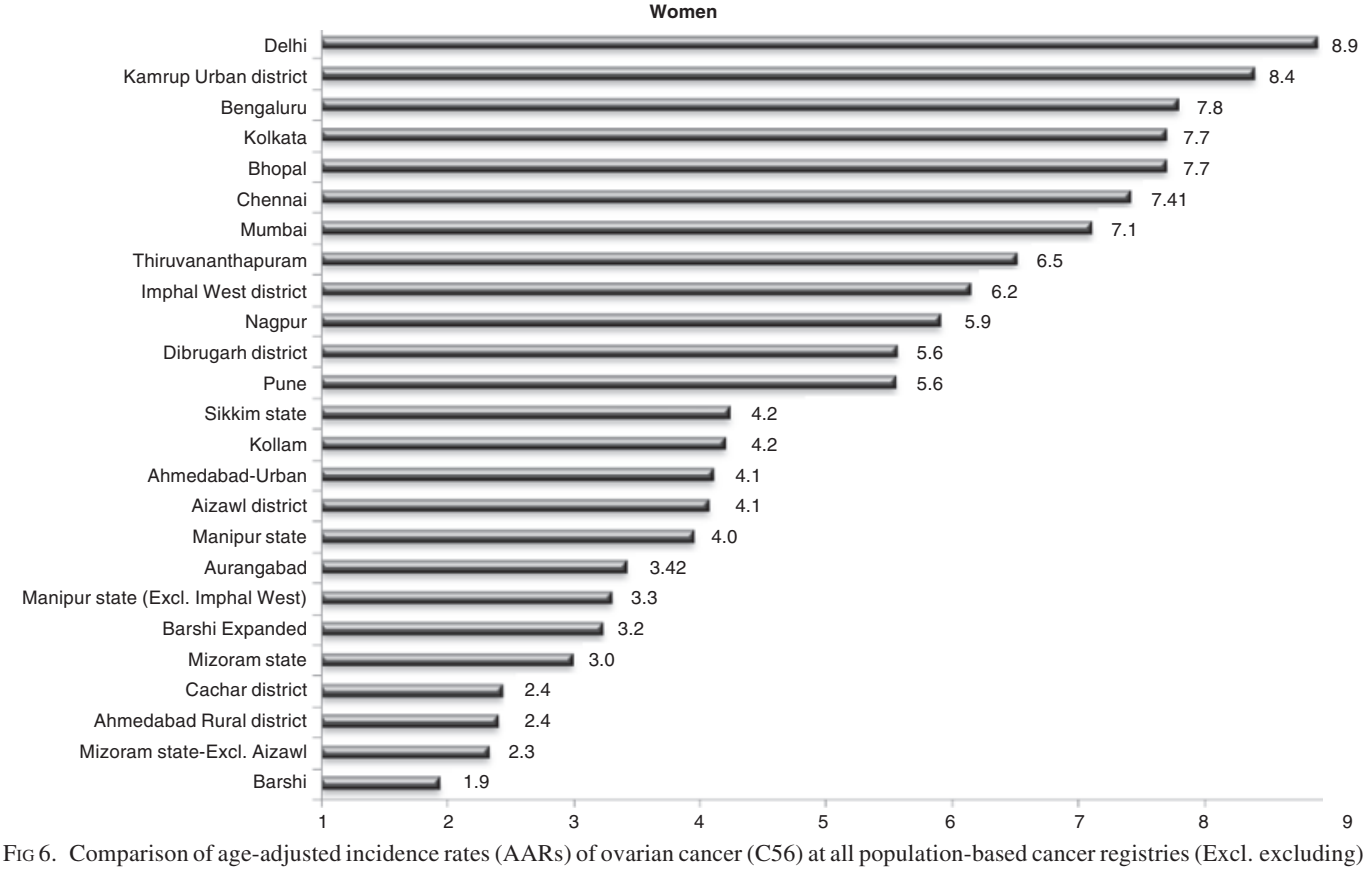

FIG 6. Comparison of age-adjusted incidence rates (AARs) of ovarian cancer (C56) at all population-based cancer registries (Excl. excluding)

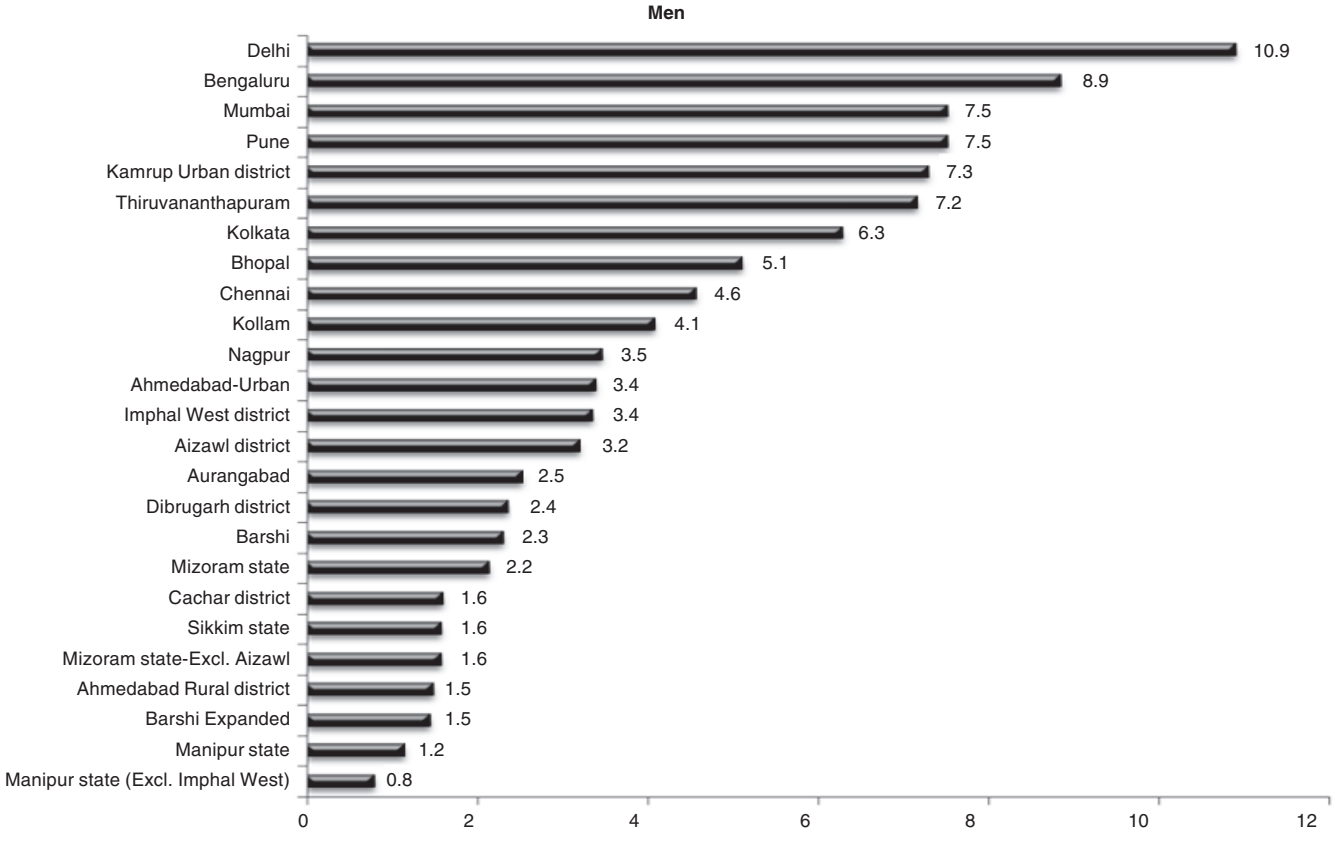

FIG 7. Comparison of age-adjusted incidence rates (AARs) of cancer of the prostate (C61) at all population-based cancer registries (Excl. excluding)

diagnose the cancer. Also, as most patients present at an advanced stage (7.2% men and 8.8% women), clinicians often rely on imaging tests for the diagnosis.

The AARs of cancer at all anatomical sites among men (167.9) were higher than at all the older urban and rural PBCRs of India but lower than the Aizawl district of Mizoram state and Mizoram state. Similar results were also observed among women (133.8) but the PBCR at Bengaluru was at the third place. The age-specific rates of cancer in the Kamrup Urban district increased steadily for men and women up to 74 years of age and showed a slight decline thereafter.

Tobacco-related cancers comprise 58.2% of all cases diagnosed among men and 26.9% among women. Tobacco chewing and smoking are major risk factors for head and neck cancers in India.[12] Tobacco control measures are important to control lung and head and neck cancers.

The oesophagus was the most frequently encountered site of cancer at PBCR Guwahati among both men (18.3% relative proportion, 30.7 AAR) and women (11.7% relative proportion, AAR 17.4%). Among men, it has the second highest rate in India and among women it has the highest. Two other PBCRs in Assam (Silchar and Dibrugarh) also had a higher incidence of oesophageal cancer among both men and women. These data indicate a high prevalence of oesophageal cancer in Assam. Many studies have shown that oesophageal cancer has an association with alcohol, tobacco consumption, scalding beverages, low intake of fresh fruits, vegetables and meat, consumption of prickled vegetables, betel chewing (in Southeast Asia) and oral consumption of opium byproducts in the Caspian Sea area.[13,14] A case–control study in Assam found a number of risk factors for oesophageal cancer,[15,16] notable among these are 'Kolakhar', a locally made unique alkaline food additive, papad, very hot spicy food, chillies, chewing quid containing fermented betelnut (processed underground) with or without tobacco, *bidi* smoking and a combination of these habits among both men and women.

The Guwahati PBCR data revealed a high incidence of head and neck cancers including those occurring in the oral cavity, tongue, tonsil, and oro- and hypopharynx among both men and women. Cancers of the hypopharynx can be misclassified especially when the disease is advanced, hence care was taken to code it correctly with the help of attending clinicians and carefully scrutinizing all relevant case records. In the Kamrup urban district, cancer of the hypopharynx (AAR18.7) among men is most common compared to all registries in India; this may be related to the tobacco and dietary habits of the population in this region.[17] A high incidence of these cancers is observed in the Indian subcontinent, Australia, France, South America (Brazil) and South Africa.[13]

In the Indian subcontinent, chewing tobacco as a betel quid (a combination of betel leaf, slacked lime, areca nut and tobacco with or without other condiments), smoking *bidi* (a local hand-rolled cigarette of dried temburni leaf containing coarse tobacco) and drinking locally brewed crude alcoholic drinks are factors related to the occurrence of cancer.[1] Consuming betel quid even without tobacco has also been found to have a high risk for oral cancer.[18]

The prostate is another important site of cancer among men in the Kamrup Urban district. Its frequency is 3.4% among men with an AAR of 7.3. A high incidence has been reported from the USA, Australia, Finland, Sweden, etc. This high incidence may be

partly because of screening with prostate-specific antigen. An increased incidence has been reported from Asia and Africa where traditionally low rates have been documented. This may be related to changes in lifestyle or environmental factors; in India, this may be contributed by increased awareness, easy availability of ultrasound and screening using prostate-specific antigen.[19]

Breast cancer has become frequent among urban women in India and there is an increasing trend at the older urban registries in India (NCRP Report, 2009).[11] At the Guwahati registry too, it was a leading cancer with 16.6% of total cancers among women but compared with all registries in India, it was twelfth (AAR 18.7). Various risk factors have been identified in several studies in Mumbai and Chennai and the difference in urban and rural areas may be due to differences in lifestyle. Western dietary influences could also have a role to play in the increasing incidence of breast cancer in India.[20,21]

Cancer of the cervix (AAR 16.4) is still the leading cancer among women in the Kamrup Urban district. Case–control studies in other regions of India have indicated early age at marriage, early age at first coitus, early age at first child birth, sexual promiscuity (among both women and their spouses), sex with uncircumcised men, multiparity, low socioeconomic status and poor genital hygiene as the major risk factors for cervical cancer in India.[17,22–25] It has now been established that infection with oncogenic subtypes of human papilloma virus (HPV) is the cause for cervical cancer.[26] Ovarian cancer was the second most common cancer among women (AAR 8.4) in the Kamrup Urban district.

Gallbladder cancer accounted for 8.5% of the total cases among women (AAR 11.7) and is higher than that in any other registry in India. The aetiology of gallbladder cancer is not well understood and studies are needed to identify the risk factors responsible for this tumour.[27]

The patterns observed from our analysis of the Kamrup Urban cancer registry data provide comprehensive information on the occurrence of cancer in the northeastern region. We hope this will assist in planning cancer control activities in the region. The incidence of cancer among both men and women is quite high, and preventive measures especially targeted towards tobacco-related cancers as well as awareness about the disease could be helpful. Also educating people about risk factors such as alcohol and betelnut use and the benefit of a healthy lifestyle and food habits could have an impact on the incidence of cancer in this region. In low-resource areas such as Assam, a well-planned and executed awareness programme could have a major impact on the prevention and early detection of cancer.

ACKNOWLEDGEMENTS

We are grateful to the ICMR for financial support and to Dr A. Nandakumar, Deputy Director General, ICMR and Officer-in-charge of the NCRP and his team for providing technical guidance. We are also grateful to Dr J. Mahanta, Director, Regional Medical Research Centre (ICMR), Dibrugarh for his valuable guidance. We sincerely acknowledge the cooperation from all the sources of registration and oncologists of Dr B. Borooah Cancer Institute, Guwahati.

We also appreciate the hard work and sincerity of all the staff members at PBCR, Guwahati and are grateful to the patients and their relatives for participating voluntarily in our study.

REFERENCES

1 National Cancer Registry, Indian Council of Medical Research. *Development of an atlas of cancer in India. First All India Report 2001–2002.* vols I and II. Bangalore:National Cancer Registry Programme (ICMR); 2004.
2 National Cancer Registry, Indian Council of Medical Research. *An overview—Development of an atlas of cancer in India. First All India Report 2001–2002*. Vols I and II. Bangalore:National Cancer Registry Programme (ICMR); 2004. Available at *http://www.canceratlasindia.org/overview/overview_1.aspx*
3 Registrar General, India. *Census of India 1991: Final population totals, series 1, vol. 1, no. 1.* New Delhi:The Registrar General and Census Commissioner, India, Ministry of Home Affairs, Government of India; 1992.
4 Fritz A. Percy C, Jack A, Shanmugaratnam K. Sobin L, Parkin DM (eds*). International classification of diseases for oncology, 3rd edition (ICD-O-3).*Geneva:WHO; 2000.
5 National cancer Registry programme, Indian Council of Medical Research, Bangalore. Available at *www.ncrpindia.org*
6 Parkin DM, Chen VW, Ferlay J, Galceran J, Storm HH, Whelan SL. *Comparability and quality control in cancer registration (IARC Tech Rep No. 19).* Lyon:International Agency for Research on Cancer; 1994.
7 Office of the Registrar General and Census Commissioner, *India. Census of India, 1991, series I.* New Delhi:ORGI; 1991
8 Ramnath T, Shobana B. Cancer incidence rates and the problem of denominators: A new approach in Indian Cancer Registries. *Asian Pacific J Cancer Prev* 2009;**10:** 123–6.
9 Day NE. A new measure of age standardized incidence: The cumulative rate. In: Waterhouse JAH, Muir CS, Correa P, Powell J (eds). *Cancer incidence in five continents, Vol. III* (IARC Scientific Publications No. 15). Lyon, France:International Agency for Research on Cancer; 1976: 443–52.
10 International Agency for Research on Cancer. *International Agency for Research on Cancer, Monographs—Supplement 7, Overall evaluations of carcinogenicity; An updating of IARC monographs. Vol. 1–42: IARC monographs on the evaluation of the carcinogenic risks to humans.* Lyon, France:IARC; 1987:357–61.
11 National Cancer Registry Programme, Indian Council of Medical Research. *Three-year report of population based cancer registries (2006–2008).* Bangalore:India; 2010.
12 Maier H, Dietz A, Gewelke U, Heller WD, Weidauer H. Tobacco and alcohol and the risk of head and neck cancer. *Clin Invest* 1992;**70:**320–7.
13 Stewart BW, Kleihues P (eds). *World cancer report.* Lyon, France:International Agency for Research on Cancer Press; 2003.
14 La Rosa F, Cresci A, Orpianesi C, Saltalamacchia G, Mastrandrea V. Esophageal cancer mortality: Relationship with alcohol intake and cigarette smoking in Italy. *Eur J Epidemiol* 1988;**4:**93–8.
15 Phukan RK, Chetia CK, Ali MS, Mahanta J. Role of dietary habits in the development of esophageal cancer in Assam, the north-eastern region of India. *Nutr Cancer* 2001;**39:**204–9.
16 Phukan RK, Ali MS, Chetia CK, Mahanta J. Betel nut and tobacco chewing; potential risk factors of cancer of oesophagus in Assam, India. *Br J Cancer* 2001;**85:**661–7.
17 Gawande V, Wahab SN, Zodpey SP, Vasudeo ND. Parity as a risk factor for cancer cervix. *Indian J Med Sci* 1998;**52:**147–50.
18 Merchant A, Husain SS, Hosain M, Fikree FF, Pitiphat W, Siddiqui AR, *et al.* Paan without tobacco: An independent risk factor for oral cancer. *Int J Cancer* 2000;**86:** 128–31.
19 Hsing AW, Tsao L, Devesa SS. International trends and patterns of prostate cancer incidence and mortality. *Int J Cancer* 2000;**85:**60–7.
20 Rao DN, Ganesh B, Desai PB. Role of reproductive factors in breast cancer in a low-risk area: A case–control study. *Br J Cancer* 1994;**70:**129–32.
21 Gajalakshmi CK, Shanta V. Risk factors for female breast cancer: A hospital-based case–control study in Madras, India. *Acta Oncol* 1991;**30:**569–74.
22 Gillison ML, Koch WM, Shah KV. Human papillomavirus in head and neck squamous cell carcinoma: Are some head and neck cancers a sexually transmitted disease*? Curr Opin Oncol* 1999;**11:**191–9.
23 Biswas LN, Manna B, Maiti PK, Sengupta S. Sexual risk factors for cervical cancer among rural Indian women: A case–control study. *Int J Epidemiol* 1997;**26:**491–5.
24 Mukherjee BN, Sengupta S, Chaudhuri S, Biswas LN, Maiti P. A case–control study of reproductive risk factors associated with cervical cancer. *Int J Cancer* 1994;59: 476–82.
25 Agarwal SS, Sehgal A, Sardana S, Kumar A, Luthra UK. Role of male behavior in cervical carcinogenesis among women with one lifetime sexual partner. *Cancer* 1993;**72:**1666–9.
26 International Agency for Research on Cancer and World Health Organization. *IARC monographs on the evaluation of carcinogenic risks to humans. Vol. 64. Human papillomaviruses.*Lyon:France; 1995.
27 Sen U, Sankaranarayanan R, Mandal S, Ramanakumar AV, Parkin DM, Siddiqi M. Cancer patterns in eastern India: The first report of the Kolkata cancer registry. *Int J Cancer* 2002;**100:**86–91.