RESEARCH COMMUNICATION

Cancer Incidences in Urban Delhi - 2001-05

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Abstract

The Delhi Population based cancer registry collects data on new cancer cases diagnosed among Delhi urban resident population. The sources for cancer registration are more than 162 government hospitals/centers and 250 private hospitals and nursing homes. During the period 1st January 2001 to 31st December 2005 a total of 54,554 cases were registered of which 28,262 were males and 26,292 were females. The age adjusted (world population) incidence rates were 116.9 per 100,000 for males and 116.7 per 100,000 for females. The leading sites of cancer among Delhi males was lung (ASR: 13.8 per 100,000) followed by oral cavity (ASR:11.4), prostate (ASR:9.0) and larynx (ASR:7.9). In females, breast (ASR: 30.2 per 100,000) was the most common site of cancer, followed by cervix uteri (ASR:17.5), ovary (ASR:8.5) and gallbladder (ASR:7.4). The incidence of prostate cancer in males and ovary cancer in females in Delhi were the highest among the Indian registries, while larynx among males was the second highest and the gallbladder cancer in females was the highest among Indian metropolitan cities.

Key Words: Cancer registration - incidence pattern - India - New Dehi

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Introduction

The population based Cancer Registry at Delhi was established in Dr BR Ambedkar Institute Rotary Cancer Hospital, All India Institute of Medical Sciences, New Delhi in January 1986 with the aim of obtaining reliable morbidity and mortality data on cancer among the Delhi urban residents so as to assess and control the impact of malignant disease in the community as well as describing data on cancer incidence and survival.

In this paper, we present the results from the Delhi population based cancer registry for the period of 5 years from 2001- 2005.

Materials and Methods

The Union Territory of Delhi, the capital of India, covering an area of 1,483 sq.km is densely populated urban metropolis situated between the Himalayan and the Aravalli range in the heart of Indian sub-continent. It lies between 28˚25' and 28˚53' north altitude and 76˚50' and 73˚20'east longitude.

According to 2001 census the population of Delhi was 13,782,976 with 3.81% annual growth rate and 46.3% decennial growth rate during 1991-2001. The sex ratio in Delhi is 821 females per 1,000 males. The literacy rate is 82% (males-87%, females – 75%). The density of the population is 9,294 persons per sq.kms (Census of India, 2001).

Delhi has multi religion and multi lingual populations representating every state in the union, approximates 82% being Hindus, 11% Muslims, 4% Sikhs and 3% others. The Delhi state for the purpose of census was divided into (i) Municipal Corporation of Delhi (ii) New Delhi Municipal Committee, (iii) Delhi Cantonment and (iv) 29 census towns and Rural areas. The rural and urban area compositions of Delhi are 591.91 sq.km and 891.09 sq.km respectively. The Delhi PBCR covers the urban area of 891.09 sq.kms of Municipal Corporation of Delhi, Delhi Municipal Committee, Delhi Cantonment and 29 census towns.

In India, cancer is not a notifiable disease. So the registration of incident cancer cases is carried out by active case finding. The source of registration/case finding for cancer data are from 162 major Govt. Hospital /Centres/ Institution and more than 250 private hospitals and nursing homes and from the vital statistics departments of the municipal corporations.

The Medical Social Workers who were well trained in cancer registration technique viz, interviewing methods, data abstraction from case records, coding etc., in locally organized courses and followed by continuing in-service training, visit various hospitals and nursing homes and interview the patients who are either undergoing cancer treatment or being investigated for cancer at radiotherapy department. They also examine the case records maintained by various departments of the hospitals viz, pathology, hematology and radiology etc. They record details of all patients with malignant tumors into a special form. The information recorded on each case include name, age, sex, address, religion, mother tongue,

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Table 1. Population at Risk by Five Year Age Group and Sex, Delhi Urban, 2001-05

Age group (in years)	Males	Females
00-04	3,650,257	3,133,813
05-09	4,192,731	3,629,873
10-14	4,323,348	3,759,358
15-19	4,257,707	3,183,784
20-24	4,229,741	3,124,082
25-29	3,833,345	3,129,096
30-34	3,244,180	2,710,133
35-39	3,013,735	2,523,105
40-44	2,446,739	1,845,443
45-49	1,856,738	1,445,636
50-54	1,349,637	1,005,297
55-59	872,777	746,002
60-64	671,085	668,431
65-69	510,173	525,499
70-74	367,428	341,899
75+	373,164	350,936
Total	39,192,785	32,122,387

occupation, date of incidence, basis of diagnosis, primary site, histology, clinical extent of disease, treatment details and vital statistics. Date of incidence of a case is defined as date of hospital admission or date of first diagnosis (for out patient) whichever is earlier.

All the information collected is crosschecked for completeness of the data. Sometimes patient may register his/her name in more than one hospital for treatment. So care has been taken to exclude duplicates and ensure that each patient is included only once in the records. The main criterion for registration is that the case should have been residing in Delhi for at least one year at the time of first diagnosis of cancer. This also includes clinically diagnosed cases.

Medical Social Workers also personally visit the vital statistics departments and collect information about deaths where the death certificate states the cause of death as cancer or tumor. These death records are then matched with morbidity records. Cases not matching with the records are registered as Death Certificates Only cases (DCO'S) in that corresponding year.

The primary site and morphology data were coded using the International Classification of Disease for Oncology (ICD–O, 3rd edition) (Fritz and Percy, 2000). Information on other variables was coded according to the international guidance (Jensen et al., 2003). These codes were converted to ICD.10 (1994) for tabulation. After entering the data into the computer quality control checks for completeness and validity of the data were carried out using the methods proposed by Parkin et al. (1994).

Population at risk during the 5 year period by sex and 5 year age group were estimated based on the Census reports of 1991 and 2001 with exponential population growth-rate (Census of India, 1991; 2001). The total population during 2001-05 was 71,315,172. Table 1 gives the population at risk by sex and 5 year age groups. The results are presented as number of cases by site, sex and age along with quinqennial crude (CR) and age-

Table 2. Incidence Cases, Rates by Site and Age Group, Delhi Urban, 2001-05, Males

		Number of cases by age group (in years)							Not	Total		Crude	ASR
ICD.10	Site	0-14	15-24	25-34	35-44	45-54	55-64	65+	Known		%	Rate*	
C00-06	Oral cavity	8	19	146	423	758	737	627	30	2,748	9.72	7.0	11.4
C9-10,12-14	Pharynx	5	5	34	131	372	384	359	20	1,310	4.64	3.3	5.7
C15	Oesophagus	0	7	23	101	282	337	325	10	1,085	3.84	2.8	4.9
C16	Stomach	2	9	35	115	208	211	225	10	815	2.88	2.1	3.5
C18	Colon	1	9	38	115	149	144	177	4	637	2.25	1.6	2.6
C19-21	Rectum	0	29	71	92	151	139	225	4	711	2.52	1.8	2.9
C22	Liver	20	15	38	53	113	180	181	5	605	2.14	1.5	2.6
C23-24	Gallbladder	0	7	38	104	197	231	248	12	837	2.96	2.1	3.6
C25	Pancreas	0	4	17	46	87	127	166	9	456	1.61	1.2	2.0
C32	Larynx	5	5	27	186	462	502	542	14	1,743	6.17	4.4	7.9
C33-34	Lung etc.	0	11	49	237	654	961	1,008	33	2,953	10.45	7.5	13.8
C40-41	Bone	111	183	78	64	84	78	70	10	678	2.40	1.7	2.0
C43-44	Skin	4	17	31	72	108	95	115	3	445	1.57	1.1	1.8
C47+C49	Conn. & Soft Tissue	70	64	73	71	75	71	60	6	490	1.73	1.3	1.6
C61	Prostate	1	9	5	17	80	385	1,189	11	1,697	6.00	4.3	9.0
C62,60,63	Other Male Genital Org	12	56	87	96	76	68	77	1	473	1.67	1.2	1.6
C67	Bladder	9	5	31	97	234	380	579	14	1,349	4.77	3.4	6.4
C64-66,68	Kidney	74	9	20	61	117	160	176	10	627	2.22	1.6	2.7
C70-72	Brain, Nervous Sys	203	104	192	193	200	190	134	11	1,227	4.34	3.1	4.0
C73	Thyroid	4	26	45	48	52	41	41	2	259	0.92	0.7	0.9
C81	Hodgkins Disease	155	113	69	59	63	48	45	5	557	1.97	1.4	1.6
C82-85, C96	Non-Hodgkin's	146	120	138	173	262	250	324	15	1,428	5.05	3.6	5.3
C90	Multiple Myeloma	0	0	5	36	151	150	161	5	508	1.80	1.3	2.3
C91	Lymphoid Leukaemia	417	120	36	31	61	61	83	6	815	2.88	2.1	2.5
C92-94	Myeloid Leukaemia	102	124	164	146	122	88	96	6	848	3.00	2.2	2.6
C95	Leukaemia Uns	64	49	45	32	28	27	25	1	271	0.96	0.7	0.8
Other and Unspecified		193	124	164	341	559	616	666	27	2,690	9.52	6.9	10..8
All Sites		1,606	1,243	1,699	3,140	5,705	6,661	7,924	284	28,262	100	72.1	116.9

* Incidence rate per 100,000

Table 3. Incidence Cases, Rates by Site and Age Group, Delhi Urban, 2001-05, Females

ICD.10	Site	Number of cases by age group (in years) 0-14	15-24	25-34	35-44	45-54	55-64	65+	Not Known	Total	%	Crude Rate*	ASR
C00-06	Oral Cavity	4	15	36	109	211	200	197	8	780	2.97	2.4	3.7
C09-10,12-14	Pharynx	4	3	10	32	56	66	61	1	233	0.89	0.7	1.1
C15	Oesophagus	0	3	17	93	155	170	189	4	631	2.40	2.0	3.1
C16	Stomach	1	6	30	55	91	90	75	2	350	1.33	1.1	1.6
C18	Colon	0	8	42	56	81	125	119	2	433	1.65	1.3	2.0
C19-21	Rectum	0	10	59	72	97	90	81	7	416	1.58	1.3	1.8
C22	Liver	8	3	12	43	69	71	77	2	285	1.08	0.9	1.4
C23-24	Gallbladder	0	9	62	267	432	403	376	16	1,565	5.95	4.9	7.4
C25	Pancreas	0	4	12	35	58	76	93	1	279	1.06	0.9	1.4
C32	Larynx	0	6	11	20	58	52	55	3	205	0.78	0.6	1.0
C33-34	Lung etc.	0	7	29	78	144	203	212	6	679	2.58	2.1	3.4
C40-41	Bone	64	70	40	32	41	42	38	3	330	1.26	1.0	1.2
C43-44	Skin	4	8	15	37	57	66	85	6	278	1.06	0.9	1.3
C47+C49	Conn. & Soft Tissue	36	27	51	63	68	65	48	5	363	1.38	1.1	1.4
C50	Breast	0	49	470	1,507	2,039	1,539	1,137	54	6,795	25.84	21.2	30.2
C53	Cervix Uteri	0	18	258	878	1,162	951	618	31	3,916	14.89	12.2	17.5
C51-52,54-55, 57-58	Other Female Genital org	3	17	70	139	313	376	314	20	1,252	4.76	3.9	6.0
C56	Ovary etc.	33	95	169	372	527	416	325	25	1,962	7.46	6.1	8.5
C67	Bladder	5	7	8	28	55	76	89	4	272	1.03	0.8	1.3
C64-66,68	Kidney	57	15	19	51	49	48	64	3	306	1.16	1.0	1.3
C70-72	Brain, Nervous Sys	114	59	97	101	136	86	49	2	644	2.45	2.0	2.4
C73	Thyroid	8	71	124	149	114	91	91	5	653	2.48	2.0	2.5
C81	Hodgkins Disease	20	41	30	31	28	27	24	0	201	0.76	0.6	0.7
C82-85 C96	Non-Hodgkin's	41	54	78	107	103	155	178	5	721	2.74	2.2	3.1
C90	Multiple Myeloma	0	1	7	25	64	84	116	2	299	1.14	0.9	1.5
C91	Lymphoid Leuk.	145	40	27	28	28	29	41	3	341	1.30	1.1	1.2
C92-94	Myeloid Leukemia	50	63	90	107	86	79	61	2	538	2.05	1.7	2.0
C95	Leukemia Uns	40	17	23	22	17	11	11	3	144	0.55	0.4	0.5
	Other and Unspecified	105	67	127	207	300	304	296	15	1,421	5.40	4.4	6.2
All Sites		742	793	2,023	4,744	6,639	5,991	5,120	240	26,292	100	81.8	116.7

* Incidence rate per 100,000

standardized incidence rates (ASR) per 100,000 population by direct method using the world standard population (Jensen et al., 2003).

Results

A total of 54,554 cases were registered during the 5-year period of 1st January 2001 to 31 December 2005, of which 28,262 were males and 26,292 were females (male to female ratio 1:1.07). The number of cases by site (ICD.10) age group, percentage, crude rates and ASR's for males and females were given in Tables 2 and 3 respectively. The rates for all sites combined were 72.1 per 100,000 (crude) and 116.9 per 100,000 (ASR) for males. In males, lung was the most commonly reported malignancy (10.5% of all cases, ASR 13.8) followed by oral cavity (9.7% of all cases, ASR 11.4), larynx (6.2% of all cases, ASR 7.9), prostate (6.0% of all cases, ASR 9.0) and NHL (5.1% of all cases, ASR 5.3).

The crude and age adjusted (world population) incidence rates for females were 81.8 per 100,000 and 116.7 per 100,000 respectively. Breast cancer (25.8%, ASR 30.2) was the most frequently reported malignancy among females followed by cervix uteri (14.9%, ASR 17.5), ovary (7.5%, ASR 8.5), gall bladder (6.0% ASR 7.4) and other female genital organs (4.8%, ASR 6.0).

Figure 1 shows the age specific incidence rate curves for all sites for males and females. In males there is a progressive increase upto the age of 70 except a small decline in the oldest age group (75+). In females the rates increases steadily upto the age of 60 years and fall only in the ages 65 years and above. Figure 2 shows the age-specific curves for lung, larynx, oral cavity, prostate and urinary bladder in males and Figure 3 the equivalent curves for breast, cervix uteri, ovary and gallbladder in females.

Tables 4 and 5 compare the age-standardized incidence rates for common sites in Delhi with the registries reported from India among males and females respectively (National Cancer Registry Programme, 2008a; 2008b ; Swaminathan et al., 2005). Of the total cases of 54, 554, 82.5% were diagnosed on the basis of microscopic

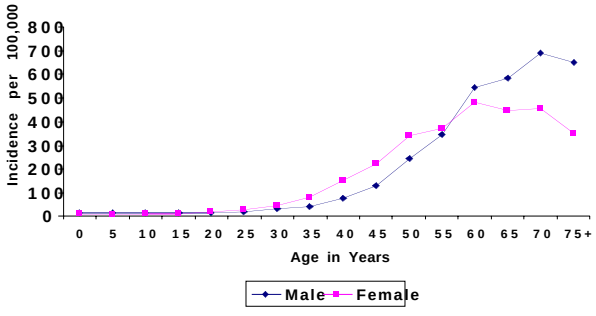

Figure 1. Age-specific Incidence Rate Curves

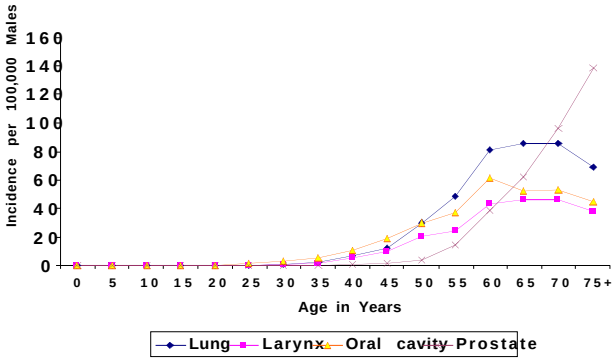

Figure 2. Age-specific Curves for Lung, Larynx, Oral Cavity, Prostate and Urinary Bladder Cancers in Males

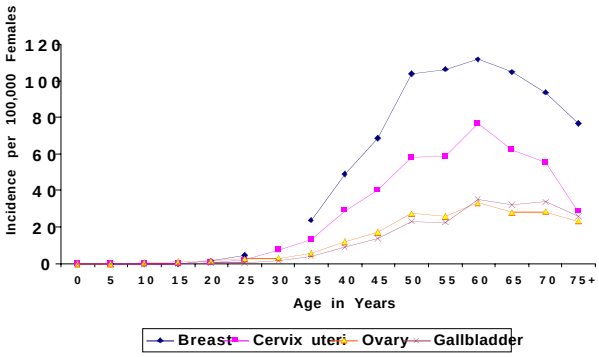

Figure 3. Age-specific Curves for Breast, Cervix Uteri, Ovary and Gallbladder Cancers in Females

verification-either by histology or cytology; 16.3% were diagnosed on the basis of non microscopic (clinical, biochemical, endoscopy or radiological examination) findings. The percentage of cases identified through DCO's was 1.2%.

Discussion

The Delhi PBCR has been collecting data on cancer patients since 1986. The data collection procedure etc has been standardized. So the incidence data is complete and valid. Over the years the number of incidence cases has been increasing.

In Delhi, the age- specific cancer incidence rates steadily increases with age upto 70 years and fall after 70 years for both males and females. The same type of trend was seen in most of the existing registries in India.

Among males lung is the leading site of cancer in Delhi. Many other Indian registries also reported lung as their common site with many parts in North Eastern states reporting a very high incidence compared to all other Indian registries. The incidence of lung cancer relates to the prevalence and duration of tobacco smoking in a population (IARC, 1996). Common smoking habit in Delhi involves cigarette and bidi smoking. The latest National Family Health Survey-3 (2007) reported that the prevalence of smoking among urban male population is 28.7% and a study reported that the prevalence of smoking among Delhi males was 23.9% (Rani et al., 2003). Case-control studies conducted in Kerala (Shankaranarayanan et al., 1994), Bhopal (Dikshit et al., 2000) and Chandigarh (Gutpa et al.,2001) reported a high risk of lung cancer among bidi and cigarette smokers. A case control study from Chandigarh also suggested that environmental smoke exposure may be a strong risk factor for lung cancer in India (Rapiti et al., 1999).

The incidence of oral cancer (ICD.10: C00-C06) is the second most common cancer among males in Delhi. According to the Cancer Incidence in Five Continents – Vol. IX (Curado et al., 2007), the incidence of oral cancer is generally higher among Indians compared to other Asian population and the incidence of tongue cancer (ICD.10: C01-02) in Delhi is the highest among the population based registries reported from Asia. But recent reports from Indian registries indicates that Bhopal, Kamrup Urban district in North eastern part of India, Ahamedabad Urban and some districts in Gujarat (National Cancer Registry Program, 2004) also have a very high incidence of oral cancer. Tobacco chewing, bidi smoking and alcohol drinking have been identified as major risk factors for oral cancer in India (Shakaranarayanan et al., 1989; 1990;

Table 4. Age Standardized Incidence Rates (per 100,000) for Common Sites in Delhi and other Indian Registries - Males

Site	Delhi[1]	Mumbai[2]	Chennai[2]	Bangalore[2]	Bhopal[2]	Barshi[2]	Kolkata[3]	Dindigul[4]*	Dibrugarh[5]*	Kamrup[5]**	Imphal West[5]*	Mizoram[5$]	Aizwal[5]*	Sikkim[5$]	Silchar Town[5]
Lung	13.8	8.7	12.4	8.5	10.1	1.4	11.9	3.6	6.3	15.0	22.8	26.7	42.5	7.3	19.2
Oral cavity	11.4	11.9	12.3	5.9	18.3	5.5	7.2	8.0	12.3	21.6	6.9	6.7	12.3	6.3	7.1
Prostate	9.0	6.8	5.0	6.8	4.7	1.6	3.0	0.7	1.6	6.7	1.5	2.9	4.8	0.8	2.0
Larynx	7.9	5.5	4.9	3.8	4.7	2.8	5.4	3.0	4.7	9.9	4.3	2.8	4.7	5.2	5.9

*District;** Urban district; $State; [1]2001-5; [2]2004-5; [3]2005; [4]2003; [5]2005-6

Table 5. Age Standardized Incidence Rates (per 100,000) for Common Sites in Delhi and other Indian Registries - Females

Site	Delhi[1]	Mumbai[2]	Chennai[2]	Bangalore[2]	Bhopal[2]	Barshi[2]	Kolkata[3]	Dindigul[4]*	Dibrugarh[5]*	Kamrup[5]**	Imphal West[5]*	Mizoram[5$]	Aizwal[5]*	Sikkim[5$]	Silchar Town[5]
Breast	30.2	29.3	33.0	30.9	24.6	9.4	20.6	12.0	10.4	17.5	14.6	14.1	19.6	6.8	7.3
Cervix	17.5	13.4	22.3	18.8	17.7	22.8	12.3	26.6	5.1	17.3	20.5	17.4	25.4	10.9	12.1
Ovary	8.5	6.5	5.4	6.2	6.5	3.8	4.6	2.3	5.6	7.7	7.6	2.3	3.1	3.5	0.9
Gallbladder	7.4	2.6	0.9	1.4	4.3	0.4	3.4	0.4	6.9	14.3	10.0	2.4	4.3	4.7	4.7

*District;** Urban district; $State; [1]2001-5; [2]2004-5; [3]2005; [4]2003; [5]2005-6

Nandakumar et al., 1990; Balaram et al., 2002; Subapriya et al., 2007; Muwange et al., 2008). The prevalent tobacco chewing habit involve use of betel quid (betel leaf with tobacco, areca nut, lime), gutkha (dried mixture of betel quid and tobacco sold in attractive pouches) mawa , zarida (flavored tobacco) and khaini (crude form of dried ground tobacco with lime). Tobacco is also used in the form of tooth paste or inhaled as snuff powder. Strict tobacco control measure and early detection will be necessary to prevent oral cancers.

An important observation is the high incidence of prostate cancer in Delhi compared to other registries reported from India. But the rates are low compared to those in many developed countries (Curado et al., 2007; Parkin et al., 2005). The large disparities between the high and low risk countries may be due to a combination of genetic and environmental factors (Hsing et al., 2000). Epidemiologic studies conducted elsewhere in the world have suggested several factors that may play a role in prostate cancer. In most instance the evidence is fragmentary or in consistent. (e.g. certain occupational exposures, sexually transmitted infectious agents, sexual activity level, history of benign prostate hyperplasia, androgenic hormones, weight or obesity, cigarette smoking, alcohol consumption, Vitamin D, Vitamin E and selenium in take). The evidence for dietary fat and red meat intake is somewhat straight and more consistent but as yet in conclusive. Age, race and a family history of prostate cancer are the only well established risk factors for prostate cancer (Standard et al., 1998). Two case – control studies from Bombay have shown a positive association between prostate cancer and vasectomy (Platz et al., 1997; Sunny 2005).

Cancer of the larynx is the forth common site of cancer among males in Delhi. The incidence in Delhi is the fourth highest among Asian registries (Curado et al., 2007). The incidence is second highest among the Indian registries with Kamrup Urban District in Assam reporting the highest incidence (9.9 per 100,000). A case- control study conducted in Delhi reported apart from consumption of alcohol and smoking, consumption of betel leaf with tobacco as well as preference for spices and fried foods emerged as risk factors for laryngeal cancer (Kapil et al., 2005) . Case-control studies from Mumbai (Rao et al., 1999) and Thiruvananthapuram (Shankaranarayanan et al., 1998) also found that smoking was significant risk factors for the cancer of larynx. A multi centric case-control study from India reported that indoor air pollution from solid fuels has increased the risk of laryngeal cancer (Sapkota et al., 2008).

Breast cancer, the most frequent cancer of women in the world is the leading site of cancer in Delhi. It constituted about 26% of total cases in female and it is the third highest among the registries reported from India. The number of cases is increasing annually due to both the aging of the population and an increase in age specific incidence.

The incidence is generally much higher in urban than in rural population. This may be due to difference in life style factors between rural and urban population. Though the etiology of breast cancer in India has not been widely studied, case-control studies from Mumbai (Rao et al., 1994) and Chennai (Gajalakshmi et al., 1991) have identified null parity, early menarche, late age at marriage and late age at pregnancy as risk factors.

Cancer of the cervix which is the second most common among women world- wide is the second leading site in Delhi. It is also the most common cancer among the Indian women. Among the Indian registries, the incidence is much higher in Dindigul District, Aizwal District, Chennai and Barshi. The incidence is higher in rural areas compared to urban and several districts from Tamil Nadu in Sothern India had also reported a high incidence of cervical cancer (National Cancer Registry Program, 2004). Cervical cancer is generally thought to be related to infection with human papillomavirus (HPV) especially HPV16 and HPV18 (IARC, 1995) and high prevalence of HPV 16 and HPV 18 in cervical cancer patients has been reported in India (Sarnath et al., 2002; Frenceschi et al., 2003; Bhatla et al., 2006) . Case-control studies conducted in various regions of India has also reported early age at marriage, early age at first sexual intercourse, early age at first birth, sexual promiscuity, sex with uncircumcised men, high parity, low socio economic status and poor genital hygiene as major risk factors (Gawande et al., 1998; Biswas et al., 1997; Agarwal et al., 1993; Dutta et al., 1990; Ciplas and Sobti, 1999; Murthy and Mathew, 2000; Menon et al., 1988) for cancer of cervix.

Ovarian cancer which is the sixth most common cancer and the seventh cause death from cancer in the world (Parkin et al., 2005) is the third common site of cancer in Delhi. The rates in Delhi are the highest among the registries reported from India. Case-control studies on the risk factors for ovarian cancer in India have been very rare and exact cause of ovarian cancer remain unknown. Several factors are known to play an important role. Studies conducted in west identified family history of ovarian cancer, fertility drugs used for ovary hyper simulation, certain diet that are high in animal fats, use of talcum powder in genital areas, post menopausal ovarian cyst, obesity and hormone replacement therapy as some of the risk factors for ovarian cancer and the risk of ovarian cancer is reduced by high parity and the use of oral contraceptive (Booth et al., 1989; Purdie et al., 1995; Riman et al., 2002; Danforth et al., 2007; IARC, 1999). A study conducted in Bangalore observed that tubectomy reduces the risk of ovarian cancer (Nandakumar et al., 1995) .

Gallbladder cancer, the fourth common cancer in Delhi is the highest among the Asian registries and third highest among the registries reported from world (Curdado et al., 2007). Comparison of the data from the various urban population based cancer registries in India indicates that it is more common in Northern India. Kamrup Urban district in Assam and Imphal West district in Manipur of North Eastern part of India has also reported a very high incidence of gallbladder cancer than in Delhi. Epidemiological studies conducted in India and elsewhere in the world has identified cholelithiasis (especially untreated chronic symptomatic gallstones), obesity, reproductive factors, chronic infections of the gallbladder,

parity, certain dietary habits and environmental exposure to certain chemicals as the main risk factors for gallbladder cancer (Lazcano-Ponce et al., 2001; Dhir and Mohandas, 1999; Strom et al., 1995; Pandey and Shukla, 2002; 2003; Dutta et al., 2005). A case-control study conducted by the Delhi population based cancer registry identified smoking, alcohol consumption, typhoid in the past, cholelithiasis and certain dietary items as risk factors for gallbladder cancer (Tyagi et al., 2008).

In conclusion, in males the incidence of tobacco related cancers and in females breast and gynecological related cancers are high in Delhi. So, primary prevention of lung and other tobacco related cancers by implementation of strict tobacco control programs and early detection and treatment of cervical and breast cancer are urgently needed.

References

Agarwal SS, Sehgal A, Sardana S, Kumar A, Luthra UK (1993). Role of male behavior in cervical carcinogenesis among women with one lifetime sexual partner, *Cancer*, **72**, 1666-9.

Balaram P, Sridhar H, Thangarajan, R et al (2002). Oral cancer in Southern India: the influence of smoking, drinking, paan – chewing and oral hygiene. *Int J Cancer*, **98**, 440-5.

Bhatla N, Dar L, Patro AR, et al (2006). Human papillomavirus type distribution in cervical cancer in Delhi, India. *Int J Gynecol Pathol*, **25**, 398-402.

Biswas LN, Manna B, Maiti PK, Sengupta S (1997). Sexual risk factors for cervical cancers rural Indian women: A case-control study. *Int J Epidemiol*, **26**,491-5.

Booth M, Beral V and Smith P (1989). Risk factors for ovarian cancer: a case-control study. *Br J Cancer*, **60**, 592-8.

Caphlas N, Sobti RC (1999). Epidemiology of cervical cancer: a case-control sudy on North Indian population. *Indian J Cancer*, **36**, 179-85.

Census of India (1991). Part IV- A – C Series – Socio Cultural Tables; Series 31 – Delhi.

Census of India (2001) – Registrar General of India, Socio cultural tables, C14, Population by Five Year Age group by Residence and Sex, New Delhi (www. Censusindia.net)

Curado MP, Edward B, Shin HR, et al (2007). Eds. Cancer Incidence in Five Continents Vol.1X, IARC Scientific Publications No.160, Lyon.

Danforth KN, Tworoger SS, Hecht JL, et al (2007). Prospective study of postmenopausal hormone use and ovarian cancer risk. *Br J Cancer*, **96**, 151-6.

Dhir V, Mohandas KM (1999). Epidemiology of digestive tract cancers in India IV. Gallbladder and pancreas. *Indian J Gastroenterol*, **18**, 24-8.

Dikshit RP, Kanhere S (2000) Tobacco habits and risk of lung, oropharangeal and oral cavity cancer: A population based case – control study in Bhopal, India. *Int J Epidemiol*, **29**, 609-14.

Dutta PK, Upadhyay A, Dutt M, et al (1990). A case-control study of cancer cervix patients attending command hospital, Pune. *Indian J Cancer*, **27**, 101-8.

Dutta U, Nagi B, Garg PK, et al (2005). Patients with gallstone develop gallbladder cancer at an earlier age. *Eur J Cancer Prev*, **14**, 381-384

Frenceschi S, Rajkumar G, Vaccarella S, et al (2003). Human papillomavirus and risk factors for cervical cancer in Chennai, India: A case-control study. *Int J Cancer*, **107**, 127-133.

Fritz & Percy C, Jack A, et al (2000). International Classifications of Diseases for Oncology, 3rd ed. Geneva; WHO.

Gajalakshmi CK, Shanta V, (1991). Risk factors for female breast cancer. A hospital based case- control study in Madras, India. *Acta Oncol*, **30**, 569-74.

Ganande V, Wahab SN, Zodpey SP, Vasudev ND (1998). Parity as a risk factor for cancer cervix. *Indian J Med Sci*, **52**, 147-50.

Gupta D, Boffeta P, Gaborieau V, Jindal SK (2001). Risk factor of lung cancer in Chandigarh, India. *Indian J Med Res*, **113**, 142-50.

Hsing AW, Tsan L, Deversa SS (2000). International trends and patterns of prostate cancer incidence and mortality. *Int J Cancer*, **85**, 60-7.

IARC (1995) IARC Monographs on the evaluation of the carcinogenic risk of chemicals to Humans Vol.64, Human papillomavirusus. Lyon.

IARC (1996) IARC Monographs on the evaluation of carcinogenetic risk to humans, Vol.38, Tobacco Smoking, Lyon.

IARC (1999) IARC Monographs on the Evaluation of Carcinogenic Risks in Humans. Vol.72, Hormonal Contraception and Postmenopausal Hormonal Therapy. Lyon,

International Statistical Classification of Diseases and Related Health Problems – 10th revision (1994), World Health Organization, Geneva.

Jensen OM, Parkins DM, MacLennan R, Muir CS, Skeet R eds. (2003). Cancer registration principles and methods, IARC Technical report No.95, Lyon: IARC Press.

Kapil U, Singh P, Bahadur S, et al (2005). Assessment of risk factors in laryngeal cancer in India: A case-control study. *Asian Pac J Cancer Prev*, **6**, 202-7.

Lazcano-Ponce EC, Miquel JF, Mufioz N, et al (2001). Epidemiology and molecular pathology of gallbladder cancer. *CA Cancer J Clin*, **51**, 349-64.

Menon R, Murthy NS, Sehgal A, Prabhakar AK, Luthra UK (1988). Role of sexual behaviors in cervical cancer: A case -control study. *Indian J Prev Soc Med*, **19**, 1.

Murthy NS and Mathew A (2000). Risk factors for pre-cancerous lesions of uterine cervix. A review. *Eur J Cancer Prev*, **9**, 5-13.

Muwange, Ramadas K, Sankila R, et al (2008). Role of tobacco smoking, chewing and alcohol drinking in the risk of oral cancer in Trivandrum, India: A nested case- control design using incident cancer cases. *Oral Oncology*, 44, 446-54.

Nandakumar A, Thimmasetty KT, Sreeramreddy NM, et al (1990). A population based case – control investigations on cancer of the oral cavity in Bangalore, India. *Br J Cancer*, **62**, 847-51

Nandakumar A, Anantha N, Dhar M, et al (1995). A case-control investigation on cancer of the ovary in Bangalore, India. *Int J Cancer*, **63**, 361-5.

National Cancer Registry Programme (ICMR) (2004). Development of an Atlas of cancer in India, 2001–2002 Volume I & II, Bangalore, India.

National Cancer Registry Programme, (ICMR) (2008a). Two-year report of Population Based cancer Registries 2004 – 2005. Bangalore, India.

National Cancer Registry Programme, (ICMR) (2008b), North East Population Based Registries, Second Report 2005-2006. Bangalore, India.

National Family Health Survey – 3 (2005-06) (2007). International Institute for Population Sciences, Mumbai.

Pandey M, Shukla VK (2002). Diet and gallbladder cancer: A case-control study. *Eur J Cancer Prev*, **11**, 365-8.

Pandey M, Shukla VK (2003). Lifestyle, parity, menstrual and

reproductive factors and risk of gallbladder cancer. *Eur J Cancer Prev*, **12**, 269-72.
Parkin DM, Bray F, Ferlay J, Pisani P (2005) Global cancer statistics, 2002. *CA Cancer J Clin*, **55**, 74-108.
Parkin DM, Chen VW, Ferley J, et al (1994). Comparability and quality control in cancer registration, IARC Technical report No.19, Lyon: IARC Press.
Platz EA, Yeole BB, Cho E, et al (1997). Vasectomy and prostate cancer: A case-control study in India. *Int J Epidemiology*, **26**, 933-8.
Purdie D, Green A, Bain C, et al (1995). Reproductive and other factors and risk of epithelial ovarian cancer: an Australian case-control study. Survey of Women's Health Study Group. *Int J Cancer*, **62**, 678-84.
Rani M, Bonu S, Jha P, Nguyen SN, Jamjoum L (2003). Tobacco use in India: Prevalence and predictors of smoking and chewing in a national cross sectional household survey, *Tobacco Control*, **12**, e4.
Rao DN, Ganesh B, Desai PB (1994). Role of reproductive risk factors in breast cancer in a low risk area: A case-control study. *Br J Cancer*, **70**, 129-32.
Rao DN, Desai PB, Ganesh B (1999) Alcohol as an additional risk factor in laryngopharyngeal cancer in Mumbai: A case-control study. *Cancer Detect Prevent*, **23**, 37-44.
Rapiti E, Jindal SK, Gupta D, Boffetta P (1999). Passive smoking and lung cancer in Chandigarh, India. *Lung Cancer*, **23**, 183-9.
Riman T, Dickman PW, Nisson S, et al (2002). Risk factors for invasive epithelial ovarian cancer: results from Swedish sase-sontrol study. *Am J Epidemiol*, **156**, 363-73.
Sankaranarayanan R, Duffy SW, Day NE, Nair MK, Padmakumari G (1989). A case- control Investigations of cancer of the oral tongue and floor of mouth in Southern India. *Int J Cancer*, **44**, 617-21.
Sankaranarayanan R, Duffy SW, Day NE, Nair MK, Padmakumari G (1990). Risk factors for cancer of the buccal and labile mucosa in Kerala. *J Epidemiol Comm Health*, **44**, 286-92.
Sankaranarayanan R, Varghese C, Duffy SW, et al (1994). A case control study of diet and lung cancer in Kerala, South India. *Int J Cancer*, **58**, 644-9.
Sankaranarayanan R, Duffy SW, Nair MK, Padmakumari G, Day NE (1998). Tobacco and alcohol as risk factors in cancer of the larynx in Kerala, India. *Int J Cancer*, **45**, 879-92.
Sapkota A, Gajalakshmi V, Jetley JH, et al (2008). Indoor air pollution from solid fuels and risk of hypo pharyngeal/ laryngeal and lung cancers: a multicentirc case-control study from India. *Int J Epidemiol*, **37**, 321-28.
Sarnath D, Khan Z, Tandle AT, et al (2002). HPV 16/18 Prevalence on cervical lesions/cancers and P53 genotype in cervical patients from India. *Gynecol Oncol*, **86**,157-62.
Standard JL, Stephenson RA, Coyle LM, et al (1998). Prostate Cancer Trends 1973-1995, SEER Program, National Cancer Institute. NIH Pub No.??? Bethesda MD.
Strom BL, Soloway RD, Rios-Dalenz JL, et al (1995). Risk factors for gallbladder cancer - an international collaborative case-control study. *Cancer*, **76**, 1747-56.
Subapriya R, Thangavelu A, Mathavan B, Ramachandran C, Nagini S (2007). Assessment of risk factors for oral squamous cell carcinoma in Chidambaram, Southern India: a case-control study. *Eur J Cancer Prev*, **16**, 251-6.
Sunny L (2005). Is it reporting bias doubled the risk of prostate cancer in vasectomised men in Mumbai, India? *Asian Pacific J Cancer Prev*, **6**, 320-5.
Swaminathan R, Sanakranarayanan R, Shantha V, Cherian J (2005). Cancer Incidences and Mortality in Dindigul district in Tamil Nadu, Year 2003: A preliminary report. Cancer Institute (WIA), Chennai.
Tyagi BB, Manoharan N, Raina V (2008). Risk factors for gallbladder cancer: A population based case control study in Delhi. *Indian J Med Pediatric Oncol*, **29**, 16-26.