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ORIGINAL ARTICLE

Epidemiology of Childhood Cancer Based on the Databases of Population-Based Cancer Registries in City of Erbil, Iraq

Hafidh AI_Sadi[*1], Allaa Hatim Thanoon[2], Moayad Aziz Abdulqadir[3], Mostafa Adnan Abdalrahman[4], Mahmood Hasen Alubaidy[5], Sadiq M. Al-shaikh[6]

[1]*College of MLT, Ahl Al Bayt University, Kerbala, Iraq*

[2]*The University of Mashreq, Baghdad, Iraq*

[3]*Department of Anesthesia Techniques, AlNoor University College, Bartella, Iraq*

[4]*Clinical pharmacist specialists, Al Nisour University College, Iraq*

[5]*Al-Hadi University College, Baghdad, 10011, Iraq*

[6]*Department of Medical Laboratory Technics, Al-Zahrawi University College, Karbala, Iraq*

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KEYWORDS

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ABSTRACT: Cancer disease in children is very rare and includes less than one percent of all cancers. However, it is one of the main causes of death among children. The aim of this study is to investigate the epidemiology of various cancers in children in Erbil city, Iraq. In this epidemiological study, in which the cancer registry data of Erbil city was used, the frequency distribution of cancer between 2014 and 2021 (for 8 years) in children under 18 years of age was investigated and the incidence rate per one million people was calculated. Data analysis was done using SPSS version 23 software and MS Excel 2016 software. The registered cancer cases related to the residents of Erbil city during these years were 1766 cases, among which blood cancers had the highest frequency. 59.7% of the cases have been observed in men, and the age group of 15-18 years (34.6%) had the highest frequency in comparison with other age groups. The average age at the time of diagnosis was estimated at 11.2 years. The minimum and maximum age-standardized incidence in this 8-year period is estimated to be 73 cases (year 2014) and 241 cases (year 2019) per million people, respectively. Based on the results of this study and contrary to our expectations, it was found that the incidence of cancer among children under 18 years old in Erbil city is not much different from developed countries.

INTRODUCTION

One of the most crucial difficulties in urban environmental management is the accumulation of dust on impermeable surfaces, and air pollution, a major issue in contemporary society, is a form of pollution that may be fatal [1, 2]. In the city of Erbil, street dust pollution by heavy metals (HMs) and polycyclic aromatic hydrocarbons (PAHs), as well as their mineralogical and morphological characteristics, were studied [3]. According to the findings, there are significant ecological and health problems in the research region due to the high levels of Cu, Pb, Zn, Hg, and PAH contamination in street dusts, particularly in the city's high-traffic and industrial zones. It was also showed that exposure to PAHs in street dust puts people of the Erbil city at risk of developing cancer. The prevalence of chronic diseases has increased despite recent advances in the management and prevention of infectious diseases [4, 5]. In the meantime, cancer is regarded as one of the most

*Corresponding author: hafidh19477@gmail.com (H. AI_Sadi)
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significant public health issues in several nations, coming in second to cardiovascular illnesses as the second leading cause of death [6, 7]. In developed nations, cancer ranks as the second most common cause of death for children. The likelihood of cure has increased significantly over the past few decades thanks to highly specific diagnostic techniques, the development of multimodal treatment approaches, and their ongoing improvement. For patients, their families, the oncologists who are treating them, as well as from the perspective of public health, childhood cancer and its treatment have nevertheless remained a challenge. In 2020, there were 12,400 cancer diagnoses among American children and adolescents under 20 [8]. Between birth and the age of 20, there is a 1 in 300 chance that a particular child will develop cancer [9–11]. In this age group, cancer-related mortality was thought to account for 2,300 deaths in 2021, or about 8% of all deaths [12]. Cancer is the second most common cause of mortality for children aged 5-14 and the third highest cause of death for children aged 1-4 [13–15]. However, cancer is the third leading cause of mortality in Iraq, following cardiovascular disease and accidents [16]. Although it is known that some postnatal exposures (radiation, viruses) and prenatal (such as radiation, diethylstilbestrol [DES]) can raise the risk of various childhood cancers, the exact cause of most cases of childhood cancer is still unknown [17,18]. The International Classification of Childhood Cancers (ICCC) divides childhood cancers into 12 major histological types (Figure 1) [19].

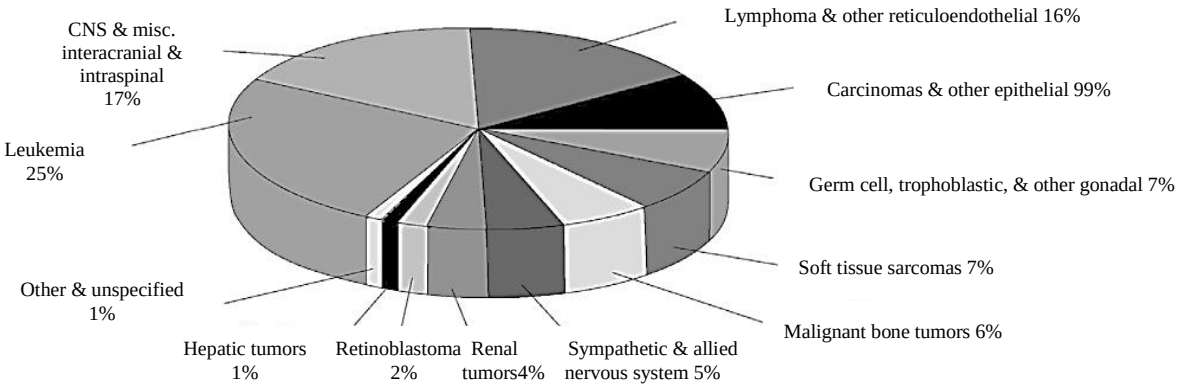

Figure 1. The prevalence of childhood cancer (age 0-18).

The epidemiology of cancer in children differs from that in adults, making blood cancers, lymph node cancers, and cancers of the central nervous system the most prevalent types of cancer in children. According to reports, there are between 62-121 and 71-156 cases of cancer per million people for girls and boys, respectively, in different geographic regions of Iraq [20]. Based on information from the Erbil cancer registry, the goal of this study is to look into the incidence rate of cancer in children under the age of 18 as well as the frequency distribution (age and sex) of different cancer types in children.

MATERIAL AND METHODS

The Kurdistan Region of Iraq, often known as Iraqi Kurdistan, is an autonomous region in northern Iraq with Erbil as its capital and three additional governorates: Halabja, Sulaymaniyah, and Duhok. It is formally recognized by the Iraqi constitution under the name Kurdistan Region of Iraq. The city of Erbil, which is the largest in northern Iraq and is situated around 350 kilometers north of Baghdad, is situated between latitudes 36° 07′ and 36° 15′ N and longitudes 43° 55′ and 44° 07′ E (Figure 2).

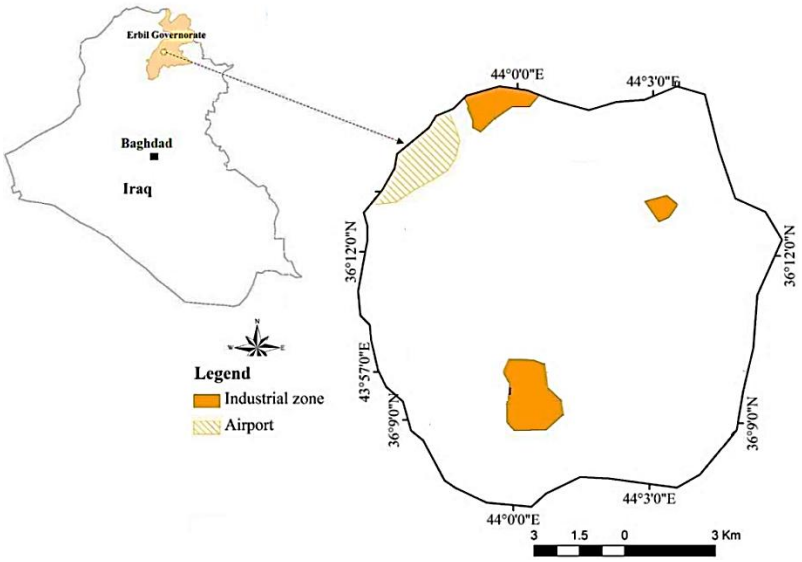

Figure 2. Industrial zones of Erbil metropolis.

Kurdistan Region's economy is dominated by the tourism, agriculture, and oil industry. It has a population of roughly 900,000 people and a governorate with a permanent population of 2,110,419 as of 2018. Erbil's climate is categorized as hot-summer Mediterranean because It has an average annual temperature of 20.2°C and experiences 540 mm of precipitation [21]. Table 1 provides annual emission of air pollutants from various sources in Erbil city [22].

Table 1. Annual emissions of various pollutants in Erbil.

Years	CO (ton)	HC (ton)	NO_x (ton)	CO_2 (ton)	Mass Particulate (Pm) (ton)
2014	17.12	2.02	1.30	267.75	0.12
2015	35.30	4.15	2.69	553.35	0.24
2016	58.29	6.87	4.47	934.50	0.51
2017	80.64	9.51	6.24	1316.70	0.84
2018	113.44	13.40	8.85	1890.00	0.84
2019	171.86	20.35	13.59	2953.65	1.38

The data used in this epidemiological study is from the cancer registration program of Erbil city, between 2014-2021. Prior to 2019, pathology centers were used in this province for cancer registration; however, since then preparations have been made for population-based cancer registration. A group of relevant experts assists in implementing the cancer registration program. The necessary data for cancer registration is gathered from pathology and non-pathology centers, with pathology centers providing 80% of the information and non-pathology centers providing 20%. It should be mentioned that there are about 77 pathology centers in Iraqi Kurdistan, of which 54 are located in the center of the province, city of Erbil. In this province, non-pathology centers include the deputy health department's death registration office, hospital medical records, private and public hematology-oncology clinics, legal medicine, immunohistochemistry clinics, flow cytometry clinics, imaging clinics, drug and alcohol monitoring departments, and blood transfusion facilities. The incidence rates were calculated per million people, and the incidence rate was standardized by direct standardization method and using the standard population of the United States of America in the year 2000 [23,24]. The collected information was coded using the International Classification of Diseases for Oncology (ICD-O) method [25], and after entering the data into the software, the patients were sorted alphabetically in order to check for repeated registration, and the duplicates were deleted. Also, the patients who came to the

treatment centers of Erbil city from other regions were not considered in the calculations, although it should be mentioned that a small percentage of the patients of this region may have gone to the neighboring provinces for treatment. Using the exponential estimation method, the population of the Erbil city was calculated for these years, and the rate of population growth between 2004 and 2019 was 1.31 [26]. SPSS version 23 was used to describe the data.

RESULTS

A total of 2433 cases were registered during the 8 years under review (2014-2021), of which 516 cases (21.2%) were connected to cases outside the province that were excluded from the study and 1766 cases were looked into in Erbil city. As shown in Table 2, the most common cancer was blood cancer (44.34% of cases), followed by eye, brain and other parts of the central nervous system and lymph nodes with 9.40% and 9.23%, respectively. The least common types of cancer, with 1.81% of cases, were those of the lip, mouth, and pharynx. The most cases were diagnosed in 2019 (21.1%). Men made up 59.7% of the cases, and compared to other age groups, the 15-18 age groups had the highest frequency, with 531 cases (34.6%). Figure 3, breaks down childhood cancer incidence rates by gender and age group by year. The highest incidence of cancer has been observed in men aged 15-18 years. The mean age at the time of diagnosis (± standard deviation) was estimated to be 11.2±4.6 years.

Table 2. Frequency distribution of tumor location in cancer patients registered in the registration center of Erbil city between 2014-2021.

	Contaminated location	Number	Percent
Tumor location	Blood cancers and endothelial network	783	44.34
	Eye, brain and central nervous system (CNS)	166	9.40
	Lymph nodes	163	9.23
	Bones and joints	128	7.25
	Urinary tract and kidney	66	3.74
	Digestive system	66	3.74
	Skin	55	3.11
	Soft tissues	53	3.00
	Thyroid and endocrine glands	50	2.83
	Respiratory system	40	2.27
	Lips, mouth and pharynx	32	1.81
	Unknown primary member and other cases	164	9.29
	All patients diagnosed	1766	100

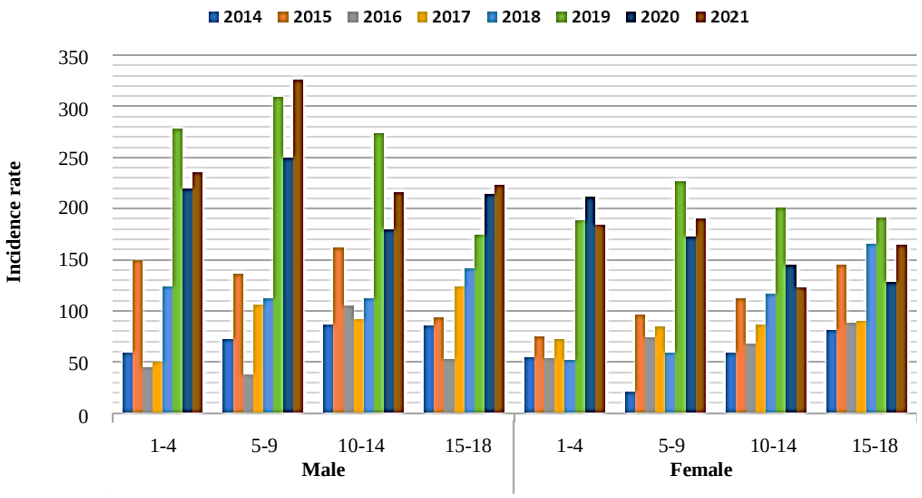

Figure 3. The age-sex specific incidence rate of cancer (per one million people) in children aged 0-18 between 2014-2021.

As shown in Figure 4, the age-standardized incidence rate of cancer between 2014 and 2021 was equal to 73, 118, 73, 89, 112, 241, 199, 213 cases per million people, respectively.

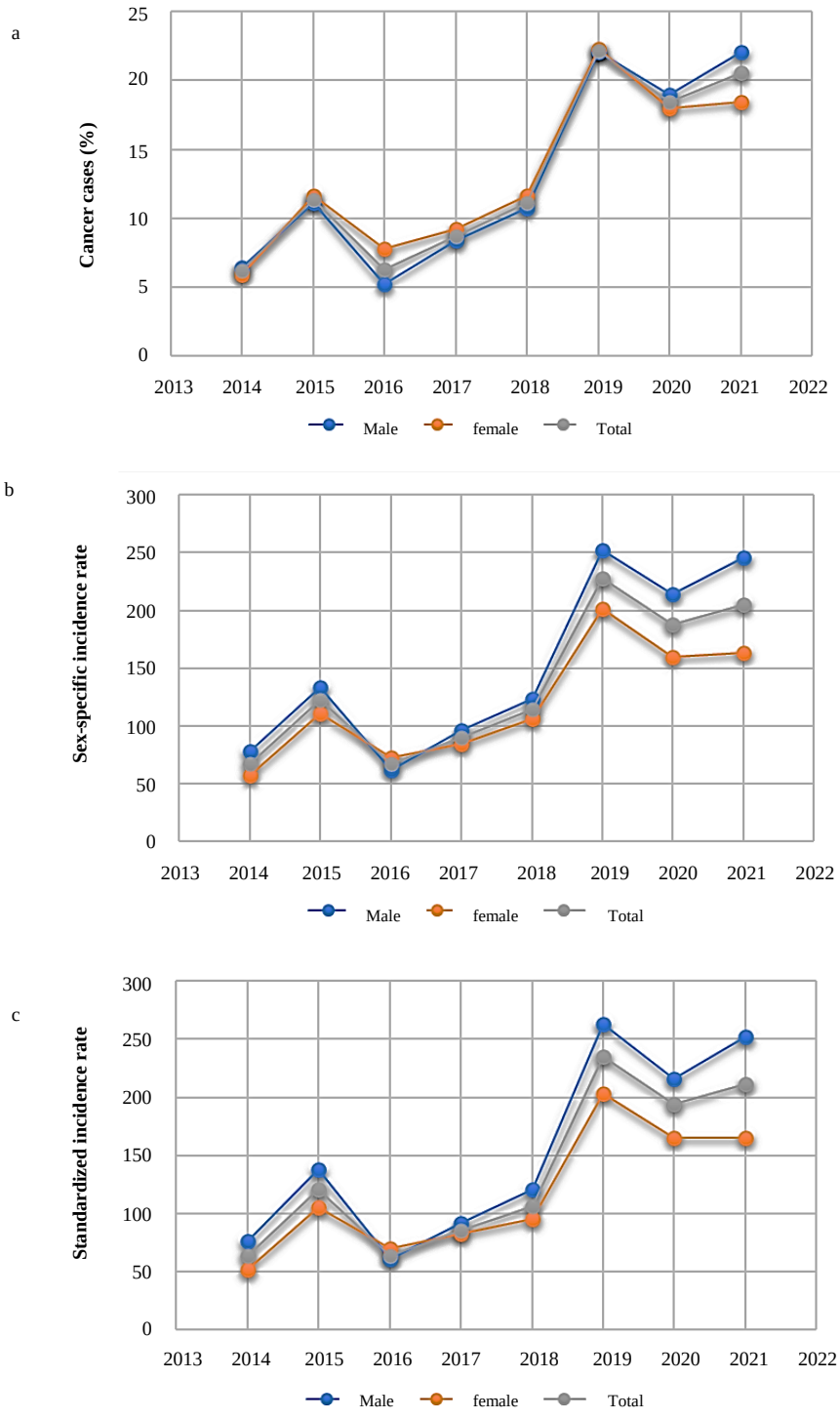

Figure 4. In children of 0-18 age range in Erbil city between 2014-2021: (a) the percentage of cancer cases, (b) sex-specific and (c) age-standardized incidence rate of cancer (per one million people).

DISCUSSION

Although all forms of cancer in people under the age of 18 are extremely uncommon and make up less than one percent of all cancers, they are still one of the leading causes of death in children, and since Iraq is one of the

nations with a young population, with a sizeable portion of that population falling under the age of 18, it is important to pay attention to the issues that this group faces. The results of a census carried out in 2019 by the Iraqi statistical center revealed that more than 31% of the population in the Erbil city is comprised of individuals who are younger than 18 years of age. Blood-related cancers made up the highest proportion of new cancer cases during the 8 years under investigation in this study, similar to other studies carried out in various societies [27–31]. Following that, cancers of the eye, brain, CNS, lymph nodes, bones, and joints, urinary tract, kidney, digestive system, skin, soft tissues, thyroid and endocrine glands, respiratory system, lip, mouth, and pharynx, as well as breast and other cancers, were ranked next. Other studies found that blood cancer was most common, followed by lymph node, eye, brain, and CNS cancers [32–35]. A study in the city of Basrah using cancer registry data came to similar conclusions [36]. In this study and over the course of 8 years (2014–2021), the age-standardized incidence rate of cancer in individuals under the age of 18 was equal to 73, 118, 73, 89, 112, 241, 199, 213 cases per million people, respectively. These figures demonstrate a rising cancer incidence in this age group. Of course, a significant portion of this rise in incidence rates may be attributable to a modification in the process of recording new cases of cancer; as discussed in the methodology section, preparations for population-based cancer registration have been made since 2019, whereas prior to that, cancer registration in Erbil was based on pathology centers. According to a study of the Basrah there are 100 new cases of cancer for every million people under the age of 19 [36]. It was calculated to be between 126.7 and 87.8 cases per million people in a study done in India between 2010 and 2018 [37]. Also, in the study conducted in Switzerland (1985-2014), the incidence rate of cancer was calculated as 142 cases per one million people [38]. Another study that looked into the epidemiology of childhood cancer in Europe found that the British Isles had the lowest incidence rate (130 cases per million people) and Scandinavian countries had the highest incidence rate (160 cases per one million people) [39]. According to the GLOBOCAN report from 2018, developing nations like Kenya, Iran, Egypt, India, and Zimbabwe have the lowest incidence rates of most cancers (at all ages) compared to developed nations (in both sexes) [40]. The highest incidence rates are found in developed nations like the United States of America, Canada, and Denmark for women and Hungary, Poland, and Belgium for men. The insufficient recording of data on some variables and the patient referral to other provinces are two of this study's limitations that could be mentioned.

CONCLUSIONS

Based on the findings of this study, it was discovered that Erbil city, a region of a developing country, has a different incidence rate for the under 18 age group than developed countries, particularly in the study's most recent years, which are based on registered information based on population. This might be as a result of the alteration in lifestyle and the greater impact it has on children. Although the difference in the incidence of cancer between developing countries and advanced countries is greater in old age, this is likely due to the fact that people who have reached this age belong to older cohorts and are, by nature, less affected by changes in lifestyle.

Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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