

## RESEARCH COMMUNICATION

# Childhood Cancer Burden in Part of Eastern India-Population Based Cancer Registry Data for Kolkata (1997-2004)

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### Abstract

The increasing magnitude of childhood cancer has become a threatening problem in developing countries like India. Data from the Population Based Cancer Registry (PBCR) of Chittaranjan National Cancer Institute (CNCI), Kolkata during 1997 to 2004 were here analyzed. CNCI receives patients from West Bengal as well as other neighboring states and countries. Childhood cancer was found to account for 2.21% of all cancers registered in this period. Crude and age adjusted rates were higher among boys than girls, with leukemia as the commonest (36.8%) followed by lymphomas (14.76%) and soft tissue tumors (8.0%). Chemotherapy was the major modality of treatment given, followed by radiotherapy and surgery. The study provides useful information on the prevalence and management protocols of childhood cancer in this part of eastern India.

**Keywords:** Childhood cancer - leukemia - lymphoma

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### Introduction

Childhood cancers cause of more than 10% of all deaths in children below 15 years of age in developed countries. Due to better management of communicable diseases in developing countries, they are also emerging as an important cause of childhood mortality in developing countries as well. More than 85% of paediatric cancers occur in developing countries who use less than 5% of world resources. The rate is expected to exceed 90% in next two decades, due to increase of youth population in favour of developing countries according to Yaris et al. (2004).

From an American Cancer Society report (2007), in the United States approximately 10,400 children under 15 years of age were diagnosed with cancer and about 1,545 children died from the disease in 2007. Ries Lag et al., (2007) showed that although this makes cancer the leading cause of death by disease among U.S. children 1 to 14 years of age, cancer is still relatively rare in this age group. On average, 1 to 2 children develop the disease each year for every 10,000 children in the United States. Incidence of childhood cancer in the United States is ~125/100,000 with slightly increased rate in males. Leukaemia account for an average 25% of all childhood cancers followed by tumor of CNS (17%), neuroblastoma (17%), NHL (6%), Wilm's tumor (6%), HD (5%), rhabdomyosarcoma (3%), retinoblastoma (3%), osteosarcoma (3%) & Ewing's sarcoma (2%) according to studies done by Gurney et al., (1996) and Moore et al. (1995).

Based on study of Li et al (1999) on report of Hong Kong Cancer Registry 1982-1991, age adjusted rate

of childhood cancer was 144.3/100,000 population. leukaemia was the most common form followed by brain tumors and lymphomas.

Arora et al., (2005) did extensive study on childhood cancer in India which revealed that it constitutes less than 5% of the total burden of cancer, with approximately 45,000 children diagnosed with different types of cancer every year. 1.6 to 4.8% of all cancer in India are seen in children below 15 years of age and overall incidence is 38-124 million children per year which is lower than that in the developed world. In the developed world, 80% of the childhood cancer cases are cured. India should also be able to ensure better treatment for childhood cancers if it is given the due priority. Arora, (2009) pointed out that considerable interregional variation in incidence and mortality of childhood cancer in India need to be ascertained and death notification is required, particularly in rural areas.

Boyle et al. (2007) pointed out that in some developing countries of the world, children constitute well over one third of the population and childhood cancer represents 3-10% of the total as opposed to nearly 1% in some other developing region. Therefore each region should have to collect detailed informational data, so as to determine the need for management of these cancers.

Extensive study made by Powell et al., (1994) and Varghese et al. (1996) showed that incidence rates of cancer differ between various ethnic groups within a single country and between various countries with similar ethnic compositions. Such differences may be the result of genetic predisposition, early or delayed exposure to infectious diseases, and other environmental factors

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Within UK, childhood cancer incidence displays some variation by ethnic groups with children of Asian ethnic origin reveals an excess of all cancers like lymphoma, Hodgkin disease, neuroblastoma and germ cell tumor.

Global studies of childhood cancer done by Howard, (2008) provide clues to cancer etiology, prevention, early diagnosis, identify biologic differences which in turn is useful for improving survival rates in low-income countries (LIC) by facilitating quality improvement initiatives, and improve outcomes in high-income countries (HIC) through studies of tumor biology and collaborative clinical trials. Review by Pui, (2003), approach to childhood cancer treatment have started in places like Central and South America, Northwest Africa and Southeast Asia as long as 10 years.

Environmental causes of childhood cancer have long been suspected by many scientists but have been difficult to pin down, partly because cancer in children is rare and because it is difficult to identify past exposure levels in children, particularly during potentially important periods such as pregnancy or even prior to conception. In addition, each of the distinctive types of childhood cancers develops differently - with a potentially wide variety of causes and a unique clinical course in terms of age, race, gender, and many other factors. Possible risk factors for specific childhood cancers are discussed in the SEER monograph mentioned above. It can be found at <http://seer.cancer.gov/publications/childhood/> on the Internet.

Silverberg, (1998) showed that childhood cancer is also unique that most pediatric cancers respond dramatically to aggressive treatment management.

The present study was undertaken to assess the burden of childhood cancer in the eastern region of India by analyzing data from the PBCR, Kolkata from 1997-2004. Once the burden of CHD in India is effectively defined for each region, it will be possible to focus attention to improve treatment facilities and improve on it by gathering information on the therapeutic outcome and achieve setting up of multidisciplinary Paediatric Units for better management of childhood cancers in India like report of Hematology/Oncology Pediatrics (1999).

## Materials and Methods

Population based cancer registration is going on since 1997 in Chittaranjan National Cancer Institute by an active method as cancer is still not a notifiable disease in India. Since its inception our registry is trying to do as much coverage as possible. Social investigators collect

data from different cancer hospitals, general hospitals, both government and private, diagnostic centers and even practicing oncologists. Data are coded according to ICD-O3 and entered in Can reg -3 software provided by IARC.

All cases of childhood cancer registered from 1st January, 1997 to 31st December, 2004 were included in this study. The case records were analyzed to show the descriptive profile of the patients. All cases were confirmed by different methods of diagnosis, the majority being histopathologically confirmed.

Total number of cases during this period was 962 and accounts for 2.21.% of all malignancies.

Comparative measures of incidence like CR and AAR were calculated. Distribution of cancer according to histopathological classification was done in three different age groups. Modality of treatment received by childhood cancer patients was described. A comparative view of childhood cancers in older registries in relation to Population Based Cancer Registry in Kolkata is also shown.

## Results

Table 1 shows that relative frequencies of pediatric cancers relative to all cancers was highest (2.63%) in the year 1997 and lowest in 2004 (1.70%). Relative frequency of childhood cancer was higher among boys than in girls. While it was 1.54% in 1997 among boys, among girls it was 1.09%. In 1998, Relative frequency among boys was 1.45% while it was 0.82% among girls. In year 2004, relative frequency among girls (0.62%) was much lower than it was among boys (1.09%).

Age adjusted male-female rate is shown in Table 2. Among males Crude Incidence rate varied from 102/100,000 population in 1997 to 101/100,000 population in 2004. Age Adjusted Incidence rate varied from 110/100,000 population in 1997 to 104/100,000 2004 among males. AAR was increasing from 110/100,000 population in 1997 to 138/100,000 population in 1999 and ultimately to 140/100,000 population in 2000. It declined to 125/100,000 population in 2001, 119/100,000 in 2002 and 101/100,000 population in 2003. It again raised to 104/100,000 in 2004.

Among females, crude incidence rate varied from 120/100,000 population in 1997 to 140/100,000 population in 2001. Age adjusted incidence rates varied from 117/100,000 population in 1997 to 137/100,000 in 2001. It declined to 118/100,000 population in 2002,

**Table 1. Distribution of Childhood Cancers According to Frequencies Relative to All Cancers From 1997 to 2004**

Year	Total no. of cases	No. of Childhood Cancer	Relative frequency (%)	Male	Relative frequency (%)	Female	Relative frequency (%)
1997	4935	130	2.63	76	1.54	54	1.09
1998	5860	133	2.22	85	1.45	48	0.82
1999	6065	128	2.11	84	1.38	44	0.73
2000	6118	148	2.41	89	1.45	59	0.96
2001	5873	137	2.33	77	1.31	60	1.02
2002	5379	123	2.32	73	1.38	50	0.95
2003	4528	80	1.76	50	1.10	30	0.66
2004	4868	83	1.70	53	1.09	30	0.62

Number (#) and relative proportion (%) of Childhood Cancer, Age Group 0 to 14 years

**Table 2. Distribution of Childhood Cancer (0-14 yr) according to Crude Incidence Rate and Age Adjusted Rate from 1997-2004**

Year	Male		Female	
	C.R	A.A.R	C.R	A.A.R
1997	102	110	120	117
1998	123	130	138	132
1999	132	138	136	135
2000	132	140	138	135
2001	119	125	140	137
2002	115	119	125	118
2003	99	101	106	98
2004	101	104	120	110

**Table 3. Number (#) and Relative Proportion (%) of Broad Types of Childhood Cancers (1997-2004)**

Broad Types of Cancer in Childhood	Total No. of Cases (#)	Relative Frequency (%)
1 Leukaemias	354	36.80
2 Lymphoma	142	14.76
3 Retinoblastoma	40	4.15
4 Soft tissue sarcoma	77	8.0
5 Renal Tumours	43	4.46
6 C.N.S Tumours	71	7.40
7 Bone Tumours	69	7.17
8 S,N.S Tumours	22	2.30
9 Hepatic Tumours	16	1.66
10 Germ-cell Tumours	36	3.74
11 Other Malignant Neoplasm	42	4.36
12 Other Carcinoma	50	5.20

**Table 4. Number (#) and Relative Proportion (%) of Broad Types of Childhood Cancer of the Age Group of 0-4 Year (1997-2004)**

Broad Types of Cancer in Childhood	Total No. of Cases (#)	Relative Frequency (%)
1 Leukaemia	161	43.40
2 Lymphoma	25	6.78
3 Retinoblastoma	34	9.20
4 Soft tissue sarcoma	28	7.54
5 Renal Tumour	27	7.27
6 C.N.S Tumour	17	4.58
7 Bone Tumour	14	3.77
8 S,N.S Tumour	12	3.23
9 Hepatic Tumour	9	2.42
10 Germ-cell Tumour	11	2.96
11 Oth. Malignant Neoplasm	9	2.42
12 Oth. Carcinoma	24	6.46

98/100,000 in 2003 then went up to 110/100,000 in 2004.

Table 3 shows the distribution and relative proportion of childhood cancers in paediatric age group (0-14 years). Leukaemia is the most common (relative frequency 36.8%). Lymphoma is the second at 14.8 % followed by soft tissue tumors (8.0%), bone tumors (7.2%) and other carcinomas (5.2%).

The distribution of different varieties of childhood cancer in 0-4 year age groups is presented in Table 4. Leukaemia is the commonest site (43.4%) followed by retinoblastoma (9.2%) and soft tissue sarcoma (7.54%), Wilm's Tumor (7.27%) and lymphoma (6.7%).

Table 5 shows the distribution of childhood cancer in 5-9 year age group. Here again predominance of

**Table 5. Number (#) and Relative Proportion (%) of Broad Types of Childhood Cancer of the Age Group 5-9 Year (1997-2004)**

Broad Types of Cancer in Childhood	Total No. of Cases (#)	Relative Frequency (%)
1 Leukaemia	117	38.00
2 Lymphoma	55	17.90
3 Retinoblastoma	5	1.62
4 Soft tissue sarcoma	22	7.14
5 Renal Tumour	10	3.24
6 C.N.S Tumour	36	11.67
7 Bone Tumour	20	6.48
8 S,N.S Tumour	2	0.64
9 Hepatic Tumour	3	0.97
10 Germ-cell Tumour	11	3.57
11 Oth. Malignant Neoplasm	11	3.57
12 Oth. Carcinoma	16	5.20

**Table 6. Number (#) and Relative Proportion (%) of Broad Types of Childhood Cancer of the Age Group 10-14 Year (1997-2004)**

Broad Types of Cancer in Childhood	Total No. of Cases (#)	Relative Frequency (%)
1 Leukaemia	76	26.86
2 Lymphoma	62	21.91
3 Retinoblastoma	1	0.35
4 Soft tissue sarcoma	27	9.54
5 Renal Tumour	6	2.12
6 C.N.S Tumour	18	6.38
7 Bone Tumour	35	12.37
8 S,N.S Tumour	8	2.83
9 Hepatic Tumour	4	1.41
10 Germ-cell Tumour	14	4.95
11 Oth. Malignant Neoplasm	22	7.77
12 Oth. Carcinoma	10	3.53

**Table 7. Distribution of Childhood Cancer in Different Age Groups According to Modality of Treatment from 1997 - 2004**

Treatment regime	0 - 4	5 - 9	10 - 14
	years (%)	years (%)	years (%)
1 S	6.43	8.17	9.55
2 R	26.90	18.86	19.10
3 C	44.44	42.76	44.00
4 S + C	7.01	1.89	8.91
5 S + R	2.92	5.08	3.18
6 R + C	9.35	17.00	14.01
7 S + R + C	2.92	4.40	1.27
8 Palliative	0.58	1.89	0.0

leukaemia is noted (38.0%) among all childhood cancers followed by lymphoma (17%), brain tumor (11.6%) and soft tissue sarcoma (7.1%).

Table 6 reveals the distribution pattern of childhood cancer in 10-14 year age group. In 10-14 year age group, Relative frequency of leukaemia is commonest (26.9%) followed by lymphoma (21.8%), bone tumor (12.4%), soft tissue sarcoma (9.5%), other malignant neoplasms (7.77%) and C.N.S tumors (6.38%).

Distribution of childhood cancer (0-14 age group) according to treatment received is reproduced in Table 7. It shows that in all three age group, chemotherapy is the commonly used modality of treatment ie. 44.4% in 0-4

**Table 8. Comparative view of Occurrence of Childhood Cancer in Some Major Cities and in Kolkata (2001-2003)**

Cities	Total Cases	Total Childhood Cancers	Relative Frequency (%)
Kolkata	15,680	340	2.16
Bangalore	15,359	352	2.29
Bhopal	3,004	88	2.92
Chennai	12,903	378	2.92
Mumbai	27,519	873	3.17
Delhi	31,156	1,471	4.72

year age group, 42.76% in 5-9 year age group and 44.0% in 10-14 year age group. Surgical treatment was received by patients in more higher age groups and it differed with growing age. It is 6.43% in 0-4 yr age group, increasing to 8.17% in 5-9 yr age group and further increasing to 9.55% in 10-14 yr age group.

Table 8 shows a comparative view of distribution of relative frequencies of childhood cancers recorded in other registries of Bangalore, Bhopal, Chennai, Mumbai, Delhi and Barshi and Kolkata. It varies from 4.72% in Delhi followed by 4.45% in Barshi and decreases to 2.29% in Bangalore. The lowest percentage is recorded in Kolkata.

## Discussion

Chittaranjan National Cancer Institute is the first regional cancer Institute in eastern region where population based cancer registry is going on since 1997. All reportable malignant neoplasm below 14 yrs age group registered and treated in this Institute from January 1997 to December, 2004 has been included. The data of the age group 0-14 years was analyzed to reveal descriptive and clinical profile of childhood cancer.

The study result provides data that throw light on magnitude of childhood cancer in this eastern region of India.

Chandy, (2006) did a study which showed that Cancer care in India depends entirely on a patient' socioeconomic status. 60% of population living in extreme poverty can not afford treatment, 35% people of middle income group can receive some care and only 5% people of upper income group can receive sufficient treatment

A consolidated report of Population Based Cancer Registry, ICMR (2001-2004) revealed relative frequencies of childhood cancer of total no. of incidence cases in 6 older PBCRs, it varies from 2.29% in Bangalore, 2.92% in Bhopal and Chennai, 3.17% in Mumbai, 4.45% in Barshi and 4.72% in Delhi being highest In Chittaranjan National Cancer Institute, it varies from year to year.

An over all view from the Consolidated Report of Hospital based Cancer Registries, ICMR (2004-2006), has shown that relative proportion of childhood cancer among males and females varies from 5.5% and %3.3% in Mumbai, 6.6% and % 3.4% in Bangalore, 3.4% & 2.2% in Chennai, 5.1% and 4.2% in Thi, puram of all Cancers.

According to Hospital Based Cancer Registry report of I.C.M.R (2004-2006) revealed that Leukemia was highest in Thi'puram (50.3%) followed by 46.8% in Bangalore, 43.3% in Chhennai and 42.3% in Mumbai. Lymphoma is second commonest Childhood cancer. The picture is same

as with PBCR report of Kolkata (1997-2004). Relative proportion of Lymphoma was highest in Chennai (19.1) then 17.6% in Mumbai and lowest in Thi''puram (10.8%). s C.N.S Tumors took the third position ,the highest cases in Thi''puram (13.7%), then 9.5% in Bangalore and lowest in Chennai (2.1%).

In India, according to Hospital Based cancer registry report, ICMR (2001-2003), in Mumbai, Surgery was commonest (23%) mode of treatment followed by Chemotherapy (21.9%) and combined treatment of Surgery and Radiotherapy (16.7%) and then combination of Radiotherapy and Chemotherapy(15.5%). In Bangalore Radiotherapy was the commonest modality of treatment (34.6%) followed by combined treatment of Radiotherapy and Chemotherapy (17.5%) and then Chemotherapy (16.5%). In Chennai, 32.6% patients received Radiotherapy followed by Chemotherapy (22.4%) and Surgery (15.3%). In Thi'puram, majority of patients received Radiotherapy (39.7%) followed by Chemotherapy (21.1%) and combined treatment of Radiotherapy and Chemotherapy (19.7). In Dibrugarh, 78% patients received Radiotherapy

Considering the data of PBCR, Kolkata all the age groups (10-14 year age group) Leukaemia is still the predominant site (26.8%) though much lower than the lower age groups ie 1-4 year and 5-9 year age group. Lymphoma is the second commonest site (21.9%), followed by Bone Tumor (12.3%), Sost tissue Sarcoma (9.5%) and Brain Tumor (6.3%). The relative frequency of Leukaemia is highest (43.4%) in 0-4 yr age group, gradually decreases to 38.0% in 5-9 yr age group and being lowest to 26.86% in 10-14 yr age group. Relative frequency of lymphoma is gradually increasing with increasing age group being 6.78% in 0-4 age group followed by 17.9% in 5-9 yr age group and being highest 21.9% in 10-14 ye age group. Relative frequency of retino-blastoma decreases with increasing age like being 9.2% in 0-4 yr age group, decrease to 1.6% in 5-9 yr age group and further decreases to 0.3% in 10-14yr age group. Renal tumor is highest in 0-4yr age group (7.27%) ,decreases to 3.24% in 5-9 yr age group and comes down to 2.12% in 10-14 yr age group. In our Institution relative frequency of brain tumor is 4.58% in 0-4 yr age group, then increases to 11.67% in 5-9yr age group and then decreases to 6.38% in 10-14 yr age group. Relative frequency of bone tumor is increases with age, being 3.77% in 0-4 yr age group increases to 6.48% in 5-9 yr age group and ultimately to 12.37% in 10-14 yr age group. Relative frequency of germ cell tumor is 2.96% in 0-4 yr age group, gradually increases to 3.57% in 5-9 yr age group and further rising to 4.9% in 10-14 yr age group. Relative frequency of soft tissue sarcoma is 7.54% in 0-4 yr age group, 7.14% in 5-9 yr age group and rising to 9.54% in 10-14 yr age group. Relative frequency of Sympathetic Nervous System Tumor is 3.23% in 0-4 year age group, only o.64% in 5-9 yr age group but 2.83% in 10-14 yr age group. Relative frequency of Hepatic tumor is 2.42%

Radiotherapy was the only modality of treatment received was highest in lower age group (0-4 year age) 26.90%, decreases to 18.86% in 5-9 yr age group and 19.10 in 10-14 yr age groups. Combined treatment of

Radiotherapy and Chemotherapy was also received in greater percentage with increasing age. It was 9.35% in 0-4 yr age group increasing to 17.0% in 5-9 yr age group but decreasing to 14.01% in 10-14 yr age group.

Combined modality of treatment i.e. Surgery, Radiotherapy and Chemotherapy was received by small no. of patients i.e. 2.92% in 0-4 yr age group, 4.40% in 5-9 yr age group and 1.27% in 10-14 yr age group. Combined treatment of Surgery and Chemotherapy was received by 7.01% in 0-4 age group, 1.89% in 5-9 year age group and 8.91% in 10-14 year age group. Combined treatment of Surgery & Radiation was received by 2.92% in 0-4 year age group, 5.08% in 5-9 yr age group and 3.18% in 10-14 year age group.

From the PBCR, Kolkata, it appears that the main modality of treatment for childhood cancer is chemotherapy, followed by radiotherapy and surgery. This possibly reflects the choice of the oncologists as well as the availability of resources and ability of the patients to bear the expenses by those who reported at the CNCI hospital.

A study done by Maria Grazia, (2008) shows that the differences in culture and availability of resources between Low Income countries and High Income countries have resulted an unequal right to health has been pointed out and discussed by many. In last few decades Developing countries are facing increased burden of cancer so there is need for availability of cancer data to formulate improved standard of care and preventive strategies Howard., et al (2008) did a study highlighting the fact that the reported incidence of childhood leukemia is lower in LIC than in more prosperous countries. Registration of childhood leukemia requires recognition of symptoms, rapid access to primary and tertiary medical care (a pediatric cancer unit), a correct diagnosis, and a data management infrastructure. In LIC, where these services are lacking, some children with leukemia may die before diagnosis and registration. In this environment, epidemiologic studies would seem to be an unaffordable luxury, but in reality represent a key element for progress. Hospital-based registries are both feasible and essential in LIC, and can be developed using available training programs. In this perspective, Cancer registration is the only way to assess the magnitude of Childhood cancer. It also reveals the predominant cancers in different age groups which helps to identify the target groups. It is useful to formulate effective screening methods specially for the specific age groups and specific cancers.

In the United State Gurney et al., (1995) showed that the Incidence of Childhood Cancer is approximately 123/100,000 with slightly increased rate in males. Leukaemia accounts for approximately 25% of all Childhood Cancers followed by tumors of CNS (17%), Neuroblastoma (7%), Non Hodgekin Lymphoma (6%), Wilms tumor (6%), Hodgekin (5%), Rhabdomyosarcom (3%), Retinoblastoma (3%), Osteosarcoma (3%) & Ewings Sarcoma (2%).

Studies of Stiller, (2007) revealed that Leukaemia is most common among childhood cancers in both developed and developing countries. In the developed world CNS was the second most common childhood cancer (22-25%) and Lymphoma a distant third. A study done by Sebastian.,

et al (2010) reveals Lymphoma is commonest (44.3%) followed by Wilm's tumor (20.1%), Sarcoma (11.5%), Neuroblastoma (8.6%) and Retinoblastoma (8%).

Chittaranjan National Cancer Institute is the first regional cancer Institute in eastern region where population based cancer registry is going on since 1997. All reportable malignant neoplasm below 14 yrs age group registered and treated in this Institute from January 1997 to December, 2004 has been included. The data of the age group 0-14 years was analyzed to reveal descriptive and clinical profile of childhood cancer.

The study result provides data that throw light on magnitude of childhood cancer in this eastern region of India.

At its most basic level, cancer is considered to be a genetic disease and expresses in association with several extrinsic and intrinsic factors. Production of genetic instability that confers some kind of mutation phenotype is most likely the chief characteristic of any inherited predisposition of cancer. As more and more information is made available by fundamental researches on childhood cancers, it may be possible to control this group of fatal diseases of children of the world in the not so distant future.

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