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Global Leukemia Trends: Analysis and Indicators

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Abstract

Background: Leukemia is a malignant disease of the blood and bone marrow that leads to cancer and accounts for 2.5% of all other cancers, with a small mortality rate (3.1) among the deaths of other cancers. Objective: This paper discusses the global data on leukemia-related cancer, its analysis and comparison by region, and a discussion of children's cancer cases of this type, in addition to an Iraqi leukemia patient analysis of white blood cell (WBC) count and hemoglobin (HB) levels before and after cancer collection from laboratories in medical city hospitals. Materials & Methods: Publications collected from the WHO for the year 2022 on the prevalence and mortality of leukemia-related diseases by region were used, with comparisons made and their indicators identified, as illustrated with graphs for each country. The blood parameters (WBC and Hb) of 25 leukemia patients before and after cancer were analyzed via paired sample t tests. Results: The data analysis shows that this type of cancer has the lowest incidence and mortality compared to other cancer types; Oceania has the lowest incidence and mortality, whereas Asia and Europe have the highest. Rates and deaths among children younger than nine years. In childhood deaths, there are two types of leukemia: acute lymphoblastic leukemia, precursor cell lymphoblastic leukemia, and NOS leukemia. The two types are equally likely. Two types, acute and precursor cell lymphoblastic leukemia, were present in a lower percentage of girls than boys, whereas other types were present in higher percentages. prevalence. In 2022, the number of cases of leukemia increased, particularly among Asian men. Conclusion: This paper offers a comprehensive explanation of leukemia by analyzing mortality and prevalence data and providing information on the frequency of this disease in children under ten years of age. The findings of the analysis revealed that, particularly in developed countries, the death rate is extremely low.

Keywords: *Cancer, Epidemics, Iraqi childhood leukemia.*

Introduction

Leukemia is a cancer of the tissues that make up the blood in the body, including the bone marrow and lymphatic system, and includes white blood cells, which constitute the body's first line of defense against infection; its symptoms include fever, chills, fatigue, weight loss, lymph gland enlargement, enlarged liver and spleen, and frequent bleeding [1, 2]. Leukemia differs from other cancers in that it produces abnormal blood cells, especially white blood cells. The spread of leukemia among children is more dangerous than that among adults and can be divided into two types: the acute type, with myeloid and lymphatic forms, and the other type, which is chronic according to the speed of development of the disease, as the blood cells in the first acute type divide very quickly before maturity, whereas those in the other type slowly develop [3,4]. Leukemia development has been linked to a number of environmental and genetic risk factors [5]. A higher incidence of certain leukemia subtypes is linked to ionizing radiation exposure. One risk factor for adult leukemia, especially AML, is benzene exposure [6]. The chance of developing acute leukemia later in life is increased by prior chemotherapy exposure, particularly with alkylating drugs and topoisomerase II inhibitors. The history of any hematologic cancer increases the likelihood of having another leukemia subtype later in life [7]. Subtypes of ALL are associated with viral infections, such as Epstein–Barr virus and human T-cell leukemia virus. A greater risk of AML and ALL is linked to a number of genetic abnormalities, including Down syndrome, Fanconi anemia, Bloom syndrome, and Li–Fraumeni syndrome [8-10].

Leukemia can be diagnosed in a laboratory by conducting several tests, the most important of which is a complete count of blood components, which gives initial signs of leukemia, or by the presence of an enlargement of the liver, spleen, and lymph nodes, sometimes a bone marrow biopsy is taken and examined in a laboratory or via a CT scan, and sometimes the symptoms of the disease do not appear via laboratory examination, especially at its beginning [11]. There are several ways to treat leukemia at the beginning of the disease, such

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as chemotherapy or radiation to eliminate cancer cells, or through bone marrow transplantation, blood transfusion can also be performed to treat anemia in patients, as can the use of antibiotics [12]. Treatment always varies depending on the age of the patient and the affected location. One of the most important reasons for preventing this disease is the absence of exposure to radiation, chemicals, and viral infections, as well as the need for communication and cooperation between the patient and the treating medical team. Scientific advances have greatly contributed to the identification of treatments for leukemia, and the vast majority of patients can recover [13-15].
There is no specific cause for this type of cancer, and the cause is probably historical, ionizing radiation or chemotherapy. This paper is based on an analysis of data issued by the World Health Organization by region and compares them with the number of cancer cases and mortality for both sexes with special graphs for each table. A special case study of a sample before and after treatment was also analyzed to determine the progression of the disease and the response of patients to the treatment.

Methodology

The Global Cancer Observatory and WHO provide online descriptions of the sources and procedures used to create the GLOBOCAN estimates. Data categorized by sex, age group, nation, or global region
In summary, the best sources of leukemia incidence and mortality data in each nation are used to create national estimates. Publications collected for the year 2022 on the prevalence and mortality of leukemia-related diseases by region were used, with comparisons made and their indicators determined, as illustrated with graphs for each country [16-29]. In addition, the blood parameters (WBC and Hb) of 25 leukemia patients (collected from a teaching laboratory in a medical city in Baghdad) before and after cancer were analyzed via paired sample t tests.
Multiple comparisons via one-way ANOVA and paired sample t tests were used to elucidate differences between groups on the basis of statistical significance via SPSS software and Microsoft Excel. Statistical significance was defined as $p < 0.05$.

Results and discussion

Data related to the incidence of leukemia-related cancer have been obtained from publications of the World Health Organization (2022) by regions of the world, as have data related to cancer mortality due to this disease. Table (1) and ‘’Figure 1’’ show that the highest incidence of leukemia-related cancer was in Asia (130921), accounting for almost half of the global cases (47%), followed by Europe (60105) (22%), and the lowest incidence of cancer-related cancer was in continental Oceania, where the incidence of female cancer was 7% lower than that of male cancer. With respect to mortality, Asia also had the largest share, with more than half of all cancer deaths (52%), followed by Europe (22%) and Oceania (1%), and female mortality was lower than male mortality (7%) (Table 2 and Fig. 2).

Table (1): Absolute incidence of leukemia-related cancer in males, females and both sexes in 2022 across all age groups

	Male	%	Female	%	Both Sexes	%
Asia	130921	47.1	96235	46	227156	0.47
Europe	60105	21.6	47643	22.8	107748	0.22
North America	42527	15.3	29140	13.9	71667	0.15
LAC	22548	8.1	18485	8.8	41033	0.08
Africa	17627	6.3	15371	7.3	32998	0.07
Oceania	4324	1.6	2327	1.1	6651	0.01
Total	**278120**		**209174**		**487294**	

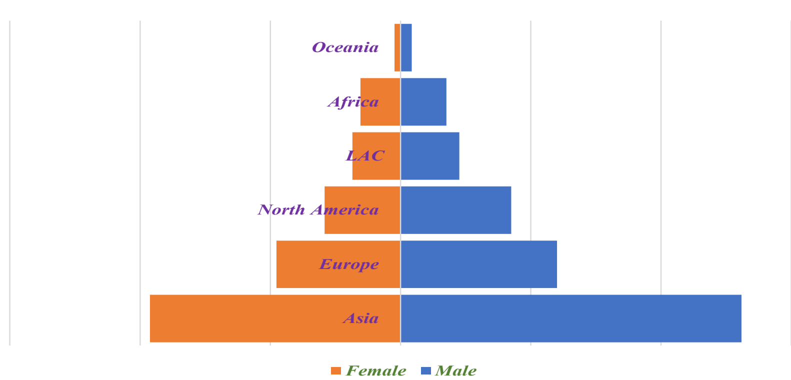

Figure 1. Absolute incidence of leukemia-related cancers in both sexes in 2022

Table (2): Absolute number of leukemia-related deaths in males, females and both sexes in 2022

	Male	%	Female	%	Both Sexes	%
Asia	91439	52.8	66705	50.2	158144	51.8
Europe	35196	20.3	28643	21.7	63839	20.9
North America	16169	9.3	11107	8.4	27276	8.9
LAC	15702	9.1	12968	9.8	28670	9.4
Africa	12989	7.5	11512	8.7	24501	8
Oceania	1794	1	1181	0.89	2973	0.97
Total	173289		132110		305405	

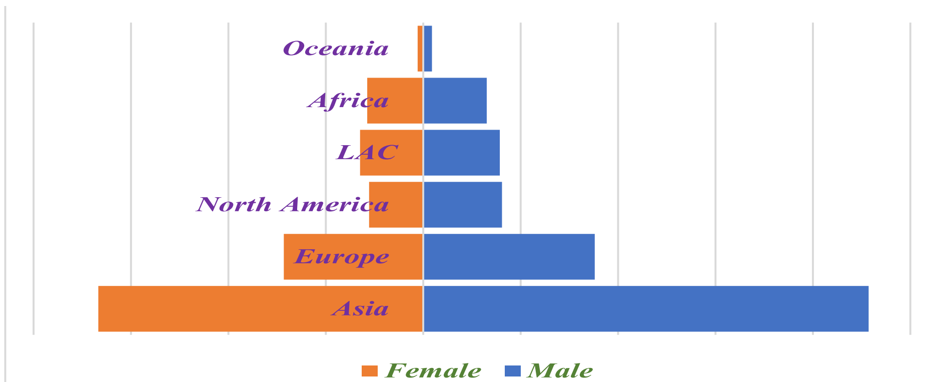

Figure 2. Absolute mortality of leukemia-related cancers in both sexes in 2022

The highest prevalence of leukemia cases was in Asia (45%), followed by Europe (24%) and, to the least extent, Oceania (1.5%), with the highest percentage of male-dominated cases compared with females (11%) (Table 3 and Figure 3).

Table (3): Estimated number of leukemia cancer prevalent cases in males, females and both sexes in 2022

	Male	%	Female	%	Both Sexes	%
Asia	91196	44.7	66182	44.2	157378	44.5
Europe	47805	23.4	36155	24.2	83960	23.7
North America	35133	17.2	23722	15.9	58855	16.6
LAC	16197	7.9	13012	8.7	29209	8.3
Africa	10162	5	8740	5.8	18902	5.3
Oceania	3478	1.7	1839	1.2	5317	1.5
Total	**203971**		**149650**		**333621**	

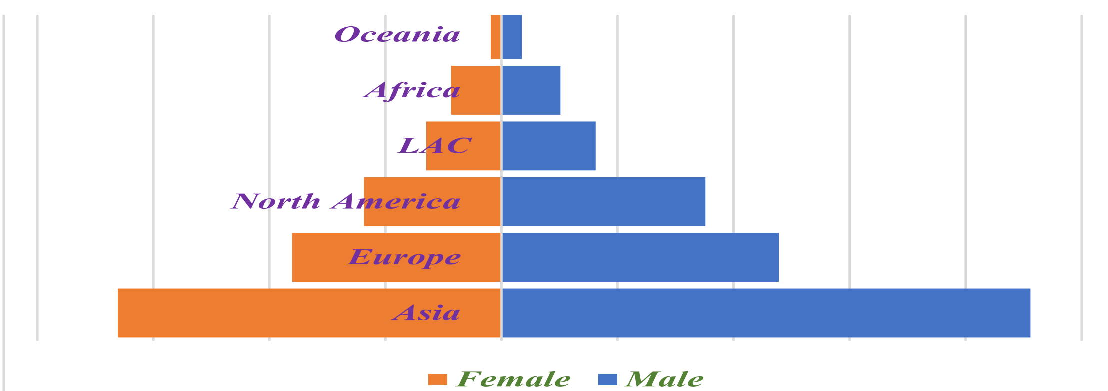

Figure 3. Estimated number of leukemia cancer-prevalent cases in 2022

The age-standardized global rate (per 100000) incidence and mortality was the highest for males in Australia, followed by North America and then Western, Northern, Southern, and Eastern Europe. The lowest rate was in Central and Western Africa, indicating that the rates of incidence and mortality are higher for males than for females, accounting for one third of the rate (Table 4, and Figs. 4, 5).

Table (4): Age-standardized global rate (per 100000) incidence and mortality for males and females in 2022

	Incidence			Mortality		
	Male	Female	Both	Male	Female	Both
Australia	15.3	9	11.4	4.6	2.4	3.5
N. America	13.7	7.6	11.2	4.1	2.5	3.1
W. Europe	10.8	6.8	8.7	4.4	2.6	3.4
N. Europe	10.5	6.7	8.5	3.7	2.2	2.9
S. Europe	9.4	6.1	7.7	4.4	2.6	3.4
E. Europe	8.3	5.6	6.8	4.4	2.6	3.3
W. Asia	6.9	5.5	6.2	4.3	3.8	4.2
C. America	6.6	5.3	5.9	4.4	3.4	3.9
Caribbean	6.5	4.6	5.5	4.2	3	3.6
S. America	6.4	4.6	5.5	4.2	3.3	3.5
S – E Asia	6.2	4.6	5.4	4.5	3.1	3.8
N. Africa	5.5	4.4	4.9	4	3.1	3.5
E. Asia	5.4	4.3	4.7	2.9	3.5	2.4
Melanesia	4.9	4	4.6	3.8	2	3.7
Polynesia	4.6	3.1	3.8	3.2	2.6	2.6
S – C. Asia	4	3	3.7	3.7	2.2	2.7
S. Africa	3.6	3	3.4	2.9	2	3
E. Africa	2.4	3	3.3	1.4	2.4	2.7
Micronesia	2.2	2.5	2.3	1.9	0.9	1.1
M. Africa	2	1.8	2	1.7	1.6	1.7
W. Africa	1.9	1.8	1.9	1.6	1.5	1.6

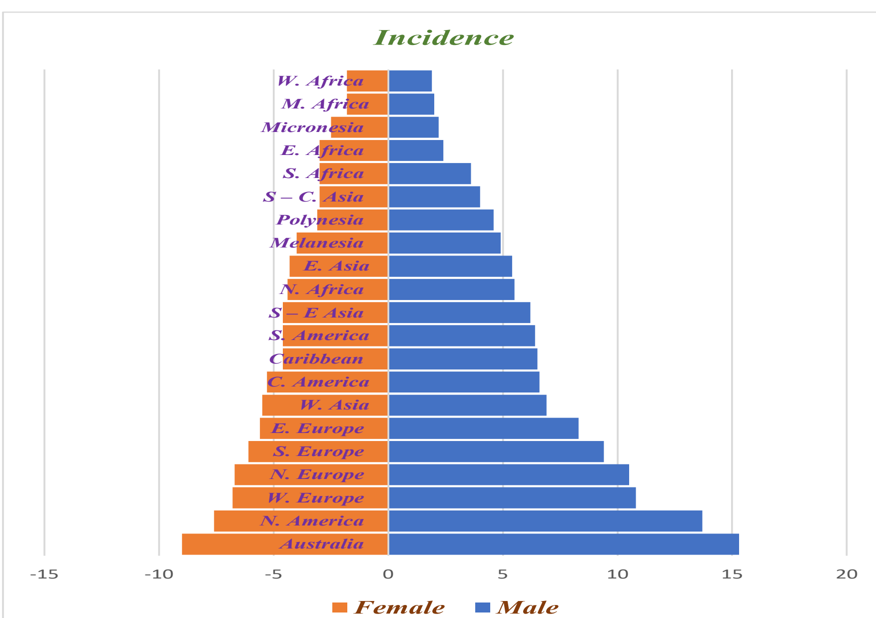

Figure 4. Age-standardized global incidence rate (per 100000) 2022

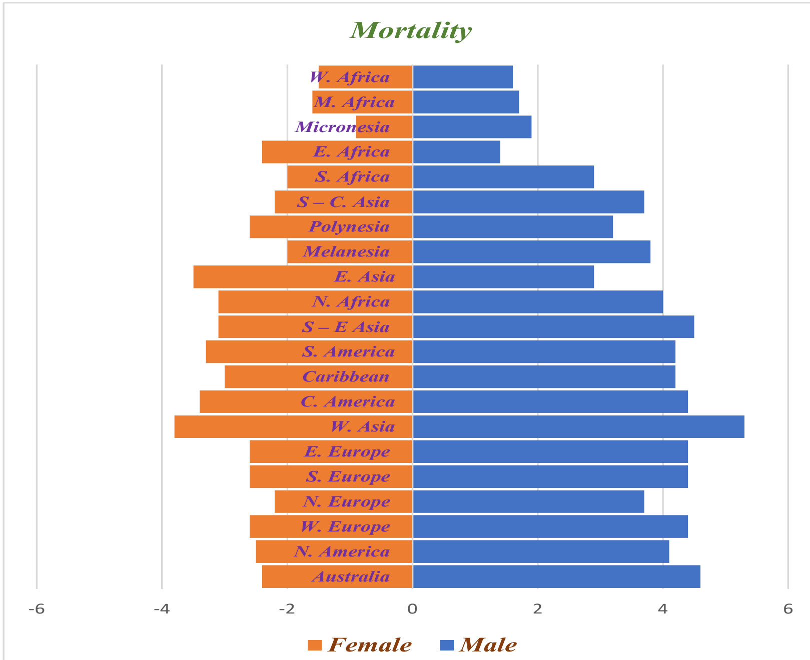

Figure 5. Age-standardized global rate (per 100000) of mortality 2022

Childhood leukemia Indicators

The cases of leukemia cancer in children aged 0--9 years were the highest in Asia, with a high percentage (60.5%), followed by Europe (8.8%) and Oceania (0.86%), and the number of male cases was greater than that of female (8%) cases (Table (5), Figure 6). The highest mortality cases were in Asia (65%), followed by Africa (17%), Latin America (13%), and Europe (3%), and no child deaths were recorded in North America or Oceania. Cases of children accounted for 10% of all ages, while deaths accounted for 5%, Table 6 and Figure. 7.

Table (5): Absolute number of leukemia cancer incidence in males, females and both sexes aged 0–9, 2022

	Male	%	Female	%	Both Sexes	%
Asia	16975	61.5	11713	58.1	28688	60.1
Europe	2341	8.5	1840	9.1	4181	8.8
North America	1564	5.7	1366	6.5	2870	6
LAC	3316	12	2566	12.7	5882	12.3
Africa	3156	11.4	2586	12.8	5742	12
Oceania	236	0.86	165	0.8	401	0.84
Total	27588		20176		47764	

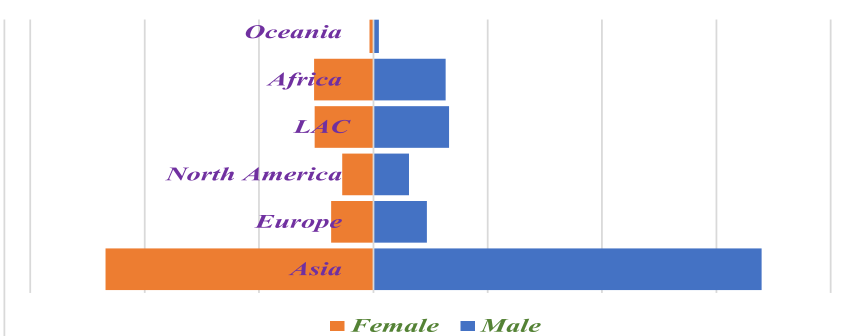

Figure 6. Absolute incidence of leukemia by age (0–9) 2022

Table (6): Absolute number of leukemia cancer mortality males, females and both sexes aged 0–9 years in 2022

	Male	%	Female	%	Both Sexes	%
Asia	6426	66.9	4239	62.4	10665	65
Europe	281	2.9	234	3.4	515	3.1
North America	-	-	-	-	-	-
LAC	1197	12.5	922	13.6	2119	12.9
Africa	1545	16.1	1260	18.6	2805	17.1
Oceania	-	-	-	-	-	-
Total	**9011**		**6790**		**16401**	

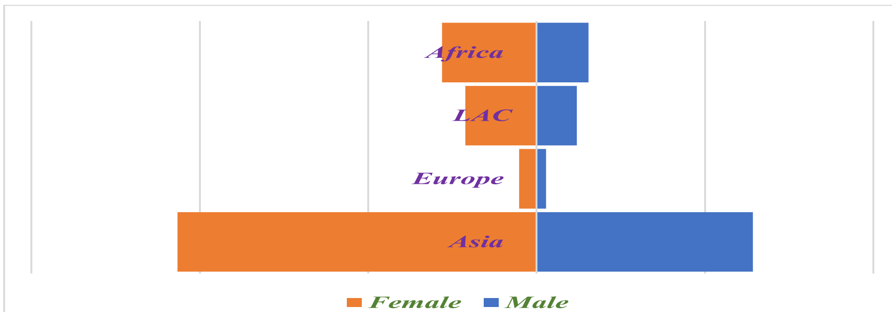

Figure 7. Absolute mortality of leukemia patients between 0 and 9 years of age in 2022

Indicators of Iraqi Childhood Leukemia

The incidence of leukemia for the age of 0--14 years was greater for boys than for girls, with an increase in the number of cases for both sexes for the period 2000--2019, with a total of 8570 cases (Table (7) and Figure 8).

Table (7): The number of incident leukemia cases by age (0--14) for the period 2000--2019

Year	Boy		Girl		Both	
	Incidence	%	Incidence	%	Incidence	%
- 2000	999	20.5	676	18.3	1675	19.5
- 2005	1028	21.1	753	20.4	1781	20.8
- 2010	1371	28.2	1128	30.5	2499	29.2
2019 – 2015	1473	30.2	1142	30.9	2615	30.5
Total	**4871**		**3699**		**8570**	

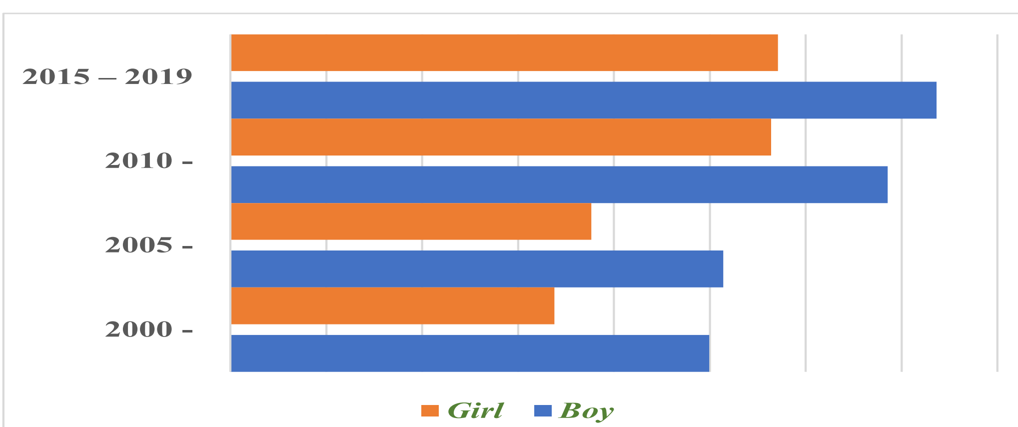

Figure 8. The number of cases of incident leukemia by age (0--14) for the period 2000--2019

The leukemia type associated with the greatest morphological distribution of childhood mortality is acute lymphoblastic leukemia (33.7 & 33.3), followed by precursor cell lymphoblastic leukemia (16.3 & 12.5). The two types associated with the lowest morphological distribution are acute and lymphoid, NOS leukemia (6.1 & 6.2). two types, the percentage of girls was lower than that of boys, with acute and precursor cell lymphoblastic leukemia; the percentage of others was greater (Table (8), Figure 9).

Table (8): Morphological distribution of childhood mortality (%) 2000–2019

Leukemia Types	Boy	Girl
Acute Lymphoblastic Leukemia	33.7	33.3
Precursor Cell Lymphoblastic Leukemia	16.3	12.5
Leukemia, NOS	15.3	18.8
Acute Myeloid Leukemia	11.2	12.5
Acute Leukemia, NOS	6.1	6.2
Lymphoid Leukemia, NOS	6.1	6.2
Others	11.2	10.4

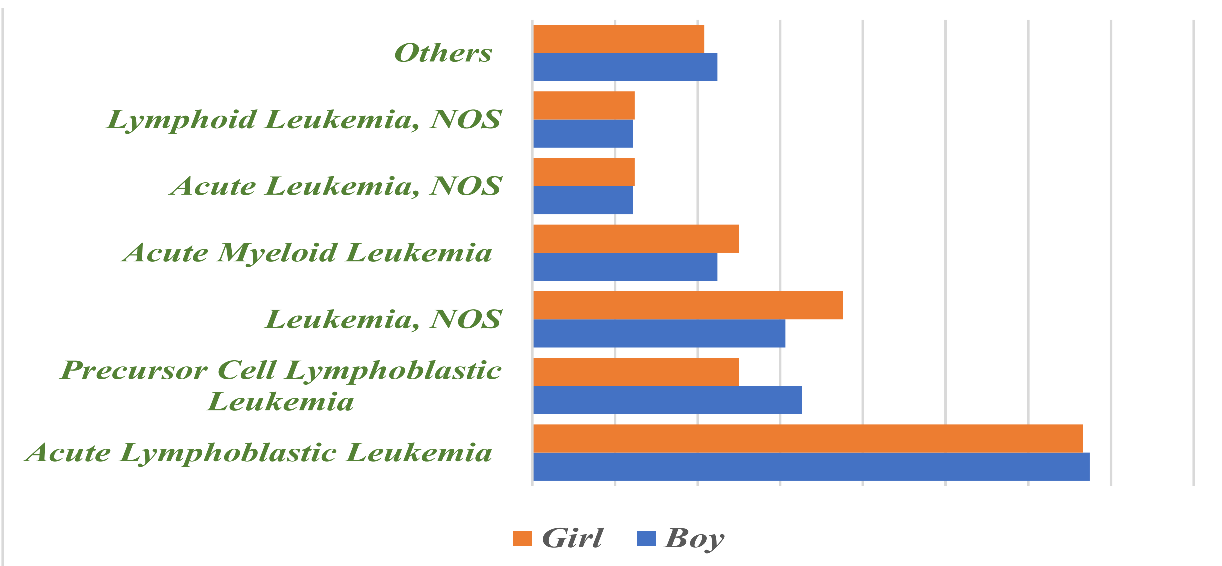

Figure 9. Morphological distribution of childhood mortality from 2000–2019

The age-specific incidence rates were highest in the lower age group (0–4) and highest in the last age group (10–14) (25%). The leukemia ASR for both sexes was also greater in the lowest age group, with a decreasing pattern in the other age groups (Table 9; Figure 10).

Table (9): Age-Specific Incidence Rates of Childhood Leukemia by Age Group 2000–2009

Age Group	Incidence	%	ASR
- 0	3596	41.96	3.88
- 5	2828	33	3.41
14 – 10	2146	25.04	2.9

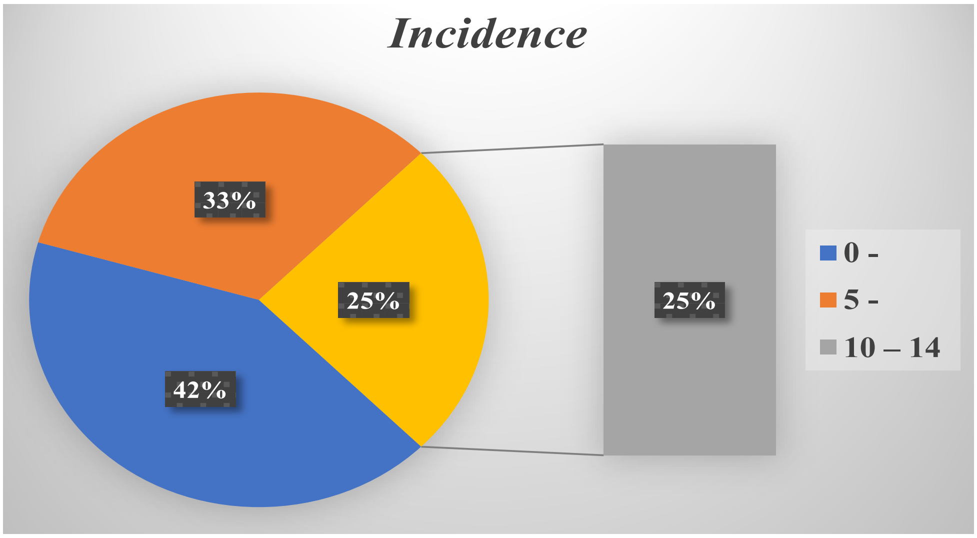

Figure 10. Age-Specific Incidence Rates of Childhood Leukemia by Age Group 2000–2009

The highest age group was for the category of children (less than ten years) for males as well as for females (25%), that is, a quarter of the number of all age groups, and the lowest age group was 70 years and older (Table (10) and Figure 11).

Table (9): Age-Specific Incidence Rates of Childhood Leukemia by Age Group 2000–2009

Age groups	Male	%	Female	%	Both	%
- 0	233	0.25	188	0.25	421	0.25
- 10	138	0.15	92	0.12	230	0.14
- 20	86	0.09	62	0.08	148	0.09
- 30	77	0.08	63	0.08	140	0.08
- 40	76	0.08	86	0.11	162	0.09
- 50	103	0.11	73	0.09	176	0.10
- 60	111	0.12	79	0.10	190	0.11
- 70	86	0.09	75	0.09	161	0.09
80+	30	0.03	35	0.04	65	0.04

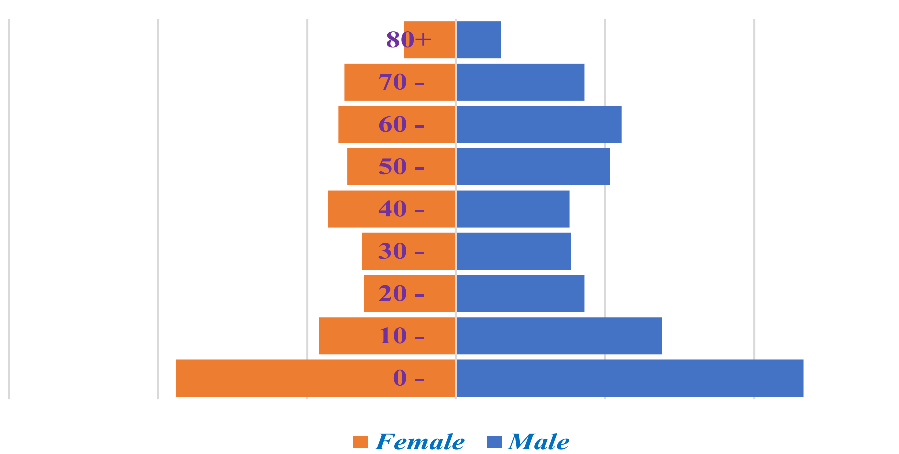

Figure 11. Distribution of Iraqi leukemia cancer males and females by age group

The highest distribution crude mortality rate (per 10000) was for the category of children (less than ten years), by (14%), and the lowest age group was (80+), as shown in Tables (10) and (13).

Table (11): Distribution of the crude mortality rate (per 10000) of Iraqi leukemia patients by age group

Age group	- 0	- 10	- 20	- 30	- 40	- 50	- 60	- 70	80+
Mortality	111	116	71	63	64	99	130	111	53
%	0.14	0.14	0.09	0.08	0.08	0.12	0.16	0.14	0.06

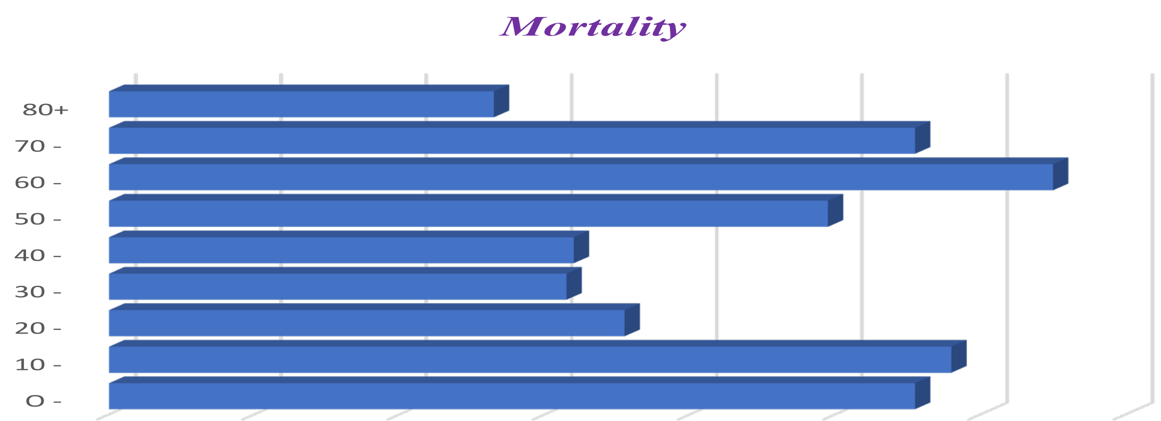

Figure 12. Distribution of the crude mortality rate (per 10000) of Iraqi leukemia patients by age group

A sample of (25) pathological cases was taken from the Education Laboratory of the Iraqi Medical City for testing (WBC) and (HB) before and after diagnosis. This sample was tested via paired sample t tests according to the statistical program SPSS. The test values (t) were moral and confirmed the correctness of the diagnosis and that all the sample members had leukemia cancer. There was a significant increase in the WBC count but a decrease in the Hb value in patients with leukemia, which is a primary indicator of leukemia (Table 13).

Table 12. Paired sample test (WBC)

	mean	Std. deviation	Std. error	P value
WBC count	14144	4550.7	910.1	0.000 >
Hb	-5.5	1.4	0.28	0.000 >

According to a 2022 study conducted in Ethiopia, the average WBC count of patients with chronic lymphocytic leukemia was strongly correlated with age, sex, lymphocytic status, disease stage, marital status, platelet count, hemoglobin level, RBC count, and follow-up period. Therefore, medical professionals should prioritize and pay proper attention to the elements that have been discovered, as well as provide regular counseling regarding how to improve the health of patients with chronic lymphocytic leukemia [30].

One possible explanation for the decline in leukemia mortality rates is the advancement of early cancer detection or the introduction of new, effective treatments, which will initially be implemented in urban hospitals or research facilities before gradually spreading to more rural, outlying hospitals. They will therefore take time to have an impact on mortality rates, leading to declining trends in rural regions. For leukemia mortality, this results in significant sex and rural–urban differences [31].

Conclusion

Because of the significant advancements in science, particularly in the early stages of its discovery, there are now viable treatments for this type of disease, which limits its progression within the body and the potential for patient therapy. The findings of the analysis revealed that, particularly in industrialized nations, the death rate is extremely low. As a result, all nations should take appropriate precautions to safeguard their population and follow the guidelines and recommendations of the World Health Organization. To learn more about leukemia risk factors and preventative strategies, studies concentrating on epidemiological evidence, experimental evidence, and "before-after" effects are needed.

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Conflicts of interest: None.

Author Contribution Statement

Ibrahim N and Abass SM did the conception, design, acquisition of data. Qasim A, Ibrahim N and Zeadan A conducted analysis. All authors took part in interpretation, drafting the A SM, revision and proofreading.

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