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Childhood cancer in Thi-Qar, Iraq: Seven-year (2012-2018) evidence of incidence trend

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Abstract—

Objectives: To determine the incidence rate of childhood cancer and its trend in Thi-Qar governorate, Iraq during 2012-2018.

Methods: This registry based descriptive study included children aged 0-14 years with primary cancer who were newly diagnosed in Thi-Qar during 2012-2018. The types of malignant tumors were classified according to International Classification of Childhood Cancer, Version 3 (ICCC-3). The overall and specific incidence rates by age and sex were calculated per 100,000 children. JoinPoint software was used to examine the magnitude, direction, and change of trends in incidence rates.

Results: For the years 2012-2018, a total of 633 new cases [349 (55.1%) boys and 284 (44.9%) girls, with ratio of 1.23:1] were registered among children aged less than 15 years. Children aged ≤4 years accounted for 41.5% of patients. The average annual incidence rate was 11.14/100,000 (ASIR was 12.00/100,000 children per year). The incidence rate increased from 7.61/100,000 in 2012 to 14.62/100,000 in 2018 with an annual percent change (APC) of 6.9%. Boys showed higher incidence rate than girls (11.93 vs. 10.30/100,000, p-value=0.02). The incidence rate was the highest for children ≤4 years. Leukemia was the most common type of childhood cancer accounting for 33.02%/%, followed by CNS neoplasms (15.48%), and lymphomas (14.53%).

Conclusion: The incidence rate of childhood cancer in Th-Qar is increasing with time. The incidence is comparable to that reported for developing countries but there is a shift of cancer types' distribution similar to that in developed countries.

Key words: Cancer, childhood, incidence, Iraq, neoplasm, registry, Thi-Qar.

INTRODUCTION:

Despite the rare occurrence of neoplasms in children, they still account for more than 4 deaths/100000, [1] particularly in developing countries where there is a lack of early diagnosis and unaffordable curative treatment. [2,3] However, they respond better to treatment. [4]

Worldwide, many studies have reported an alarming increase in childhood cancer. [1,3-5] Furthermore, a great geographical variation in incidence and trend was well-known. [6,7]
According to 153 registries from 62 countries, a study revealed that the overall global age-adjusted incidence rate of pediatric cancer in one decade (2001-2010) was 14.1/100,000 person-years in children aged 0-14 years, and leukemia was the most common cancer. [3]
In Iraq, children under 15 years of age constitute about 40% of the total population. [8] Among this age group, cancer represents 5.44% of all newly diagnosed cancers in 2018 with an incidence rate of 11.12/100,000 children. [9]

In developing countries, even in the presence of population-based cancer registries, statistics about childhood cancer are more susceptible to missing information or imprecision [3] because of their relative

rarity, difficulties in diagnosis and tracing cases, underreporting or delay in case notification, and insufficient funding. [4,10,11]

Estimating the incidence rates and the trend of childhood cancer at national and subnational levels is essential in designing specific programs to control the disease burden. The regional and global positions of Thi-Qar Governorate, in terms of childhood cancer extent and the pattern of incidence trend are unclear.

This study aims to provide an overview about the extent and trend of childhood cancer incidence in Thi-Qar, Iraq during a 7-year period (2012-2018).

PATIENTS AND METHODS

Thi-Qar Governorate is located in Southern Iraq to the North of Basrah Governorate; it covers an area of 12900 Km^2 with a population of 2,150,338 persons in 2019.

This study was a retrospective registry based study. Data about childhood cancer were obtained from the Iraqi Cancer Registry Center. Iraqi cancer registry (ICR) was established in 1974; it began operation in 1975.

This study included all newly diagnosed childhood cancer cases from Thi-Qar Governorate inhabitants aged 0-14 years of either sex during the period 2012-2018 exclusively. The diagnosis was confirmed by histological or hematological tests. The International Classification of Diseases for Oncology (ICD-O) [12] was used for topographical and morphological coding. Cases were grouped into 12 main groups according to the International Classification of Childhood Cancer Third Edition (ICCC-3). [13]

Information about a set of variables including basic demographic data (age and sex), date of diagnosis and site of tumors were achieved using a summary format.

Statistical analysis:

Incidence rates were calculated as the average annual number of children with newly diagnosed cancer per 100,000 children. Age standardized incidence rates (ASIR) per 100,000 children were calculated by the direct method, using the weights of the world standard population for the age groups under 15 years (0-4, 5-9, and 10-14 years). [14]

Population estimates used for calculation of incidence rates were obtained from the Central Department of Statistics and Information, Ministry of planning.

JoinPoint software was used to examine the magnitude, direction, and change of trends in incidence rates, and to quantify the annual percentage change (APC). [15]

The Ethical Committee of College of Medicine, University of Basrah approved this study.

RESULTS:

During 2012-2018, 633 cases of paediatric cancers were diagnosed in Thi-Qar Governorate [349 (55.1%) boys and 284 (44.9%) girls, with ratio of 1.23:1]. Children aged <4 years accounted for 41.5% of patients. The average annual crude incidence rate was 11.14/100000 and age-standardized rate (ASIR) of 11.20/100000 per year. The overall incidence rate was increased during the study period (2012-2018) with an annual percent change (APC) of 6.9%. [Table 1 & Figure 1]. The rate increased by 7.5% for boys and 6.2% for girls.

[Table 1]

[Figure 1]

Boys showed a significantly higher incidence rate than girls (11.93 vs. 10.30/100,000, p-value=0.02). The peak crude incidence rate of cancer was noticed among children aged <4 years (12.77/100,000) followed by 5-9 years and 10-14 years groups (10.85/100,000 and 9.50/100,000 respectively, p-value <0.001). [Table 2]

[Table 2]

The most common type of cancer was leukemia (33.02%) with a crude incidence rate (CIR) of 3.68/100,000 followed by CNS neoplasms (15.48%) with CIR of 1.72/100,000, and lymphoma ranked as the third common cancer (14.53%) with CIR of 1.62/100,000. The crude incidence rates of leukemia, CNS, lymphoma, and bone malignant tumors were higher in boys than in girls. While renal and soft tissues cancers were higher in girls than in boys. [Table 3]

[Table 3]

DISCUSSION

The overall crude incidence rate of childhood cancer in Thi-Qar during the period 2012-2018 (11.14/100,000) was within the range for that reported in many neighboring and developing countries but it is lower than that reported in developed countries [16-29] [Figure 2]. Genetic predisposition and environmental risk factors could contribute to such geographical variation. [25]

[Figure 2]

Despite minor fluctuations, the incidence rate of childhood cancer in Thi-Qar Governorate during 2012-2018 showed no significant increment trend, particularly in the early years of the study, with an annual percent change (APC) of 6.9%. The increase was steeper in the first years of the study 2012-2014 with an APC of 12.7%, followed by a slightly increasing trend in the later period (2014-2018) with an APC of 4.1%. The trend showed higher increase in boys than girls (APC for boys was 7.5% Vs. 6.2% for girls). A comparable increase was reported in Beijing, China during 2000-2009 with an average annual increase of 5.84% (95% CI: 1.0-10.9). [24] However, lower increment rates were reported in many countries particularly developed ones. In United States, the rate has increased slightly at an annual rate of 0.6% since 1975, [30] Europe (0.54% from 1991-2010), [31] Australia (1.2%% per year between 2005 and 2015), [16] and Estonia (0.5% annually during 1970–2016), [26] and 2.4% per year in Korea from 1999 to 2011. [22] Change in incidence trend is multifactorial. It could be artificial due to improvement in diagnostic abilities and registration or coding practices, and inaccurate estimation of population at risk, [32] or it could be a real increase due to a set of genetic and environmental factors. [33]

Although controversial, advancing parental age, particularly maternal age, was found to be related to higher childhood cancer risk, with some variations across types of cancer. [34] Increased birth weight was reported to be a determinant to increased childhood incidence rate. [35] However, certain factors that enhance growth such as gestational age should be considered rather than birth weight alone. [36] In United States, racial differences were revealed for a variety of cancers. The incidence rate of leukemia was found to be higher among white children compared with black children. [37]

Similar to what had been previously reported, [24,26] higher frequency of childhood cancer was found among those aged 0-4 years; probably due to the higher incidence of embryonic cancers during infancy [38] or due to immature immunity as a result of delayed exposure to infections in this age group. [39]

The observed cancer type distribution in this study is similar to that reported in developed countries. Leukemia ranks first as the most common tumors in Thi-Qar governorate followed by CNS tumors and then lymphoma. A pattern, which differs from that reported previously for Iraq, Basrah [21] and some developing countries [40,41] where lymphoma ranks second after leukemia followed by CNS tumors as the third most common tumors. However, such trend of cancer distribution was noticed at the national level in the last years [9,42] and neighboring countries such as Iran, [27] and Saudi Arabia. [28] Such change in cancer type distribution may be attributed to change in biological or environmental risk factors or partly due

to improvement in cancer registry and diagnostic facilities. It could be of note for establishment of etiological studies to understand these changing trends.
One limitation that should be addressed in this study is that under-registration, particularly in early years of the study, cannot be excluded.

CONCLUSIONS

This study revealed an increasing pattern of incidence rate of childhood cancer in Thi-Qar governorate, but it is still comparable to that reported for developing countries. Furthermore, a shift of cancer type distribution similar to that reported for developed countries was noticed.

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Conflicts of interest
There are no conflicts of interest

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Table 1 Incidence rates of childhood cancer in Thi-Qar, Iraq during 2012-2018

Year	Population	No. of cases	CIR/100,000	ASIR
2012	762115	58	7.61	7.65
2013	781409	95	12.16	12.20
2014	801128	87	10.86	11.20
2015	821276	88	10.71	10.75
2016	841852	89	10.57	10.66
2017	826019	92	11.14	11.34
2018	847916	124	14.62	14.72
Average population	**811,673**	**633**	**11.14**	**11.20**

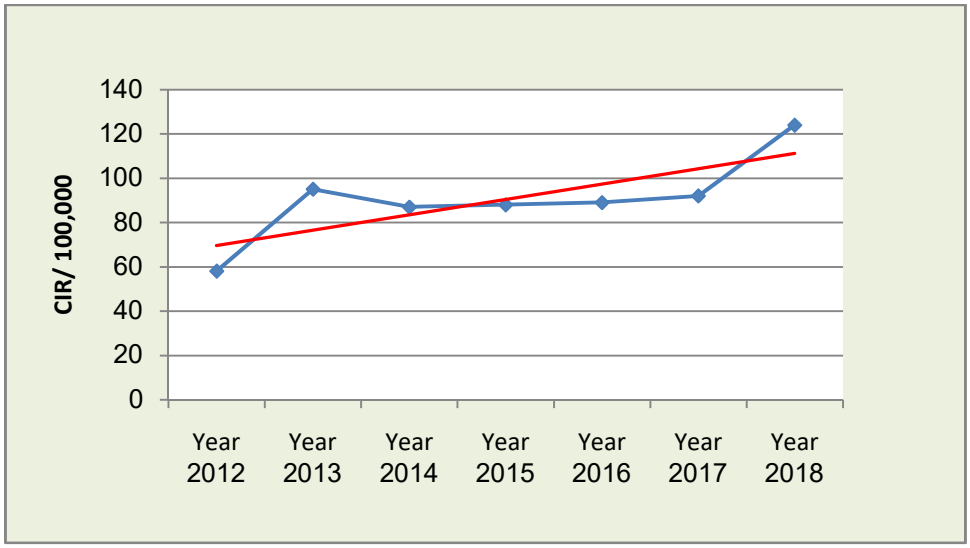


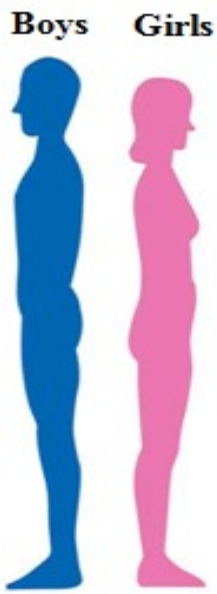
Figure 1 Incidence trend of childhood cancer in Thi-Qar Governorate (2012-2018)

Table 2 Age & sex distribution

	Estimated population	No. of cases	% out of total	IR/100,000/ year	X^2; P-value
Age (in years)					
0 - 4	294224	263	41.5	12.77	17.33;
5 - 9	273767	208	32.9	10.85	< 0.001
10 - 14	243683	162	25.6	9.50	
Sex					
Boys	417,971	349	55.1	11.93	25.028;
Girls	393,703	284	44.9	10.30	0.02
Total	**811,674**	**633**	**100**	**11.14**	

Table 3 Frequency and incidence rates (IR/100,000) of different types of cancers according to sex

IR	%	No.	Type of cancer
3.90	32.7	114	Leukemia
1.85	15.5	54	CNS
2.02	14.5	59	Lymphoma
0.92	7.9	27	Neuroblastoma
0.24	2.0	7	Retinoblastoma
0.44	3.7	13	Wilms & other renal
0.21	1.7	6	Hepatic tumors
0.79	6.6	23	Malignant bone tumors
0.48	4.0	14	Soft tissues
0.24	2.0	7	Germ cell & gonads
0.41	3.4	12	Epithelial & melanoma
0.44	3.7	13	Unspecified
11.93	**100**	**349**	Total



Type of cancer	No.	%	IR
Leukemia	95	33.5	3.45
CNS	44	15.5	1.60
Lymphoma	33	11.6	1.20
Neuroblastoma	23	8.1	0.83
Retinoblastoma	5	1.8	0.18
Wilms & other renal	20	7.0	0.73
Hepatic tumors	5	1.8	0.18
Malignant bone tumors	13	4.6	0.47
Soft tissues	17	6.0	0.62
Germ cell & gonads	4	1.4	0.15
Epithelial & melanoma	13	4.6	0.47
Unspecified	12	4.2	0.44
Total	**284**	**100**	**10.30**

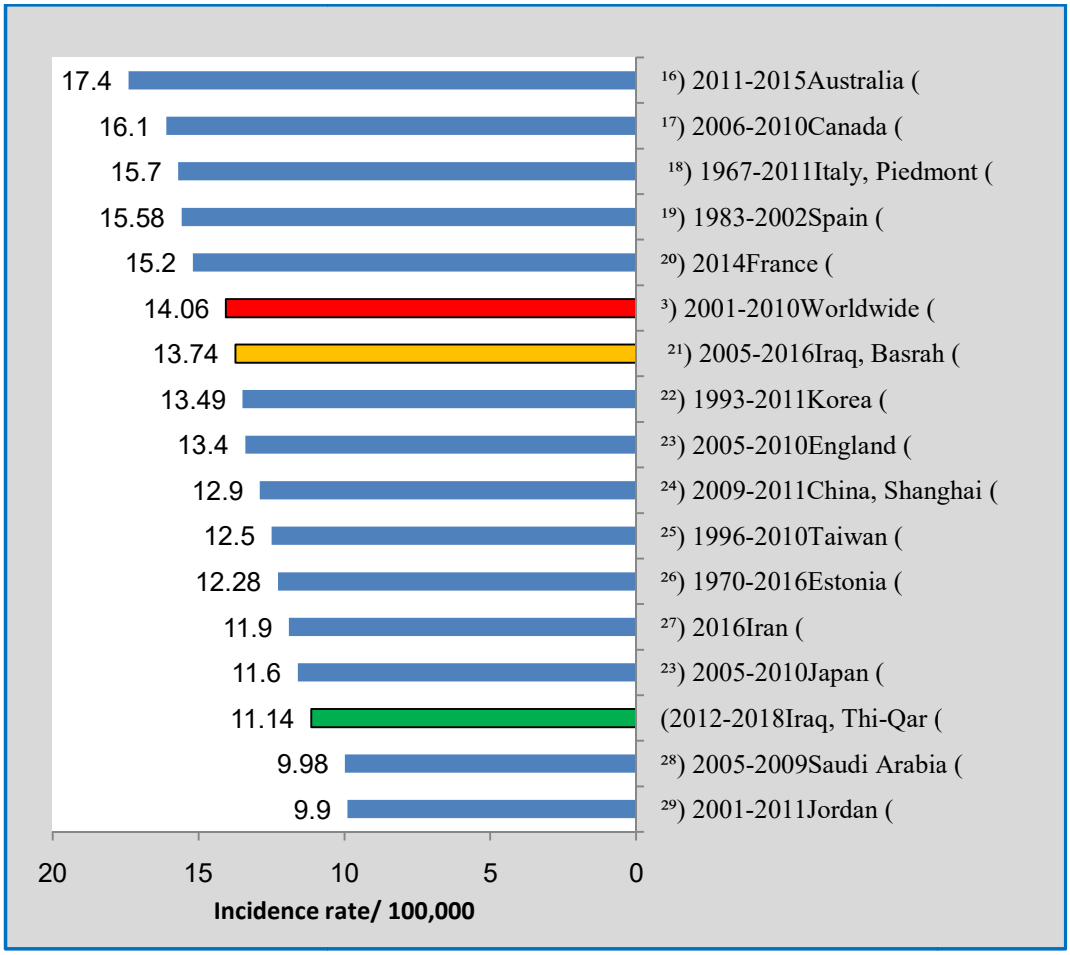


Figure 2 Childhood cancer incidence rate by countries