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Urban-Rural Disparities in Female Cancer Incidence and Mortality in Trivandrum, South India

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Abstract

Background: Cancer incidence and mortality have been observed higher among females in urban than rural around the world. This study assessed the pattern of cancer incidence and mortality among females in urban and rural populations of Trivandrum, South India.

Methods: Crude (CR) and Age-Standardised (ASR) incidence and mortality rates, Rate Ratios (RR) and 95% confidence interval (CI) by urban vs. rural were calculated using Trivandrum population-based cancer registry data for 2012-2014.

Results: Combination of all cancer incidence rates (per 10^5) were 177.2 (ASR: 137.7) in urban and 142.6 in rural (ASR: 112) and showed a higher incidence (RR: 1.23; CI: 1.2-1.3) and mortality (RR: 1.09; CI: 1.01-1.18) and lower fatality (mortality/incidence) in urban (29.2% urban vs. 33.1% rural). Common cancers in urban were breast (CR: 55.4, ASR: 42.2), thyroid (CR: 15.1, ASR: 12.5), ovary (CR: 11.1, ASR: 8.6) and colo-rectum (CR: 10.6, ASR: 8.0), and in rural, these were breast (CR: 38.8, ASR: 29.9), thyroid (CR: 16.5, ASR: 13.7) and cervix uteri (CR: 9.4, ASR: 7.0). Striking higher incidence in urban were for corpus uteri (RR: 1.85, CI: 1.5-2.3), breast (RR: 1.41, CI: 1.3-1.5), ovary (RR: 1.40, CI: 1.2-1.7) and colo-rectum (RR: 1.35; CI: 1.1-1.6).

Conclusion: A distinction is drawn in cancer incidence and mortality between urban and rural women in Trivandrum. Higher incidence of breast, corpus uteri and colo-rectal cancers might be due to some changes in life-style factors and improved health care access in urban population.

Keywords: Cancer incidence; Mortality; Urban-Rural differences; Cancer control

Introduction

Significant differences in cancer incidence between urban and rural women have been reported and for the same type of cancer, rural women are generally diagnosed at a later stage and have decreased survival rates as opposed to their urban counterparts [1,2]. This has been shown for cancers such as breast, colo-rectum in both developed and developing countries [3,4]. Rural women may suffer significant inequalities in terms of access to medical care and health awareness and these women tend to be less educated with lower economic means. Poorer hygienic conditions tend to aggravate physical threats in rural areas. Conversely, mechanized life-style, stress and air pollution are more widespread in urban environment.

Currently, lifestyle homogenization, particularly in developed countries, and the increased opportunities to healthcare access in rural population, has led to a minimal difference in cancer pattern. However, within Asia, large differences in cancer pattern are found between urban and rural population. Incidence rates of cancers such as cervix uteri, esophagus, stomach etc. are generally low in urban than rural population. In contrast to this, cancers such as breast, corpus uteri, ovary, colo-rectum etc. incidence rates are higher in urban than rural [5].

Cancer incidence particularly breast cancer among women in Kerala, South India, is a growing threat to public health. In urban Trivandrum other cancers such as corpus uteri, colo-rectum and kidney are also reported as the highest in the country (NCRP 2016). In Kerala, urban-rural difference according to education among women is minimal (literacy rate: 84.6% urban vs. 81.6% rural) (Census of India 2011) and the distances by road between the main oncology centers in Trivandrum and the rest of the regions are small. It is therefore possible to hypothesize that urban-rural differences in health care access is minimal. However, the magnitude and pattern of cancer incidence and mortality may differ by type of residence due to the difference in socio-demographic and life-style factors.

Here we describe a descriptive epidemiological study concerning urban-rural gradients of female cancer incidence and mortality and assess inequalities in the quality of data by making use of data from district cancer registry, Trivandrum for the year 2012-2014. This is to derive specific epidemiological information and establish a working hypothesis based on findings. This approach would allow the characterization of health inequalities across the rural/urban axis and would give an opportunity for dynamic health policy formulation targeted at improved health care access and health education among women.

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Table 1: Urban-Rural comparison of Female Cancer Incidence in Trivandrum (2012-2014).

	Number	MD (%)	Crude Rate (CR)			ASR		RR	95% CI	P
Site	U/ R	U/R	U	R	Diff.	U	R			
All sites	3141/4887	88.0/86.1	177.2	142.6	34.6	137.7	112	1.23	1.2 - 1.3	0.0001*
Oral cavity (lip, mouth & tongue) & pharynx										
Oral cavity	129 / 250	91.0/92.0	7.3	7.3	0	5.5	5.4	1.01	0.8 - 1.2	0.656
Tongue	53/103	92.5/98.1	3	3.1	-0.1	2.3	2.3	1	0.7-1.3	0.763
Mouth	71/138	88.7/87.0	4	4.1	-0.1	3	3	1	0.8-1.3	0.731
Digestive organs										
Esophagus	21 / 43	90.5/90.7	1.2	1.3	-0.1	0.9	1	0.93	0.5 - 1.6	0.698
Stomach	47 / 79	91.5/82.3	2.7	2.3	0.3	2	1.8	1.14	0.8 - 1.6	0.609
Colorectum	188 / 265	92.6/90.9	10.6	7.7	2.9	8	6	1.35	1.1 - 1.6	0.004*
Pancreas	35 / 67	65.7/55.2	2	2	0	1.5	1.5	1.04	0.7 - 1.6	0.863
Respiratory organs										
Lung	126 / 184	86.5/81.0	7.1	5.4	1.7	5.4	4.1	1.32	1.1 - 1.7	0.042*
Breast & gynecological organs organs										
Breast	982/1328	96.5/95.7	55.4	38.8	16.6	42.2	29.9	1.41	1.3 - 1.5	0.0001*
Cervix uteri	167 / 315	91.0/94.6	9.4	9.2	0.2	7	7	1.01	0.8 - 1.2	0.825
Corpus uteri	168 / 174	98.2/97.7	9.5	5.1	4.4	7.3	3.9	1.85	1.5 - 2.3	0.0001*
Ovary	197 / 271	89.8/86.7	11.1	7.9	3.2	8.6	6.2	1.4	1.2 - 1.7	0.002*
Urinary tract organs										
Kidney	26 / 31	92.3/83.9	1.5	0.9	0.6	1.2	0.9	1.37	0.8 - 2.3	0.097**
Bladder	27 / 39	100/94.9	1.5	1.1	0.4	1.2	0.9	1.29	0.8 - 2.1	0.325
Brain, other central nervous system (CNS) & Thyroid										
Brain & CNS	49 / 77	85.7/89.6	2.8	2.2	0.5	2.5	2	1.26	0.9 - 1.8	0.377
Thyroid	268 / 565	99.3/99.1	15.1	16.5	-1.4	12.5	13.7	0.91	0.8 - 1.1	0.074**
Hematological malignancies										
Lymphoma	101 / 153	100/100	5.7	4.5	1.2	4.6	3.6	1.27	1.0 - 1.6	0.122
Myeloma	58 / 75	96.6/97.3	3.3	2.2	1.1	2.4	1.7	1.4	1.0 - 2.0	0.04*
Leukaemia	75 / 117	100/100	4.2	3.4	0.8	4.1	3.3	1.25	0.9 - 1.7	0.254

MD: Microscopic diagnosis, RR: Rate ratio compared to urban, CI: confidence interval;
*significant at 5% level;
** borderline significance.

Materials and Methods

The Trivandrum district cancer registry covers an area of 2,192 sq.kms and a female population of 171,9749 (Census of India, 2011). People residing for a minimum period of 1 year in Trivandrum district are considered as residents. Urban-rural classification has been made according to Taluk. The registry area includes four Taluks. Trivandrum Taluk is considered as urban (91.7% population urban) and the rest of the three Taluks as rural (67% population rural). Cancer registry data collection system is active by visiting more than 60 hospitals and 7 pathology laboratories in the registry area. Two governments [Regional Cancer Centre (RCC), the physical location of the registry, and Medical College Hospital, located in the same campus] and a private hospital are the oncology (radiotherapy treatment services) centres in Trivandrum. In addition, a large number of private hospitals and government hospitals also diagnose and treat cancer patients. Address linkage of cancer patient data, obtained from pathology laboratories, are made. Cases registered include all invasive cancers (ICD-10: C00 to C58; C64-C96).

Almost all deaths are registered in the vital statistics offices, but cause of death is not accurate. Hence cancer deaths were obtained in three different ways: i) matching cancer deaths with 'cancer incidence database' to obtain cause of death ii) cancer deaths unmatched with incidence database as death certificate only (DCO) and iii) matching 'non-cancer specific-mortality database (excluded deaths due to accidents or natural calamity)' 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 (incidence and mortality), consisting checking (comparing the values of certain variables against the others), and duplicate eliminations (also manually) were carried out using a customized version of the software developed by the National Cancer

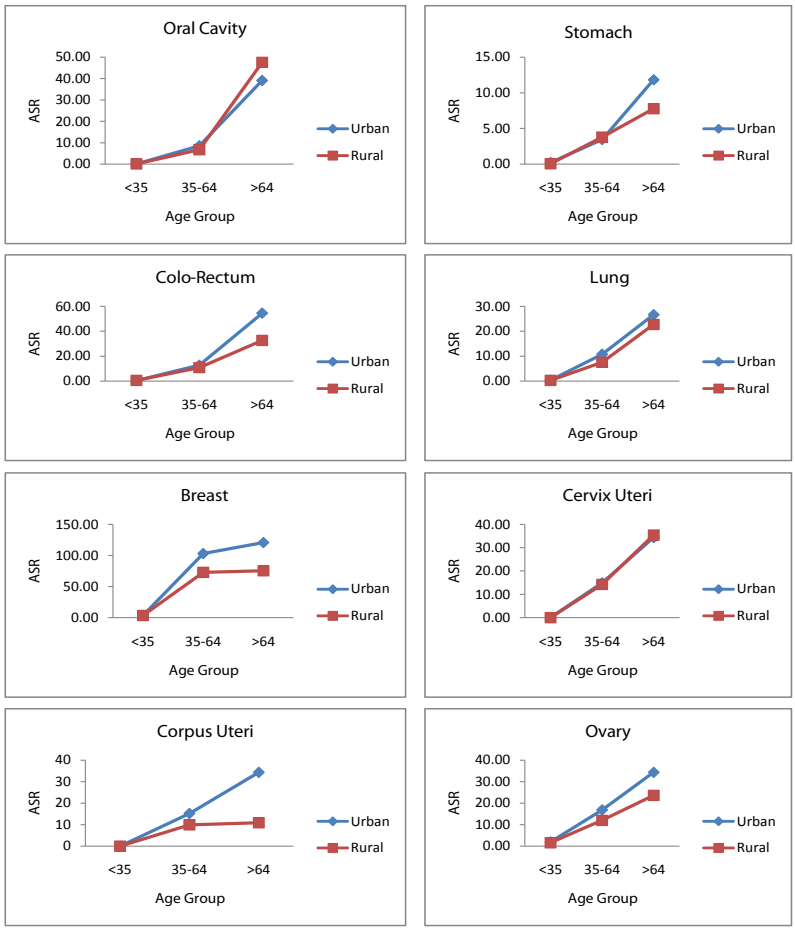

Figure 1: Urban-Rural comparison of age - specific cancer incidence of leading cancers among women in Trivandrum (2012-2014).

Registry Programme, Government of India (PBCR DM 2.1 software).

Statistical methods

Based on the distribution different method and using the census of India (2011) and population growth rate from 2001 to 2011, the Taluk-wise population of the district for the years 2012-2014 were estimated [6,7]. Quality indicators by type of residence were assessed in terms of proportion of microscopic verification, 'DCO' and ill-defined sites (ICD-10: C76). The results were presented as the number of cases by site (ICD-10) and type of residence, with crude incidence (CR) and mortality (CMR) rates, age-specific incidence (ASpR), age-standardized (direct method using the world standard population) (ASR) incidence and mortality (ASMR) rates per 100,000 person-years [8] and rate ratio (RR) along with 95% confidence interval (CI). Assuming approximately normal distribution, Chi-square p-value was estimated for the RR of large samples. Fatality ratio (mortality/incidence) was assessed for each cancer site by type of residence [9].

Results

A total of 8028 female cancer patients were diagnosed during 2012-2014 from Trivandrum (3141 urban and 4887 rural). Patients reported in RCC were 34.5% and 36.1% and in medical college hospital were 25% and 30.9%, from urban and rural regions respectively. Microscopic diagnosis (MD) was 88% and 86.1%, 'DCO' was 6.1% and 7.3% and 'ill-defined sites' were 1.2% and 1.1% in urban and rural populations respectively. MD was more than 90% for most of the cancer sites except for pancreas in both urban and rural populations and no major difference in MD was observed by type of cancer.

Combination of all cancer incidence rates (per 10^5) were 177 in urban (ASR: 138) and 143 in rural (ASR: 112) and showed a significant higher incidence rates (RR: 1.23; CI: 1.2-1.3) in the urban region. The common cancers (rate per 10^5) in the urban were breast (CR: 55.4, ASR: 42.2), thyroid (CR: 15.1, ASR: 12.5), ovary (CR: 11.1, ASR: 8.6), colo-rectum (CR: 10.6, ASR: 8.0), and corpus uteri (CR: 9.5, ASR: 7.3).These cancers together accounts 57.4%. The common cancers in the rural region were breast (CR: 38.8, ASR: 29.9), thyroid (CR: 16.5, ASR: 13.7), cervix uteri (CR: 9.2, ASR: 7.0) and ovary (CR: 7.9, ASR: 6.2) colo-rectum (CR: 7.7, ASR: 6.0), and these cancers accounts 56.1% of all cancers.

Significantly higher cancer incidence rates in the urban population was observed for corpus uteri (RR: 1.85; CI: 1.5-2.3), breast (RR: 1.41; CI: 1.3-1.5), ovary (RR: 1.40; CI: 1.2-1.7), colo-rectum (RR: 1.35; CI: 1.1-1.6), lung (RR: 1.32; CI: 1.1-1.7), myeloma (RR: 1.40; CI: 1.0-2.0) and kidney cancer (RR: 1.37; CI: 0.8-2.3) (borderline significance). Thyroid cancer incidence was higher in rural (RR: 0.91, CI: 0.8-1.1) (borderline significance). Slightly higher rates in rural areas were observed for oral cavity and esophageal cancers, but not significant

Table 2: Urban-Rural comparison of Female Cancer Mortality (M) & Fatality ratio in Trivandrum (2012-2014).

Site	Number U/ R	CMR			ASR		RR (95% CI)	p-value	Fatality (%)	
		U	R	Diff	U	R			U	R
All sites	917/ 1617	51.7	47.2	4.5	39.4	36.1	1.09 (1.01,1.18)	<0.001*	29.2	33.1
Oral cavity (lip, mouth & tongue) & pharynx										
Oral cavity	33/ 115	1.86	3.39	-1.53	1.27	2.54	0.50 (0.34,0.74)	0.617	25.6	46
Tongue	16/ 43	0.9	1.37	-0.47	0.6	1.04	0.58 (0.32,1.02)	0.862	30.2	41.7
Mouth	17/ 68	0.96	1.98	-1.02	0.68	1.48	0.46 (0.27,0.78)	0.507	23.9	49.3
Digestive organs										
Esophagus	10/16	0.56	0.47	0.09	0.46	0.38	1.21 (0.55,2.67)	0.389	47.6	37.2
Stomach	24/ 42	1.35	1.23	0.12	1.06	0.92	1.15 (0.70,1.90)	0.238	51.1	53.2
Colorectum	57/ 68	3.22	1.98	1.24	2.34	1.49	1.57 (1.10,2.23)	0.003 *	30.3	25.7
Pancreas	23/ 18	1.3	0.77	0.53	1.01	0.62	1.63 (0.88,3.02)	0.009*	65.7	26.9
Respiratory organs										
Lung	43/ 90	2.43	2.63	-0.2	1.83	1.97	0.93 (0.65,1.34)	0.294	34.1	48.9
Breast & gynecological organs										
Breast	168/ 302	9.48	8.81	0.67	7.19	6.75	1.07 (0.88,1.29)	0.003*	17.1	22.7
Cervix uteri	56/ 101	3.16	2.95	0.21	2.42	2.19	1.11 (0.80,1.53)	0.089**	33.5	32.1
Corpus uteri	25/ 31	1.41	0.9	0.51	1.09	0.69	1.58 (0.93,2.68)	0.056**	14.9	17.8
Ovary	63/ 79	3.55	2.31	1.24	2.75	1.72	1.60 (1.15, 2.23)	0.003*	32	29.2
Brain, other central nervous system (CNS) & Thyroid										
Brain & CNS	18/ 30	1.02	0.88	0.14	0.89	0.78	1.14 (0.64,2.05)	0.267	36.7	39
Thyroid	09/16	0.51	0.47	0.04	0.36	0.36	1.0 (0.44, 2.26)	0.483	3.4	2.8
Hematological malignancies										
Lymphoma	28/ 37	1.57	1.08	0.49	1.23	0.84	1.46 (0.90,2.39)	0.059**	27.7	24.2
Myeloma	15/ 23	0.84	0.67	0.17	0.66	0.52	1.27 (0.66,2.43)	0.25	25.9	30.7
Leukaemia	36/ 52	2.03	1.52	0.51	1.78	1.34	1.33 (0.87,2.03)	0.054**	48	44.4

(Table 1). Age specific incidence rate with respect to urban-rural were not statistically significant (Figure 1).

Overall mortality rates (per 10^5) were 52 in urban and 47 in rural (ASR: 39 in urban and 36 in rural). In urban, significantly higher mortality rates were observed for ovary (RR: 1.60, CI: 1.15-2.23) and colo-rectal cancers (RR: 1.57, CI: 1.10-2.23). In rural, higher mortality rates were observed for oral cavity (RR: 0.50, CI: 0.34-0.74) and thyroid cancer. Even though overall fatality ratio was only slightly higher in rural, significantly higher fatality ratio was observed in rural population for specific cancer sites such as oral cavity (25.6% urban vs. 46.0% rural), lung (34.1% urban vs. 48.9% rural), breast (17.1% urban vs. 22.7% rural), which indirectly showed higher late stage at diagnosis in rural than urban (Table 2).

Discussion

In the present analysis, we found a significantly higher incidence and mortality in urban women for combination of all cancer sites and some common sites such as breast, colo-rectum and corpus uteri. Data quality indicators such as MD and DCO were almost similar in both urban and rural population. A higher proportion of patients approached private hospital services in rural than the urban population. The distances by road between the three main oncology centers (2 governments and 1 private) in urban Trivandrum and the rest of the regions are small. All rural population in Trivandrum are not strictly rural (33% are urban).The urban-rural difference in education among women in Trivandrum is very minimal. Considering all the above facts, it is possible to assume that an urban-rural difference in health care access is minimal.

Breast cancer incidence was higher in urban Trivandrum than the rural counterparts, which was the highest in the country (NCRP, 2016). It is reported that the disease is common in developed countries with higher incidence in urban population [5]. Studies have reported increased obesity and sedentary activity among breast cancer urban women in Kerala [10,11,12]. In the present analysis, even though breast cancer incidence and mortality was lower in rural population, fatality ratio was higher in rural. One of the most important finding is that rural residents are generally diagnosed at a later stage and have decreased survival rates as opposed to their urban counterparts [1,2].

Colo-rectal cancer incidence was higher in urban Trivandrum than the rural counterparts. Incidence rate in urban Trivandrum was the highest in the country (NCRP, 2016). Similar pattern has been observed among men in Trivandrum [13]. Studies have reported that the disease is common in developed countries in both genders and higher incidence in urban population, mainly due to screening programme [5]. However, higher incidence of this cancer in urban

Trivandrum is not due to screening programme, as the same has not been practicing in both the regions. The difference could be due to difference in life-style and certain dietary factors. Even though there was difference in incidence, almost similar mortality rate was observed in both regions which indicated that the late stage at diagnosis is higher in rural. Some studies have observed increased risk of death for colon cancer among rural residents in Georgia, US [14].

Corpus uteri cancer incidence was higher in urban Trivandrum than the rural counterparts. Incidence rate in urban Trivandrum was the highest in the country (NCRP, 2016). It is reported that the disease is also common in developed countries and higher incidence in urban population [5]. Even though corpus uteri cancer incidence and mortality was lower in rural population, fatality ratio was slightly higher in rural. Similar to corpus uteri cancer, ovarian cancer incidence was higher in urban Trivandrum than the rural counterparts. It is reported that ovarian cancer is common in developed countries and higher incidence in urban population [5].

Unlike among men, thyroid cancer, the second commonest cancer among women, incidence was slightly higher in rural region. This explains minimal difference in health care access between urban-rural women in Trivandrum.

Lung cancer incidence among women was higher in urban Trivandrum. Tobacco smoking prevalence among women in Trivandrum is almost negligible. Hence possible explanation for the higher incidence in urban might be due to higher exposure to air pollution. Studies have reported an excess of lung cancer cases in urban areas after controlling for smoking behavior and possible explanations suggested were air pollution, occupational differences and the legacy of selective migration between urban and rural areas [15].

In the present analysis, overall incidence and mortality rates were higher in the urban Trivandrum, fatality ratio was slightly higher in the rural than the urban population. This might be due to later stage at diagnosis and there by lower survival rates. One of the most important finding is that rural residents are generally diagnosed at a later stage and have decreased survival rates as opposed to their urban counterparts [1,2].

Conclusion

In conclusion, the present analysis indicated higher incidence and mortality rates among women in urban Trivandrum. Higher incidence of breast, corpus uteri and colo-rectal cancers might be due to some exposure differences. More research is required to establish a clear picture of epidemiological map, inequalities in terms of access to medical care and health awareness that will confirm the hypothesis of rural/urban disparities in cancer incidence and mortality among women.

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