RESEARCH ARTICLE

Cancer Incidence and Mortality: District Cancer Registry, Trivandrum, South India

Aleyamma Mathew[1]*, Preethi Sara George[1], Kalavathy MC[1], Padmakumari G[1], Jagathnath Krishna KM[1], Paul Sebastian[2]

Abstract

Background: Cancer is emerging as a major cause of morbidity and mortality in low and middle-income countries. Cancer registry figures help for planning and delivery of health services. This paper provided the first results of cancer incidence and mortality [Crude (CR) and age-standardized (ASR)] rates (world-standard population) of Trivandrum district, South India and compared with other registries under the network of National Cancer Registry Programme (NCRP), Government of India. **Materials and Methods:** Trivandrum district cancer registry encompasses a population of 3.3 million, compiles data from nearly 75 sources (hospitals and diagnostic laboratories) and included under the NCRP in 2012. During 2012-2014, registry recorded 15,649 incident cases and 5667 deaths. Proportion of microscopic diagnosis was 85% and 'Death certificate only' was 8%. **Results:** Total cancer incidence (CRs) rates were 161 and 154 (ASR: 142.2 and 126) and mortality rates were 66 and 49 (ASR: 54 and 37) per 10^5 males and females respectively. Common cancers in males were lung (ASR:19), oral cavity (ASR:15), colo-rectum (ASR:11.2), prostate (ASR:10.2) and lymphoma (ASR:7) and in females, breast (ASR:36), thyroid (ASR:13.4), cervix-uteri (ASR:7.3), ovary (ASR:7) and colo-rectum (ASR:7). Nationally, the highest CRs for breast, prostate, colo-rectum, corpus-uteri and urinary bladder cancers and low incidence of cervix-uteri cancer were observed in Trivandrum. **Conclusion:** Cancer incidence (CR) in Trivandrum was the highest in both genders in India (except Aizwal). This is mainly due to the highest life-expectancy in Kerala. Also, an epidemiologic transition in cancer pattern is taking place and is changing to more similar to "western" jurisdictions.

Keywords: Cancer incidence- mortality- cancer registry- IndiaBus aut optis mint, sum quid que quam facitia musant

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Introduction

In India, based on the available cancer registries and verbal autopsy surveys, it was estimated that there were 1,014,900 new cancer cases, 682,800 cancer deaths and 1,790,500 people living with cancer (within 5 years of diagnosis) in 2012 (Ferlay et al., 2013). Using National Cancer Registry Programme (NCRP) data of Indian Council of Medical Research (ICMR) during the period 2001-2004, estimated nearly 1,193,000 new cancer cases for the year 2011 with a higher load among females (603,500) than males (589,800) (Murthy et al., 2013). Recently based on the 27 cancer registries functioning under the NCRP of ICMR, a total of 13,88,397 cancer cases were estimated for the year 2015 (NCRP 2016).

Age standardized (ASR) cancer incidence rates (per 10^5) in India were 92.4 and 97.4 and mortality rates were 69.7 and 60.2 in men and women respectively. Five common cancers (ASR per 10^5) in men were lung (11.0), oral cavity (10.1), stomach (8.6), colo-rectum (7.2) and pharynx (excluding nasopharynx) (6.3) and in women, breast (25.8), cervix uteri (22.0), colo-rectum (5.1), ovary (4.9) and oral cavity (4.3) (Ferlay et al., 2013). Estimated burden of these cancers in India for the year 2015 were 149,978 oral cavity, 134,214 female breast, 106,794 lung, 97,909 cervix uteri, 73,725 colo-rectum and 44,998 stomach (NCRP, 2016).

Cancer Registry, Thiruvananthapuram (Trivandrum) district, Kerala, South India has been included under the network of NCRP (ICMR) since 2012 (NCRP, 2016). Trivandrum, the south-most district and capital of the state of Kerala, encompasses a population of 3.3 million (48% males and 52% females), 15% were >60 years, 46% urban, 73 years life-expectancy, and 93% literacy rate (Census of India, 2011).

It is recognized within Kerala that cancer is a growing threat to public health. In this paper, the first results of Trivandrum District Cancer Registry for the period 2012-2014 are presented with an aim to assess the public health burden of this disease by estimating the overall and

*[1]Division of Cancer Epidemiology and Biostatistics, [2]Director, Regional Cancer Centre, Medical College Campus, Thiruvananthapuram, India. *For correspondence: aleyammamathewrcc@gmail.com*

site-specific cancer incidence and mortality rates and to assess the position of the burden of this disease nationally by comparing the rates with other cancer registries under the network of NCRP.

Materials and Methods

Study Population and Cancer Registry

People residing for a minimum period of 1 year in Trivandrum were considered as residents. The major sources for cancer incidence were the Regional Cancer Centre (RCC), the physical location of the registry, and the Government Medical College Hospital, Trivandrum. A large number of private hospitals (n=47) and government hospitals (n=32) also diagnose and treat cancer patients. Since cancer is not made as a notifiable disease in Kerala, registration of incident cancer cases was carried out by active case finding. Based on an administrative letter provided by the Principal Secretary, Health and Family Welfare, Government of Kerala to all health authorities in the district, co-operation from all hospitals has been obtained. The registry employs 14 tumour registrars who were trained through continued in-service training in cancer registration. The registry staff reviewed medical records from nearly 75 potential data sources (hospitals and diagnostic laboratories) at regular intervals to abstract data on incident cancer cases. The information collected included age, residential address, gender, religion, marital status, education, mother tongue, date of incidence, basis of diagnosis, topography, morphology, clinical extent of disease, treatment and vital status. Address linkage of cancer patient data, obtained from pathology laboratories, were made. The cases registered were all invasive cancers [ICD-10:C00 to C96 (WHO 1992); ICD-O-3 for coding of topography and morphology (Fritz et al., 2000)].

Mortality data were obtained electronically. Almost all deaths are registered, but cause of death is not accurate. Hence all-cause mortality data were obtained. Special efforts were made for obtaining cancer deaths. Firstly, all cancer deaths were compared with the 'cancer incidence database'. Any death, which was matched with the incidence database, the corresponding site of cancer was added to the 'cancer mortality database'. Secondly, any cancer death, unmatched with the registry database, was included in the incidence as 'death certificate only' (DCO). Thirdly, 'non-cancer specific-mortality database (excluded deaths due to accidents or natural calamity)' was compared with the 'cancer incidence database'. If all details except cause of death were matched with this database, such deaths were also added to the 'cancer mortality database' and their cause of death was corrected as the respective cancer obtained from the 'cancer incidence database'.

Data entry was carried out using a customized version of the software developed by the NCRP (PBCR DM 2.1). The software has provisions for detecting duplicate registrations and performing checks on the validity of the entered data. The database was subjected to a series of consistency checks (comparing the values of certain variables against the others), to ensure that valid codes were entered and necessary corrections were made based on the error list of cases.

Statistical methods

The population at risk, by gender and 5-year age group, was estimated based on the census reports of 2001 and 2011 using distribution-difference method (Takiar and Shobana 2009). Quality of data was assessed in terms of the proportion of microscopic verification (MV), 'DCO' and ill-defined sites (ICD: C76). The number of cases as well as incidence and mortality rates [crude (CR), age-specific (ASpR) and age-standardized (ASR) (world standard population) per 10^5 person-years (Jenson et al., 1995)] were presented by site (ICD-10) and gender. Capture-re-capture method was used for assessment of completeness in case ascertainment for each year. In this method, Schnabel index was measured to estimate the missing proportion in case ascertainment (Brown, 2000).

Results

Details from a total of 48,254 incident cases were collected from the various hospitals (75.3% from government hospitals) during 2012-2014. The source of registration was 35.1% from the RCC, 40.2% from the government medical college hospital, 6% from the other government hospitals and 12% from the private hospitals. After eliminating duplicates, a total of 15,649 (4847 in 2012; 5172 in 2013, and 5630 in 2014) cancer patients were included in the registry during the three-year period, of which 51.2% were females. Proportion of MV was 82% and 87% and the same for each site for males and females

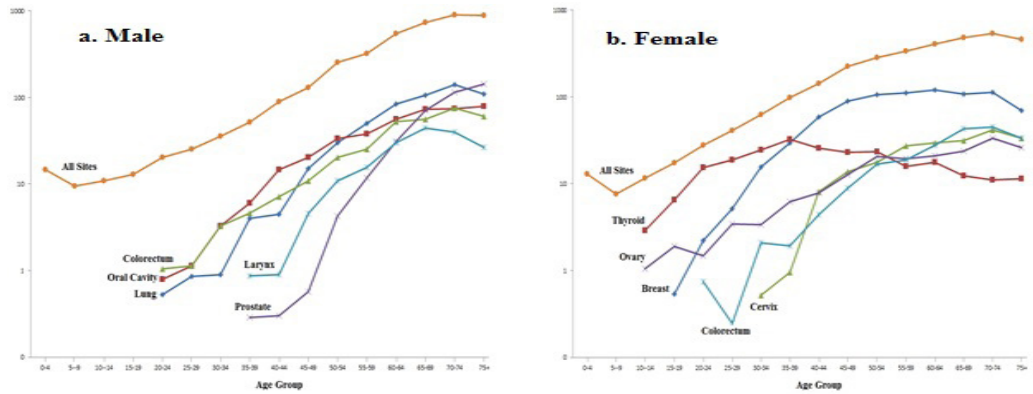

Figure 1. Age Specific Incidence Rates (per 10^5 Males) of Common Cancers in Trivandrum (2012-2014)

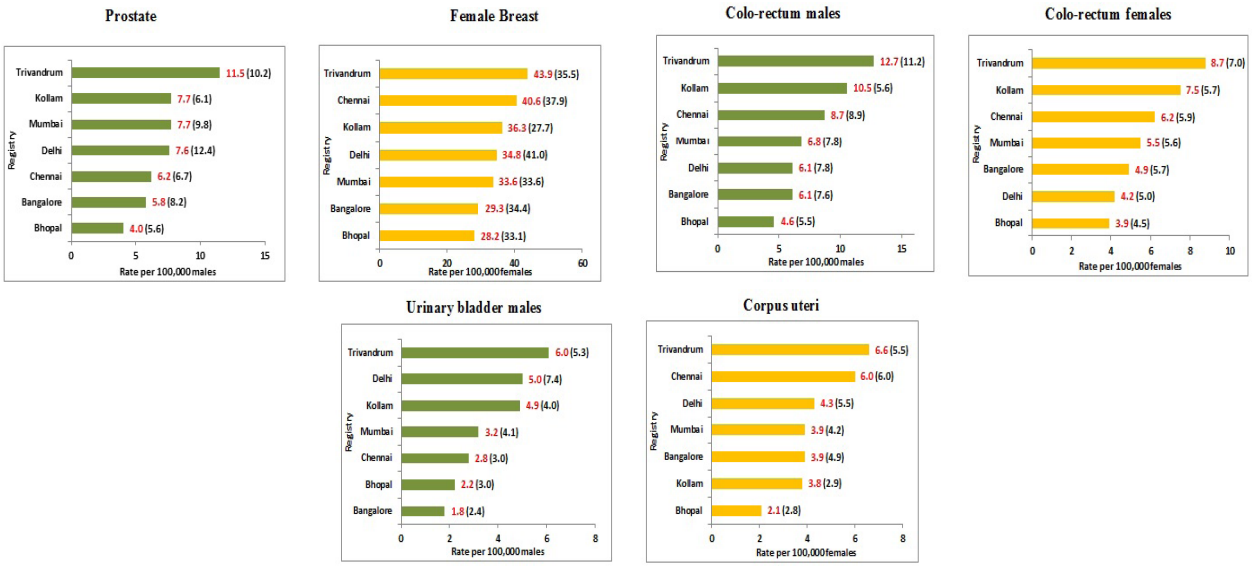

Figure 2. Crude Incidence Rate (ASR Given in Parentheses) of Common Cancers in Trivandrum with Other Registries in India

Table 1. Relative Frequencies (# & %), Mean Age (SD), Microscopic Verification (MV%), Average Annual Crude (CR) and Age-Standardized (ASR) Incidence Rates by Site Among Men in Trivandrum (2012-2014)

Site	# (%)	Mean (SD)	MV%	CR	ASR	ICD-10
All sites	7645 (100)	60.3 (15.1)	81.4	160.5	142.2	C00-C96
Oral cavity (lip, mouth and tongue) and pharynx						
Oral cavity	799 (10.5)	59.8 (12.4)	94.2	16.8	14.5	C00–06
Tongue	386 (5.0)	57.9 (12.4)	96.4	8.1	6.5	C01-C02
Mouth	390 (5.1)	60.3 (15.1)	92.1	8.2	6.6	C03-C06
Pharynx	246 (3.2)	62.4 (10.1)	89.4	5.2	4.6	C09,10,12,13,14
Digestive organs						
Oesophagus	229 (3.0)	63.4 (10.3)	90.4	4.8	4.3	C15
Stomach	291 (3.8)	62.4 (13.2)	88.7	6.1	5.3	C16
Colon	265 (3.5)	60.6 (13.2)	89.8	5.6	4.9	C18
Rectum	339 (4.4)	61.7 (11.8)	94.7	7.1	6.3	C19-21
Liver	305 (4.0)	59.9 (12.8)	60.7	6.4	5.6	C22
Pancreas	158 (2.1)	59.1 (11.7)	71.5	3.3	2.9	C25
Respiratory organs						
Larynx	318 (4.2)	63.1 (9.4)	88.4	6.7	6.0	C32
Lung	989 (12.9	63.3 (10.8)	81.5	20.8	18.5	C33-34
Bone, Connective tissue	165 (2.2)	45.1 (21.9)	94.2	3.4	3.2	C40,41,47,49
Genital organs						
Prostate	549 (7.2)	70.6 (8.5)	93.3	11.5	10.2	C61
Urinary tract organs						
Kidney	167 (2.2)	59.5 (12.7)	91.6	3.5	3.1	C64-66; 68
Bladder	288 (3.8)	65.6 (11.7)	94.4	6.0	5.3	C67
Brain, other central nervous system (CNS) and Thyroid						
Brain and other CNS	154 (2.0)	46.9 (19.1)	88.3	3.2	3.0	C70-72
Thyroid	203 (2.7)	46.2 (16.9)	99	4.3	3.8	C73
Haematological malignancies						
Hodgkin's disease	93 (1.2)	40.2 (18.4)	100	2.0	1.8	C81
Non-Hodgkin's disease	281 (3.7)	56.0 (14.7)	99.6	5.9	5.1	C82-85; 96
Myeloma	198 (2.6)	63.0 (12.2)	99	4.2	3.7	C88; 90
Lymphoid leukemia	92 (1.2)	34.2 (27.8)	100	1.9	2.1	C91
Myeloid leukemia	182 (2.4)	48.0 (22.5)	100	3.8	3.6	C92-95

Rates per 10^5 person-years

Table 2. Relative Frequencies (# & %), Mean Age (SD), Microscopic Verification (MV%), Average Annual Crude (CR) and Age-Standardized (ASR) Incidence Rates by Site Among Women in Trivandrum (2012-2014)

Site	# (%)	Mean (SD)	MV%	CR	ASR	ICD-10
All sites	8,004	55.6 (15.6)	86.8	153.7	125.7	C00-C96
Oral cavity (lip, mouth and tongue) and pharynx						
Oral cavity	379 (4.7)	65.0 (12.6)	91.6	7.3	5.6	C00–06
Tongue	156 (1.9)	62.7 (12.0)	96.2	3.0	2.3	C01-C02
Mouth	209 (2.6)	55.6 (15.6)	87.2	4.0	3.0	C03-C06
Pharynx	38 (0.5)	57.6 (17.0)	89.5	0.7	0.6	C09,10,12,14
Digestive organs						
Oesophagus	63 (0.8)	65.3 (13.0)	92.1	1.2	0.9	C15
Stomach	126 (1.6)	58.1 (13.7)	85.7	2.4	1.9	C16
Colon	203 (2.5)	60.7 (12.0)	90.1	3.9	3.1	C18
Rectum	250 (3.1)	61.5 (12.6)	92.8	4.8	3.9	C19-21
Liver	69 (0.9)	56.9 (17.3)	72.5	1.3	1.1	C22
Pancreas	102 (1.3)	60.5 (12.2)	58.8	2.0	1.6	C25
Respiratory organs						
Lung	310 (3.9)	60.4 (12.6)	83.2	6.0	4.8	C33-34
Bone and Connective	120 (1.5)	45.2 (20.8)	97.7	2.4	2.1	C40,41,47,49
Breast	2,284 (28.5)	54.5 (12.2)	96.2	43.9	35.5	C50
Gynaecological organs						
Cervix uteri	483 (6.0)	60.4 (11.7)	93.4	9.3	7.5	C53
Corpus uteri	343 (4.3)	59.1 (9.7)	98	6.6	5.5	C54
Ovary	468 (5.8)	55.0 (15.5)	88	9.0	7.3	C56
Urinary tract organs						
Kidney	57 (0.7)	47.5 (20.9)	87.7	1.1	0.9	C64-66; 68
Urinary Bladder	66 (0.8)	62.8 (13.3)	97.0	1.3	1.0	C67
Brain, other central nervous system (CNS) and Thyroid						
Brain and nervous	126 (1.6)	43.2 (19.9)	88.1	2.4	2.2	C70-72
Thyroid	831 (10.4)	41.4 (14.3)	99.2	16	13.4	C73
Haematological malignancies						
Hodgkin's disease	48 (0.6)	36.6 (20.1)	100.0	0.9	0.9	C81
Non-Hodgkins disease	206 (2.6)	58.1 (15.1)	100.0	4	3.2	C82-85; 96
Myeloma	133 (1.7)	60.2 (11.8)	97.0	2.6	2.1	C88; 90
Lymphoid leukemia	49 (0.6)	30.6 (26.2)	100.0	0.9	1.1	C91
Myeloid Leukemia	143 (1.8)	49.1 (20.4)	100.0	2.7	2.4	C92-95

Rates per 10^5 person-years

were given in Tables 1 and 2 respectively. Proportion of 'DCO's were 8.8% and 6.9% and 'ill-defined sites' were 1.7% and 1.1% in males and females respectively. The rates were 66 and 49 (ASMR: 54 and 37) in males and females respectively for the year 2012-2014 (Tables 1- 4). However, CRs for the year 2014 alone was 173 and 167 in males and females respectively. Age at diagnosis was < 50 years in 18.3% males and 32.4% females. Average age at incidence (SD) was 60 years (15 years) in males and 56 years (16 years) in females. In males, the peak ASpR (per 10^5) was in 75+ years (924) followed by 65-74 years (868) and in females, the same was in 75+ years (495) followed by 55-64 years (472) (Figures 1a and 1b).

Five common cancers (CR per 10^5) among men were lung (CR: 21), oral cavity (CR: 17), colo-rectum (CR: 13), prostate (CR: 12) and larynx (CR: 7) (Table 1) and the same among women were breast (CR: 44), thyroid (CR: 16), cervix uteri (CR: 9), colo-rectum (CR: 9) and ovary (CR: 9) (Table 2). Among males, the peak ASpR (per 10^5) was 131 in 65-74 years for lung, 83 in 75+ years for oral cavity, 69 in 65-74 years for colo-rectum and 149 in 75+ years for prostate cancers (Figure 1a). Among females, the peak ASpR (per 10^5) was 147 in 55-64 years for breast, 25 in 35-44 years for thyroid, 39 in 55-64 years for cervix-uteri and 24 in 55-64 years for ovary (Figure 1b). Tobacco-related cancers [oral cavity, pharynx (excluding nasopharynx), larynx, lung, esophagus and urinary bladder] accounted 38% (CR: 60) and 8.4% (CR:11) of the total male and female cancers respectively.

Discussion

Table 3. Relative Frequencies (# & %), Mean Age (SD), Average Annual Crude (CMR) and Age-Standardized (ASMR) Mortality Rates by Site Among Men in Trivandrum (2012-2014)

Site	# (%)	Mean (SD)	CMR	ASMR	ICD-10
All sites	3,133	61.7 (13.7)	65.9	53.6	C00-C96
Oral cavity (lip, mouth and tongue) and pharynx					
Oral cavity	321 (10.2)	61.6 (11.9)	6.75	5.41	C00–06
Tongue	135 (4.3)	60 (11.9)	2.96	2.37	C01-C02
Mouth	180 (5.7)	62.67 (11.8)	3.79	3.05	C03-C06
Pharynx	110 (3.5)	62.2 (9.6)	2.48	2	C09,10,12,13,14
Digestive organs					
Oesophagus	109 (3.5)	63.3 (9.4)	2.29	1.88	C15
Stomach	133 (4.2)	61.6 (12.8)	2.80	2.28	C16
Colon- Rectum	152 (4.9)	62.54 (11.5)	3.20	2.6	C18-21
Liver	128 (4.1)	59.1 (12.6)	2.69	2.19	C22
Pancreas	73 (2.3)	59.3 (10.5)	1.54	1.23	C25
Respiratory organs					
Larynx	97 (3.1)	64.26(9.7)	2.04	1.64	C32
Lung	489 (15.6)	63.2 (10.15)	10.29	7.5	C33-34
Bone, Connective tissue	41 (1.3)	41.39 (24.7)	0.86	0.81	C40,41,47,49
Genital organs					
Prostate	102 (3.3)	69.95 (9.6)	2.15	1.73	C61
Urinary tract organs					
Kidney	18 (0.6)	63.17 (8.81)	0.38	0.297	C64-66; 68
Bladder	50 (1.6)	64.98 (11.1)	1.05	0.83	C67
Brain, other central nervous system (CNS) and Thyroid					
Brain and other CNS	55 (1.8)	50.2 (18.2)	1.16	0.98	C70-72
Thyroid	16 (0.5)	64.4 (11.6)	0.34	0.28	C73
Haematological malignancies					
Lymphoma	82 (2.6)	56.2 (15.44)	2.66	2.22	C81
Myeloma	66 (2.1)	63.47 (12.2)	3.95	3.15	C82-85; 96
Leukaemia	85 (2.7)	44.96 (22.4)	6.53	6.01	C88; 90

Rates per 10^5 person-years

The present analysis was based on a total of 15,649 new cancer cases diagnosed in Trivandrum district during 2012-2014. Cases reported in 2012 (n=4847) was 16% higher than that in 2014 (n=5,630) and the estimated missing proportion decreased from 20% in 2012 to 12% in 2014. These values suggested a level of under-registration in the first year of operations. Even though the data collection system is active, co-operation from all the data sources was very good because of an administrative letter, provided by the Principal Secretary, Government of Kerala to all health authorities in the district and hence the coverage has been improved in the latter years. The under-reporting for the first year is not surprising during this initial "learning" year of operations.

As regards the quality of registry data, duplicate registrations and a series of consistency checks on the database were done locally as well as at the NCRP and cleaned the data to the best possible ways. Quality indicators such as the microscopic verification ranged from 65% to 100% in other registries in India (NCRP, 2013) and the same was comparable in Trivandrum as it was 82% and 87% in males and females respectively. Since it being the beginning registry covering the entire district of Trivandrum (unavailability of matching incidence database), the 'DCO' in the Trivandrum district registry was slightly higher (9% in males and 7% in females) than the values in other registries in India; and it is expected that the 'DCO' rate will decrease as matching database will be increased over time. In the present analysis, the estimated missing proportion was 12%. Hence the various rates might not be over-estimated even though the proportion of 'DCO's were slightly higher than the national figures (NCRP, 2016).

The proportion of CRs in Trivandrum were the highest in both genders except the rates in Aizwal, North East region. However, ASRs were less than the CRs. Similar pattern of higher CRs than the ASRs was observed in Kollam (the neighboring district) district cancer registry (NCRP, 2016). This is due to the fact that the life expectancy is 8 years (66 years vs. 74 years) higher in the state of Kerala than the national figures. Also, 13.2% and 14.2% were higher than 60 years in Trivandrum compared to 7.7% and 8.4% nationally in males and females respectively (Census of India, 2011). Higher

Table 4. Relative Frequencies (# & %), Mean Age (SD), Average Annual Crude (CMR) and Age-Standardized (ASMR) Mortality Rates by Site Among Women in Trivandrum (2012-2014)

Site	# (%)	Mean (SD)	CR	ASR	ICD-10
All sites	2,534	60.41 (14.51)	48.7	37.2	C00-C96
Oral cavity (lip, mouth and tongue) and pharynx					
Oral cavity	148 (5.8)	68.05 (14.51)	3.39	2.54	C00–06
Pharynx	12 (0.5)	70.17 (13.74)	0.33	0.22	C09,10,12,14
Digestive organs					
Oesophagus	26 (0.6)	65.88 (8.01)	0.5	0.41	C15
Stomach	66 (2.6)	59.82 (12.79)	1.27	0.96	C16
Colon-Rectum	125 (4.9)	63.59 (12.18)	2.4	1.78	C18-21
Liver	30 (1.2)	57.17 (12.83)	0.58	0.45	C22
Pancreas	50 (2.0)	62.04 (10.44)	0.96	0.75	C25
Respiratory organs					
Lung	133 (5.2)	59.84 (12.65)	2.56	1.92	C33-34
Bone and Connective	24 (0.4)	44.79 (22.68)	0.46	0.42	C40,41,47,49
Breast	470 (18.5)	56.58 (11.57)	9.04	6.89	C50
Genital organs					
Cervix uteri	157 (6.2)	61.22 (11.99)	3.02	2.27	C53
Corpus uteri	56 (2.2)	61.78 (12.29)	1.08	0.83	C54
Ovary	142 (5.6)	57.17 (13.96)	2.73	2.07	C56
Urinary tract organs					
Kidney	7 (0.3)	57.17 (13.96)	0.13	0.1	C64-66; 68
Bladder	9 (0.4)	61.56 (13.35)	0.17	0.13	C67
Brain, other central nervous system (CNS) and Thyroid					
Brain and other CNS	48 (1.9)	47 (18.32)	0.92	0.82	C70-72
Thyroid	25 (1.0)	62.4 (12.99)	0.48	0.36	C73
Haematological malignancies					
Lymphoma	65 (2.6)	62.6 (15.96)	1.25	0.91	C81-C85,C96
Myeloma	38 (1.4)	61.44 (11.79)	0.73	0.57	C88; 90
Leukaemia	88 (3.5)	46.29 (20.79)	1.69	1.49	C91-C95

Rates per 10^5 person-years

proportion of older age population in Kerala explains the higher burden (CRs) of the disease.

The ASRs (per 10^5) in Trivandrum were higher (ASR: 132.0 and 120.4) than the estimated national figures (ASR: 92.4 and 97.4) in men and women respectively (Ferlay et al., 2013). Among the available 27 cancer registries in India, the areas having higher ASRs in males than Trivandrum were in the north east areas in India such as Aizawl, Papumpare, East Khasi Hills, Kamrup and Meghalaya as well as Delhi. Among females, the areas having higher ASRs than Trivandrum were north east areas Papumpare, Aizawl and Kamrup and the urban populations such as Delhi, Chennai and Bangalore. Common cancers in north east areas in India were mostly esophagus, lung and pharynx. However, in Trivandrum, tobacco-related cancers (TRC) constituted only 37% and 11% of the total male and female cancers respectively where as in Aizwal, TRCs accounted 48% and 27% in males and females respectively (NCRP, 2016).

As regards the mortality rates, special efforts were made for obtaining cancer deaths in Trivandrum. This is due to the limitation of accurate cause of death. Overall mortality rates in both genders were low in Trivandrum compared to the estimated national figures (Globocan 2012). The crude cancer mortality rates were 66 and 49 per 10^5 males and females respectively in Trivandrum. One of the reasons for the lower mortality rates could be due to the prognostically better leading cancers such as thyroid, cervix uteri, corpus uteri etc. affecting among females. However, there is a need to obtain accurate cause of death by the vital statistics offices.

Another major challenge in operating the registry is the fact that the disease coding is not available in most of the peripheral hospitals and hence retrieval of cancer cases was very difficult. Secondly, some pathology laboratories did not have the hospital name/number/address. Hence data linkage was not possible for such cases. Thirdly, it was observed that many patients once registered and diagnosed as cancer, they drop-out from treatment and approached other systems of medicine such as Ayurveda, Homoepathy, Unani, Sidha etc. and data collection from these systems of medicine were not done.

Even with the existing limitations in case ascertainment, Trivandrum had the highest cancer incidence (CR) rate (except Aizwal, North East) in India in both genders and the highest CRs (per 10^5) for prostate (CR:12),

colo-rectum (CR:12.7) and urinary bladder (CR:6.0) cancers in males (Figure 2a) and breast (CR:44), colo-rectum (CR:9) and corpus-uteri (CR:7) cancers in females (Figure 2b) and low incidence of cervix-uteri (CR: 9.3) cancers were observed nationally (NCRP 2016). However, incidence rates of prostate, colo-rectum and corpus uteri cancers in western countries are much higher (more than five-fold) than the rates in Trivandrum (Ferlay et al., 2013).

The pattern of cancer in Kollam district cancer registry is almost similar to Trivandrum. However, the crude incidence rates were slightly lower in Kollam (NCRP 2016). The case ascertainment and the population structure are almost similar in both districts. However, a higher population proportion (56%) in Trivandrum is urban as against 44% in Kollam district (Census of India, 2011). The more urbanized life-style might be the reason for the higher incidence in Trivandrum than Kollam.

In conclusion, the burden of cancer in Trivandrum was high in both genders. This is mainly due to our increased life expectancy. Burden of (crude incidence) of breast, corpus-uteri, prostate, colo-rectum and urinary bladder cancers were the highest in India and low incidence of cervix-uteri cancers were observed in Trivandrum. An epidemiologic transition in cancer pattern is taking place and is changing to more similar to "western" jurisdictions. Studies are required to assess the factors related to the changing pattern of cancer.

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