

CHILDHOOD CANCER: EMERGING TRENDS IN CHENNAI, INDIA

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ABSTRACT

Compared to developed countries, only a limited number of studies systematically engage with India's experience with the burden of childhood cancer and its implications for public healthcare in the country. As per the estimates, the incidence rate of cancer among children in India ranges from 38 to 124 per million children per year and Chennai city reported with high incidence. Given this background, this study aims to assess the long-term trend in the incidence of cancerous conditions, demographic factors, and burden of the disease among children. The study has used the Madras Metropolitan Tumour Registry (MMTR), covering cancer cases reported among children (0-14 years) in Chennai for the last 34 years (1982-2016). The study analyses the incidence of the paediatric tumor for different age groups, gender, and type of cancer and the long-term trend over the years and compares the same with existing studies. The trend indicates that more cases are reported during 2007-11 and the least number of cases are reported during 2012-16 (respectively 16.7% and 11.9% of total cases reported).

Keywords: Childhood cancer, paediatric cancer, tumour.**Duration: Received-** 17/02/2021, **Reviewed-** 21/02/2021, **Revised/ Accepted-** 24/02/2021**Correspondence**Dr P Sajna* ✉ sachusajnap@gmail.com**Address** - Department of Epidemiology, The Tamil Nadu Dr M.G.R. Medical University, Chennai-600032, Tamil Nadu, India**INTRODUCTION**

Globally, the incidence of childhood cancer has been increasing steadily and throws new challenges in public health management and policymaking. Its nature, types, and risk factors vary across the countries. As a developing country, India's experience with its given context is very important in understanding the role of epidemiological, demographic, socio-economic factors and policy engagements in addressing the public healthcare challenges. Available evidence indicates that India also experiences a steady increase in the number of children affected by different types of cancer. The details suggest that leukemia is the most common cancer affecting children followed by lymphoma and retinoblastoma. The profile of children affected by cancer shows variation across the age groups. The incidence of retinoblastoma, renal tumors, neuroblastoma, and hepatic tumors was found higher among children aged below five years whereas lymphoma, leukemia, bone tumors, and central nervous system tumours were found more among children aged above five years.^[1]

Globally, the annual number of new cases of childhood cancer exceeds 2,00,000, and more than 80 percent of the reported cases are from the developing world^[2]. Thirteen percent of the annual deaths worldwide are cancer-related and 70 percent of them are in low and middle-

income countries^[3] Childhood cancer (age at diagnosis 0-14 years) is associated with a variety of malignancies and its incidence varies by age, sex, ethnicity, and geography, as reported by cancer etiology^[4,5] The incidence of childhood cancer across the countries ranges from 75 to 150 per million children per year. For instance, only 0.5 percent of all cancer cases reported in England occurs in children less than 15 years of age whereas in India this proportion appears higher at 1.6-4.8 percent with variation by place of residence. This is related to the population structure (33% of the population in India is less than 15 years of age compared to 18% in England).^[6,7]

Though it remains less than the cases reported in the developed world, about 1.6 to 4.8 percent of all cancer reported in India is found in children below 15 years of age, and the overall incidence of 38 to 124 per million children, per year^[8] As 75 percent of the world population lives in these countries, developing countries bear more than half of the global cancer burden^[9] Because of population growth, aging and urbanization, changing dietary habits, better control of infections, increasing tobacco consumption, developing countries are anticipated to bear greater cancer burden, including that of greater lympho-hemopoietic

malignancies^[10] India found have 3 million persons are reported with cancer at any time, with 0.8 million new cases of cancer are diagnosed each year^[11] There is a constant rise in cancer cases, but the trend and pattern vary according to geographical region^[12]

India's experience with a fast-growing economy and change in lifestyle-related behaviors can be connected with increasing cancer load^[13,14] The relative difference in the incidence of lympho-hemopoietic malignancies in the urban and rural population can be connected with the differences in the environmental, and socioeconomic factors affecting the dietary habits and lifestyle in rural and urban areas.^[15-16] They tend to follow the larger trends noticed in terms of disease risk connected with the relative contributions of environment and genetics in the etiology of specific cancers. Studies consider their contribution to risk due to variation in exposure to carcinogens (in the external environment, or through lifestyle choices), or in genetic susceptibility to them.^[17-18]

This study broadly highlights the intensity of childhood cancer and its implications for child healthcare and health management in the global, national and local contexts.^[19] It aims to assess the long-term trend in the incidence of cancerous conditions, demographic factors, and burden of the disease among the children in Chennai during 1982-2016

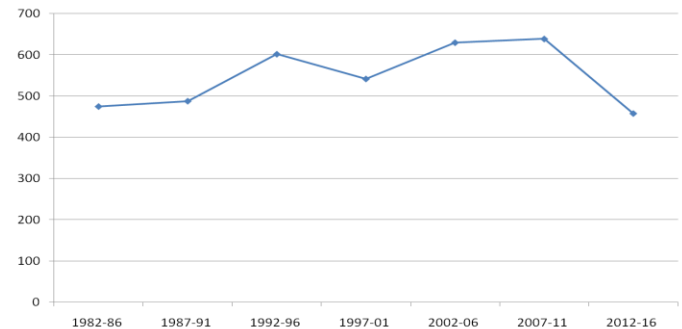
MATERIALS AND METHODS

This study has used the Madras Metropolitan Tumor Registry (MMTR), a population-based cancer registry (PBCR) based at the Cancer Institute (WIA), Chennai covering all cases reported among children (0-14 year) in Chennai for the last 34 years (1982-2016). All cases of childhood cancer from 0-14 years of age that were registered from 1st January 1982 to 31st December 2016 were included in this study. The study analyses the data on the incidence of the paediatric tumor concerning different age group, gender and type of cancer and the long-term trend over the years and compare the same with existing studies. Childhood cancers (age at diagnosis 0-14 years) comprise a variety of malignancies, with incidence varied by age, sex, and ethnicity that provided insights into cancer etiology. The analysis looks into the types and incidence rate of cancer across the different age groups of children. This study was reviewed and approved by the ethical and scientific committees of The Tamil Nadu Dr. M.G.R. Medical University, Chennai

RESULT AND DISCUSSION

The analysis covers 34 years (1982 and 2016) and shows the trend of the cancerous condition of children of madras. The long-term trend indicates that (Figure 1) more cases are reported during 2007-11(639cases) constitute 16.7 percent of the total cases reported during this period. At the same time, the least number of cases are reported during 2012-16 (458cases, constitutes 11.9%).

Figure 1 Number of cancer cases reported among the children (1982-2016)



Source: MMTR

Table 1- Sex-wise distribution of cancer cases reported

Sex	Frequency	Percent (%)
Male	2313	60.3
Female	1521	39.7
Total	3834	100

Sex-wise distribution of paediatric cancer during this period shows that more cases are reported among male children (2313 cases) constituting 60.3% of total cases reported (3834). Compared to this, only 1521 cases (39.7%) are reported among female children (Table 1).

Table: 2 Distribution of reported cases across the age groups

Age-Group	Frequency	Percent (%)
00-04 Years	1417	37.0
05-09 Years	1242	32.4
10-14 Years	1175	30.6
Total	3834	100

Table 2 describes the age group distribution of paediatric cancer for 1982-2016. When the children are classified into three age-groups, the data shows that more paediatric cancer is reported in 0-4 years of age (1417 cases) accounting for 37% of the total cases reported (3834 cases). The details show that the highest number of cases (370 cases, constitutes 9.7%) at

Table: 3- Religion-wise distribution of reported cases

Religion	Frequency	Percent (%)
Hindu	3172	82.7
Muslim	392	10.2
Christian	247	6.4
Sikh	1	0.0
Jain	22	0.6
Total	3834	100

Hodgkin's Disease	204	5.3
Brain Tumor	139	3.6
Eye Cancer	120	3.1
Other Cancer	1124	29.3
Bone Cancer	95	2.5
Rectum Cancer	192	5.0
Testis Cancer	53	1.4
Adrenal gland Cancer	69	1.8
Liver Cancer	40	1.0
Kidney Cancer	140	3.7
Leukemia unspecific	46	1.2
Multiple myeloma	52	1.4
Total	3834	100

Table 3 shows the distribution of reported cases among the major religious groups. Compared to other religious groups, more paediatric cancer was reported in the Hindu community, (3172 cases) constitutes 82.7% of the total out of 3834 cases. A large number of cases were reported among children from Muslim (392 cases, 10.2%), Christian (247 cases 6.4%) communities.

Table 4 describes the distribution of different types of paediatric cancer reported during this period. The trend indicates that lymphoid leukemia is the most common type of cancer reported (1002 cases, constituting 26.1% of 3834 cases). Non-Hodgkin's lymphoma, Myeloid Leukemia, Hodgkin's disease, Brain Tumor, Eye Cancer, and other types follow this (Table 4).

Table: 4- Major types of cancer reported

Type of cancer	Frequency	Percent (%)
Lymphoid Leukemia	1002	26.1
NHL	297	7.7
Myeloid Leukemia	261	6.8

Major types of cancer: Trends across specific intervals

Types	1982-86	1987-91	1992-96	1997-01	2002-06	2007-11	2012-16	Total
Lymphoid Leukemia	92 (19.4%)	106 (21.7%)	173 (28.7%)	138 (25.5%)	209 (33.2%)	172 (26.9%)	112 (24.5%)	1002 (26.1%)
NHL	51 (10.7%)	43 (8.8%)	57 (9.5%)	48 (8.9%)	34 (5.4%)	39 (6.1%)	25 (5.5%)	297 (7.7%)
Myeloid Leukemia	44 (9.3%)	50 (10.2%)	34 (5.6%)	32 (5.9%)	41 (6.5%)	31 (4.9%)	29 (6.3%)	261 (6.8%)
Hodgkin's D	19 (4.0%)	38 (7.8%)	35 (5.8%)	35 (6.5%)	31 (4.9%)	26 (4.1%)	20 (4.4%)	204 (5.3%)
Brain Tumor	14 (2.9%)	30 (6.1%)	14 (2.3%)	13 (2.4%)	22 (3.5%)	29 (4.5%)	17 (3.7%)	139 (3.6%)
Eye Cancer	29 (6.1%)	18 (3.7%)	26 (4.3%)	39 (7.2%)	8 (1.3%)	0 (0.0%)	0 (0.0%)	120 (3.1%)
Other CA	147 (30.9%)	138 (28.3%)	165 (27.4%)	136 (25.1%)	164 (26.0%)	219 (34.3%)	155 (33.8%)	1124 (29.3%)
Bone CA	13 (2.7%)	16 (3.3%)	13 (2.2%)	13 (2.4%)	16 (2.5%)	10 (1.6%)	14 (3.1%)	95 (2.5%)
Rectum CA	24 (5.1%)	23 (4.7%)	31 (5.1%)	24 (4.4%)	28 (4.4%)	37 (5.8%)	25 (5.5%)	192 (5.0%)
Testis CA	11 (2.3%)	8 (1.6%)	12 (2.0%)	8 (1.5%)	9 (1.4%)	2 (0.3%)	3 (0.7%)	53 (1.4%)
Adrenal gland CA	3 (0.6%)	0 (0.0%)	0 (0.0%)	8 (1.5%)	18 (2.9%)	18 (2.8%)	22 (4.8%)	69 (1.8%)
Liver CA	3 (0.6%)	2 (0.4%)	11 (1.8%)	3 (0.6%)	8 (1.3%)	7 (1.1%)	6 (1.3%)	40 (1.0%)
Kidney CA	14 (2.9%)	10 (2.0%)	14 (2.3%)	22 (4.1%)	27 (4.3%)	33 (5.2%)	20 (4.4%)	140 (3.7%)
Leukemia unspecific	3 (0.6%)	4 (0.8%)	8 (1.3%)	14 (2.6%)	9 (1.4%)	5 (0.8%)	3 (0.7%)	46 (1.2%)
Multiple myeloma	8 (1.7%)	2 (0.4%)	9 (1.5%)	9 (1.7%)	6 (1.0%)	11 (1.7%)	7 (1.5%)	52 (1.4%)
Total	475 (100%)	488 (100%)	602 (100%)	542 (100%)	630 (100%)	639 (100%)	458 (100%)	3834 (100%)

The trend indicates that the pattern of reported cases changes across the years. Types of major cancer reported between different periods show that more cases were reported during 2007-11 (639 cases, 16.7%). Major types include Non-Hodgkin's lymphoma (39 cases, 6.1%),

brain tumor (29 cases, 4.5%), rectum cancer (37 cases, 5.8%), kidney cancer (33 cases, 5.2%), and other cancers (219 cases, 34.3%). The other categories of cancer include cancers of the Nose, Pinna, fingers, and nasopharyngeal cancers.

Figure: 2- Sex-wise distributions of reported cases and types of cancer (Share in %)

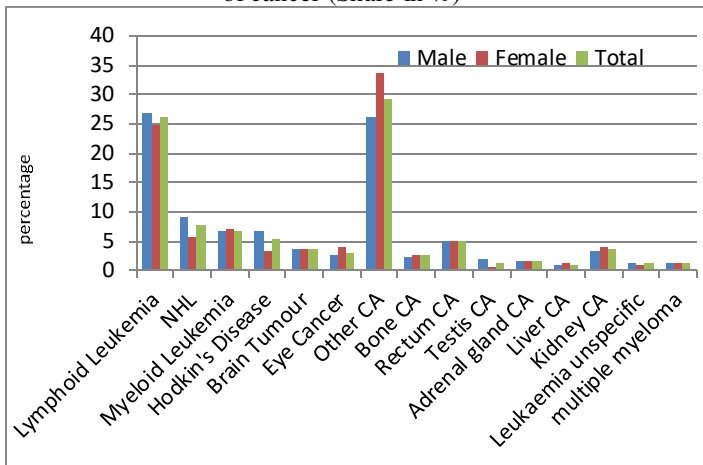


Figure 2 shows the distribution of reported cases with their types and gender 1982-2016. The trend indicates that most of the types of cancer reported remain high among the male children, except myeloid leukaemia (7.1%), eye cancer (4%), bone cancer (2.7%), liver cancer (1.2%), kidney cancer (4.1%) and other types of cancers (33.9%).

Table 6 shows the incidence of different types of paediatric cancer for the different age groups. More paediatric cancers are reported in 0-4 years of age (1417 cases, 37%) out of 3834 cases. Which include myeloid leukaemia (14.7%), eye cancer (6.4%), adrenal gland cancer (3.8%), liver cancer (2.3%), and multiple myeloma (1.5%). Compared to this, more cases of lymphoid leukaemia (29.1%), non-Hodgkin's lymphoma (9%), Hodgkin's disease (7%), brain tumour (5.2%), rectum cancer (5.1%), testis cancer (2.3%), kidney cancer (4.2%), and unspecified leukaemia (1.3%) were reported in 5-9 years of age. The number of cases reported on Bone cancer (2.5%), and other cancer (29.3%) found high among children in 10-14 years of age.

Table 6 - Incidence of paediatric cancer across age in %

Type of cancer	00-04 Years	05-09 Years	10-14 Years
Lymphoid Leukemia	28.9	29.1	26.1
NHL	4.7	9.0	7.7
Myeloid Leukemia	14.7	3.7	6.8
Hodgkin's Disease	1.7	7.0	5.3
Brain Tumor	2.5	5.2	3.6
Eye Cancer	6.4	2.0	3.1
Other Cancer	24.3	27.5	29.3

Bone Cancer	0.5	1.3	2.5
Rectum Cancer	3.9	5.1	5.0
Testis Cancer	0.6	2.3	1.4
Adrenal gland Cancer	3.8	0.8	1.8
Liver Cancer	2.3	0.5	1.0
Kidney Cancer	3.1	4.2	3.7
Leukemia unspecified	1.0	1.3	1.2

The overall incidence of paediatric cancer has gradually decreased in Chennai during the period of 2012-16, compared to the previous years. Leukemia emerges as the most common pediatric cancer like other reviews (Table 4). The results broadly follow some of the existing studies like the highest incidence occurring between 0-4 years of age (Table 2) and Non-Hodgkin's disease exceeds Hodgkin's disease (Table 4) as reported in India between 2012 and 2014 (Suman Das et. al). Similarly, overall cancer in children is more common in male children than female children (Stiller C 2007),(Gurney JG. et. al 2006).

Existing studies report that both Hodgkin's and Non-Hodgkin's disease had the highest incidence among 10-14 years age group for both sexes (Suman Das. et al 2017) whereas the present study finds that the Non-Hodgkin's disease and Hodgkin's disease had the highest incidence among 5-9 years of age group (Table 6). Our analysis also highlights that brain tumours had the highest incidence among 5-9 years of the age group for both sexes (Table 6). Eye and liver tumors had the highest incidence among the 0-4 years age group while bone and gastrointestinal tumours had the highest incidence among the 10-14 years age group for both sexes (Table 6).

CONCLUSION

Between 1982 and 2016, three thousand eight hundred and thirty-four pediatric cancer cases are registered in the Madras Metropolitan Tumor Registry. The long-term trend indicates that childhood cancer gradually decreased during the recent years (2012-16) while maximum cases are reported during 2007-11. The results show a higher incidence of cancer among the male children (60.3%) of 0-4 years of age.

The prevalence of cancer was found more common in 0-4 years of age except for lymphoid leukemia, NHL, Hodgkin's disease, brain tumor, and kidney cancer which were found high among children of 5-9 years of age. Leukemia is the most common pediatric cancer and

it constitutes 27 percent in males and 25 percent in females. Across the social groups, more cases are reported from the Hindu community, while specific types like myeloid leukemia, NHL, brain tumor, and multiple myeloma are found high in the Jain community. Similarly, lymphoid leukemia and rectum cancer are more common among the Muslim community. The paediatric tumor shows wide variation concerning different age groups.

Given that genetic and environmental factors can play a critical role in the etiology of paediatric cancer, most paediatric cancer is curable if it has been detected early. Thus, the study offers some important insights and updates on the paediatric cancer trends in the city of Chennai and may serve as a reference source for clinicians and researchers on paediatric oncology and policymakers engaged in public health.

CONFLICT OF INTEREST

The authors have no conflicts of interest regarding the content of this article

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