

RESEARCH COMMUNICATION

An Alternative Approach to Study the Changes in the Cancer Pattern of Women in India (1988-2005)

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Abstract

Background: The changes in the cancer pattern are often studied with the help of changes in the rank of leading sites, changes in the Age Adjusted Rates of the sites over the time or with the help of time trends. However, these methods do not quantify the changes in relation to overall changes that occurred in the total cancer cases over the period of time. An alternative approach was therefore used to assess the changes in cancer pattern in relation to overall changes in time and also an attempt was made to identify the most emerging new cancers in India. **Methods:** The cancer incidence data of various sites for women, over the periods 1988-90 and 2003-05 in India, for five urban registries namely Bangalore, Bhopal, Chennai, Delhi and Mumbai, functioning under the network of National Cancer Registry Programme (ICMR), formed the sources of data for the present analysis. The changes in incidence cases by various cancer sites for women were assessed by calculating the differences in incidence cases over the two period of time. Based on the contribution of each site to total change, the ten most leading sites were identified separately for each registry. The relative changes in the sites with time were taken to identify the most emerging new cancer cases over the period of time. **Results:** The pooled cancer cases for women among five urban registries increased from 29447 cases in 1988-90 to 48472 cases in 2003-05 registering an increased of about 63.3%. The lowest percentage of increase was observed in the registry of Chennai (41.5%) and the maximum in Bhopal (102.0%). Based on the pooled figures, the breast cancer contributed to the maximum % change (38%), followed by ovarian (8.0%), gallbladder (5.1%), corpus uteri (4.9%) and cervix uteri (4.1%). Based on the pooled data and relative changes, the emerging new cancers were corpus uteri (187%), gallbladder (162.1%) and lung cancer (136.1%). The % change by sites and the emerging new cancers varied between the registries.

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Introduction

The changes in the cancer pattern are often studied with the help of changes in the rank of leading sites, changes in the age adjusted rates of the sites over the time or with the help of time trends. The registered numbers of overall cancer cases in Bangalore, Chennai, Delhi, Bhopal and Mumbai are rising (Marimuthu, 2008) and changes for many body sites in India have been documented (Sunny et al., 2004a; 2004b; 2004c; Mehrotra et al., 2005; Murthy et al., 2005; 2008; Elango et al., 2006; Jayalekshmi et al., 2006; Yeole, 2007; 2008a; 2008b; 2008c; 2008d; Takiar and Srivastav, 2008; Agarwal et al., 2009). Age-adjusted incidence rates for cancers of the stomach and esophagus are generally decreasing, while breast, colon and rectum and liver cancers are on the rise in most registries (Yeole, 2008). However, the methods described above do not quantify the changes in relation to overall changes that occurred in the total cancer cases over the period of time. An alternative approach was therefore here used to assess the changes in cancer pattern in relation to overall changes in time and also an attempt was made to identify the most emerging new cancers among women in India.

Materials and Methods

The cancer incidence data of various sites for women, over the periods 1988-90 and 2003-05 in India, for five urban Population Based Cancer Registries (PBCRs) namely Bangalore, Bhopal, Chennai, Delhi and Mumbai, functioning under the network of National Cancer Registry Programme (ICMR), formed the sources of data for the present analysis. The incidence cases for 3 years were mainly pooled to adjust for the possible fluctuations in the number of cases, likely to occur, from one single year to another single year. The changes in incidence cases by various cancer sites for women were assessed by calculating the differences in incidence cases over the two period of time. Based on the contribution of each site to total change, the ten most leading sites were identified separately for each registry. The relative changes in the sites with time were taken to identify the most emerging new cancer cases over the period of time. In terms of formulae

$$\text{Change} = (b-a); \quad \% \text{ Change} = [(b-a)/(B-A)] * 100;$$

$$\text{Relative Change} = [(b-a)/a] * 100$$

Where: a = No. of incidence cases for the period

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1988-90 for the cancer site 'X'; b = No. of incidence cases for the period 2003-05 for cancer site 'X'; A = No. of incidence cases for the period 1988-90 for all sites of cancer; B = No. of incidence cases for the period 2003-05 for all sites of cancer.

Results

The number of cancer cases covered by different PBCRs and periods are shown in Table 1. The pooled cancer cases for women among five urban registries increased from 29447 cases in 1988-90 to 48472 cases in 2003-05, registering an increase of 18,636 cases over the period of time. The change in the cancer cases ranged from 772 cases in Bhopal PBCR to 7,070 cases in Delhi PBCR. The overall percentage change during the period was 63.3% while the lowest percentage of increase was observed in the registry of Chennai (41.5%) and the maximum in Bhopal (102.0%).

The number of cases covered by the leading sites, period, their % and % relative changes for Bangalore

Table 1. No. of Cases Covered by Period and Change - Females

Registry Area	Cancer Cases -Females		Change (B-A)	% Relative Change [(B-A)/A]*100
	2003-05 (B)	1988-90 (A)		
Bangalore	8,167	4,459	3,708	83.2
Bhopal	1,529	757	772	102.0
Chennai	7,184	5,077	2,107	41.5
Delhi	16,443	9,373	7,070	75.4
Mumbai	14,760	9,781	4,979	50.9
Pooled	48,472	29,447	18,636	63.3

PBCR is shown in Table 2. The overall increase (change) in the number of cases, over the period 1988-90 to 2003-05, was 3708. Among these, the maximum change was due to breast cancer cases (1364) which constituted about 36.8% of the total change cases. This was followed by the change in cervix cases (7.4%) followed by ovary (6.9%), corpus uteri (5.7%) and NHL (4.1%). The relative changes over the period were observed to be maximum in corpus uteri (366%) followed by the site of lung (253%) and NHL (208%). These sites can be termed as the emerging sites of cancer among women in Bangalore PBCR.

In case of Bhopal PBCR (Table 3), the rise in the number of cases was 772, the maximum contribution being due to breast (31%) followed by cervix (12.7%), ovary (8.4%), gall bladder (6.0%) and mouth (3.9%). The relative changes over the period were observed to be maximum for the site of rectum (600%), followed by liver (229%) and gall bladder (200%), these being the emerging sites of cancer among women in Bhopal PBCR.

In case of Chennai PBCR (Table 4), the rise in the number of cases was 2,107. Of these, the maximum contribution was due to breast cancer (51.3%), thyroid (6.8%), ovary (5.9%), lung (5.1%) and brain/nervous system (4.3%). Based on the relative changes, the emerging new sites were thyroid (248%), brain/nervous system (192%) and lung (159%).

In case of Delhi PBCR (Table 5), the rise in the number was 7,070, with maximum contributions by breast (34.3%), ovary (9.0%), gall bladder (8.8%), cervix (6.2%) and corpus uteri (5.8%). Based on the relative changes, the emerging new sites were corpus uteri (263%), gall bladder (174%) and thyroid (168%).

In Mumbai PBCR (Table 6), the rise in the number

Table 2. No. of Cases Covered by Period, % Change and % Relative Change-Females-Bangalore PBCR

ICD-10	Site	2003-05 (b)	1988-90 (a)	Change (b-a)	% Change [(b-a)/(B-A)]* 100	% Relative Change [(b-a)/a]* 100
C50	Breast	2,108	744	1,364	36.8	183.3
C53	Cervix Uteri	1,284	1,010	274	7.4	27.1
C56	Ovary etc.	414	159	255	6.9	160.4
C54	Corpus Uteri	270	58	212	5.7	365.5
C82-85,C96	NHL	225	73	152	4.1	208.2
C33-34	Lung etc.	208	59	149	4.0	252.5
C16	Stomach	324	185	139	3.7	75.1
C15	Oesophagus	407	278	129	3.5	46.4
C19-20	Rectum	190	75	115	3.1	153.3
C70-72	Brain, Nervous System	184	70	114	3.1	162.9
	All sites	8,167	4,459	3,708	100.0	83.2

Table 3. No. of Cases covered by Period, % Change and % Relative Change-Females-Bhopal PBCR

ICD-10	Site	2003-05 (b)	1988-90 (a)	Change (b-a)	% Change [(b-a)/(B-A)]* 100	% Relative Change [(b-a)/a]* 100
C50	Breast	400	161	239	31.0	148.4
C53	Cervix Uteri	279	181	98	12.7	54.1
C56	Ovary etc.	106	41	65	8.4	158.5
C23-24	Gallbladder etc.	69	23	46	6.0	200.0
C03-06	Mouth	67	37	30	3.9	81.1
C01-02	Tongue	34	6	28	3.6	466.7
C19-20	Rectum	28	4	24	3.1	600.0
C15	Oesophagus	60	37	23	3.0	62.2
C70-72	Brain, Nervous System	34	15	19	2.5	126.7
C22	Liver	23	7	16	2.1	228.6
	All sites	1,529	757	772	100.0	102.0

Table 4. No. of Cases Covered by Period, % Change and % Relative Change-Females-Chennai PBCR

ICD-10	Site	2003-05 (b)	1988-90 (a)	Change (b-a)	% Change [(b-a)/(B-A)]* 100	% Relative Change [(b-a)/a]* 100
C50	Breast	2008	928	1080	51.3	116.4
C73	Thyroid	202	58	144	6.8	248.3
C56	Ovary etc.	341	217	124	5.9	57.1
C33-34	Lung etc.	176	68	108	5.1	158.8
C70-72	Brain, Nervous System	137	47	90	4.3	191.5
C18	Colon	119	48	71	3.4	147.9
C54	Corpus Uteri	145	76	69	3.3	90.8
C92-95	Myeloid Leukaemia	111	43	68	3.2	158.1
C16	Stomach	323	259	64	3.0	24.7
C19-20	Rectum	127	74	53	2.5	71.6
	All sites	7184	5077	2107	100.0	41.5

Table 5. No. of Cases Covered by Period, % Change and % Relative Change-Females-Delhi PBCR

ICD-10	Site	2003-05 (b)	1988-90 (a)	Change (b-a)	% Change [(b-a)/(B-A)]* 100	% Relative Change [(b-a)/a]* 100
C50	Breast	4,330	1,908	2422	34.3	126.9
C56	Ovary etc.	1,164	529	635	9.0	120.0
C23-24	Gallbladder etc.	978	357	621	8.8	173.9
C53	Cervix Uteri	2,446	2011	435	6.2	21.6
C54	Corpus Uteri	566	156	410	5.8	262.8
C33-34	Lung etc.	446	168	278	3.9	165.5
C73	Thyroid	404	151	253	3.6	167.5
C82-85,C96	NHL	421	199	222	3.1	111.6
C70-72	Brain, Nervous System	435	225	210	3.0	93.3
C92-94	Myeloid Leukaemia	342	167	175	2.5	104.8
	All sites	16,443	9,373	7070	100.0	75.4

Table 6. No. of Cases Covered by Period, % Change and % Relative Change-Females-Mumbai PBCR

ICD-10	Site	2003-05 (b)	1988-90 (a)	Change (b-a)	% Change [(b-a)/(B-A)]* 100	% Relative Change [(b-a)/a]* 100
C50	Breast	4,199	2,202	1,997	40.1	90.7
C56	Ovary etc.	967	567	400	8.0	70.5
C53	Cervix Uteri	1,881	1,643	238	4.8	14.5
C54	Corpus Uteri	380	175	205	4.1	117.1
C33-34	Lung etc.	432	243	189	3.8	77.8
C03-06	Mouth	509	322	187	3.8	58.1
C23-24	Gallbladder etc.	351	172	179	3.6	104.1
C82-85,C96	NHL	393	219	174	3.5	79.5
C70-72	Brain, Nervous System	363	211	152	3.1	72.0
C22	Liver	285	135	150	3.0	111.1
	All sites	14,760	9,781	4,979	100.0	50.9

Table 7. No. of Cases Covered by Period, % Change and % Relative Change-Females-Pooled

ICD-10	Site	2003-05 (b)	1988-90 (a)	Change (b-a)	% Change [(b-a)/(B-A)]* 100	% Relative Change [(b-a)/a]* 100
C50	Breast	13,105	5,984	7,121	38.0	119.0
C56	Ovary etc.	3,014	1,522	1,492	8.0	98.0
C23-24	Gallbladder etc.	1,544	589	955	5.1	162.1
C54	Corpus Uteri	1,399	486	913	4.9	187.9
C53	Cervix Uteri	7,345	6,568	777	4.1	11.8
C33-34	Lung etc.	1,301	551	750	4.0	136.1
C82-85,C96	NHL	1,197	594	603	3.2	101.5
C70-72	Brain, Nervous System	1,158	570	588	3.1	103.2
C73	Thyroid	1,123	559	564	3.0	100.9
C92-94	Myeloid Leukaemia	895	463	432	2.3	93.3
	All sites	48,472	29,720	18,752	100.0	63.1

of cases was 4,979. Of these, the maximum contribution was due to breast cancer (40.1%), ovary (8.0%), cervix (4.8%), corpus uteri (4.1%) and lung (3.8%). Based on the relative changes, the emerging new sites were corpus uteri (117%), liver (111%) and gall bladder (104%).

With pooled cases of PBCR (Table 7), the rise in the number of cases was 18,752. The maximum contribution was due to breast (38.0%), ovary (8.0%), gall bladder (5.1%), corpus uteri (4.9%) and cervix uteri (4.1%). Based on the relative changes, the emerging new sites were

corpus uteri (188%), gall bladder (162%) and lung (168%).

Discussion

The changes in cancer pattern can be studied in more than one ways. One of the approaches is to compare the leading sites at two different points of time and highlight the shifts in rank of certain sites and also appearance of new sites in the list of leading sites. Attempts are also made to compare the age adjusted rates of various sites over time to conclude increasing or decreasing trends among them.

There can be another way of looking the changes. It has been shown that the number of cases covered by different PBCRs have increased from 29,447 cases in 1988-90 to 48,472 cases in 2003-05. This amounts to almost an increase of 19,000 cases which in terms of percentages will be 63.3%. Generally, it is understood that the distribution of this increased cases should be similar to those of current cases which is not always true. In the present approach, the total change in cancer cases is first assessed and then the percentage contribution of various sites to it is determined and then arranged according to decreasing order. This helps us to identify the sites which are prominently contributing to the change over time.

The list of sites so obtained may not coincide with the list of leading sites obtained conventionally. For example, based on 2003-05 data of Bangalore PBCR, oesophagus and stomach rank 4th and 5th leading sites respectively while based on changes they rank 7th and 8th respectively. This could be either due to decreasing trend in their rates or due to relatively sharp increase observed in the rates of ovary and corpus uteri. It is important to note that changes give different set of leading sites while the conventional method gives different leading sites. Changes have to be given more importance as they show the sites which have started emerging as threat to health planners and health administrators and warrant to develop suitable hospital management and treatment policies accordingly. It may be pointed out that the age adjusted rate (AAR) of all sites cancers, for the PBCR of Bangalore, was 121.3 for the period 1988-90 which has changed to be 119.3 for the period 2003-05. This implies a decline in the rate. But in terms of numbers, the registry has registered an increase of 3,708 cases over the same period of time. This may warrant an additional requirement of beds and also enhancement in budget to meet the treatment facilities.

In all the registries, it was breast cancer which contributed to maximum change, ranging from 31.0% in Bhopal PBCR to 51.3% in Chennai PBCR, followed by ovary (8.0%), gall bladder (5.1%), corpus uteri (4.9%) and cervix (4.1%) with variations in their ranks at registry level. The reason for cervix cancer missing from the list of leading sites, contributed to change from the registry of Chennai, was that cervix cancer cases have shown a decline in numbers in the period 2003-05 as compared to that seen in 1988-90.

The relative changes help us to identify the most emerging type of cancers in the community. The most emerging site of cancer for the PBCR of Bangalore, Delhi and Mumbai was Corpus uteri while for Bhopal and Chennai PBCR; it was cancer of rectum and thyroid,

respectively. This method in short can be taken as an alternative approach to assess the changes in cancer pattern. It can be noted that this analysis solely depends upon the number of cases rather than rates at two selected points of time. The knowledge of estimated population figures for inter-census years is also not needed in the present type of analysis.

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