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Patterns of hematological malignancies in Kordofan Oncology Center, Sudan

Short title: Epidemiology of Leukemia Types in Kordofan

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Abstract

Background: Hematological Malignancies (HM) incidence is uprising in developing countries with limited resources especially in Sudan. **Methodology:** This descriptive retrospective study was conducted by utilizing leukemia data acquired from Kordofan Oncology Center for Chemotherapy, El-Obeid, Sudan between 2016 to 2023. The study included a total of one hundred patients. Data were retrieved from the files of patients who were admitted to Kordofan Oncology center with hematological malignancies. **Results**: CLL is the most prevalent HM representing 61%, followed by CML accounting for 17%, then NHL which is 11%, MM 6% and HL 3%. Approximately 58% of males and 42% of females were affected with HM. Although HM were more prevalent among older individuals, chronic lymphocytic leukemia (CLL) was more usually observed in those aged over 71 years, accounting for 23 out of 61 cases (36%). The majority of participants in this study were persons residing in urban areas. The majority of patients with HM were housewives, followed by self-employed individuals and farmers, accounting for 31 out of 88 (35%), 28 out of 88 (32%), and 13 out of 88 (15%) patients, respectively. Regarding staging 39% of patients were at stage 1, 27% patients stage II, 25% patients stage IV, and 9% patients at stage III. **Conclusion:** CLL was the dominant type of hematological malignancies observed in Kordofan Oncology Center. beside the majority of cases were observed among males, urban residents, and elder populations aged >70 years. Special focus should be given to the highly affected population. Further more detailed studies are required in the Sudan.

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Keywords: Leukemia, Lymphoma, El-Obeid, Sudan

Introduction:

Hematological malignancies are a heterogeneous group of neoplasms in the blood which comprise leukemia, lymphoma, and myeloma; characterized by dysregulated hematopoiesis [1]. HM is one of the most common cancers and leading cause of the global tumor burden [2]**.** It represents 6.5% of all cancers worldwide [3]. Approximately 185,840 individuals were diagnosed with hematologic malignancies in the United States in 2020, including multiple myeloma and all forms of lymphomas and leukemias [4]. Occupational Exposure to benzene and formaldehyde is a known risk factor for leukemia [5]. Overweight/obesity, adult attained height and physical activity are possible risk factors for hematological malignancies [6].

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HM ranked as the second commonest malignancy in Sudan, accounting 10:100000 for leukemia and 8.2 per 100000 for lymphomas [7]. In Sudan paucity studies were conducted regarding this issue. This study aimed to determine the patterns of different hematological malignancies in Kordofan states, Sudan.

Materials and Methods:

This descriptive retrospective study was conducted by utilizing leukemia data acquired from Kordofan Oncology Center for Chemotherapy, El-Obeid, Sudan between 2016 to 2023. The study included a total of one hundred patients. Leukemia is a dependent variable while the independent variables were age, gender, residence, tribe, inhabitants, occupation, year of diagnosis and stage of disease. Data were retrieved from the files of patients who were admitted to Kordofan Oncology center with any type of hematological malignancies during the period.

Statistical Analysis:

Initially data were prepared in data sheet, then entered a computer software statistical package for social analysis (SPSS version 24, Chicago, USA). Frequences, Percentages, Cross tabulation and Chi Squire test were calculated. Considering 95% confidence interval (95% CI), P-value was calculated. P-value <0.05 was considered statistically significant.

Ethical Approval:

Ethical approval was obtained from Ministry of Health Ethical Committee, North Kordofan State, El-Obeid, Sudan. The research protocol was approved by the human Research Ethics Committee (HREC) at Prof. Medical Research Center-MRCC. Ethical Approval Code: HREC 0006/MRCC.3/24.

Results:

This study investigated 100 patients, aged 15 to 117 years, with a mean age of 61 years. Out of them 43 were males and 34 females. Most of participant in this study were aged ≥71, followed by 61-70, 51-60, and <40 representing 28/100(28%), 28/100(28%), 22/100(22%), and 14/100 (14%) respectively. Of the 100 patients, 78% patients including 43 (55%) male and 35 (45%) female were from Urban area, and 22% including 14(64%) male and 9 (36%) female were from the Rural area. As indicated in Table1 and Fig.1, most of the patients were identified as housewives, followed by self-employed individuals, farmers and employers, accounting for 31/89(3), 28/89 (31%), 13/89(15%) and 5/89(6%), respectively.

Table 1 Distribution of the study population by demographic characteristic

Variable	**Males**	Females	**Total**
Age			
≤ 40 years	7	7	14
41-50	4	4	8
51-60	12	10	22
61-70	15	13	28
≥ 71	19	9	28
Total	57	43	100
Residence			
Urban	43	35	78
Rural	14	8	22

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Total	57	43	100
Occupation			
Self-employed	27	1	28
Farmer	12	1	13
Employer	3	2	5
Retired	7	1	8
Housewife	0	31	31
Student	2	1	3
Other	1	0	1
Total	52	37	89

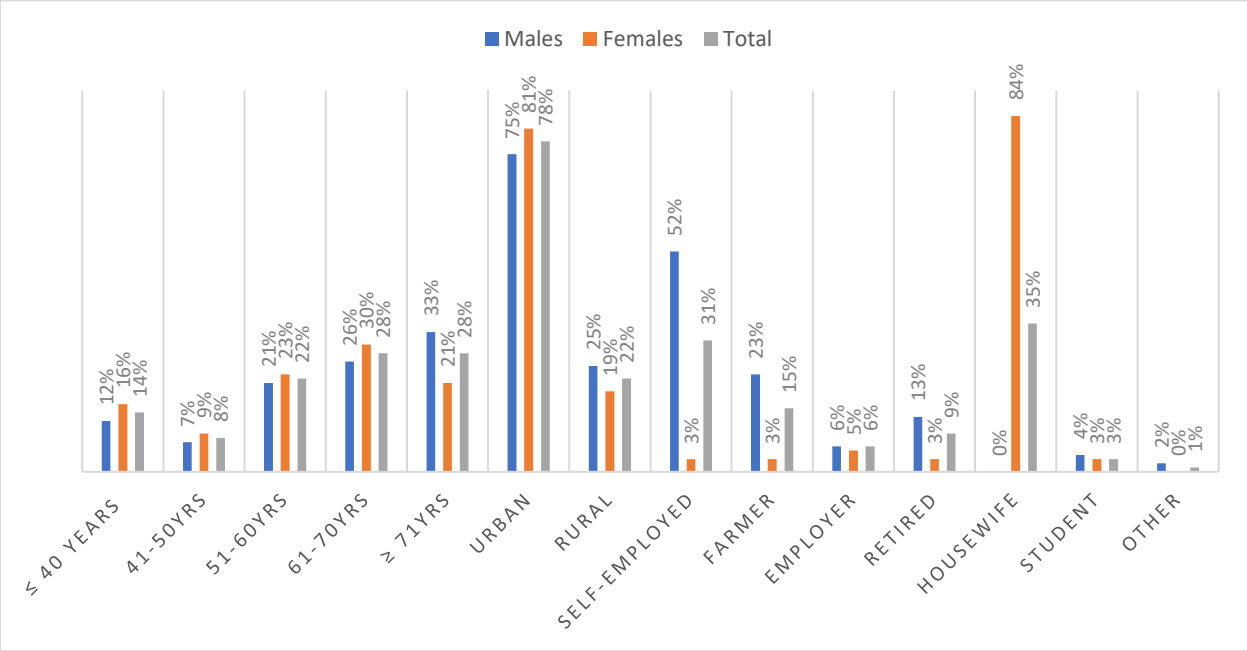

Figure 1 Description of the participant by demographical characteristics

The distribution of the study subjects by year of diagnosis was presented in Table2 and Figure 2. Approximately most of the patients were diagnosed in 2021, followed by 2020, 2018, 2019, 2022 and 2017 accounting for 22%, 18%, 17%, 13%, 12% and 8% respectively.

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Table 2 Distribution of the study subjects by year of diagnosis

Variable	Male	Female	Total
Year of diagnosis			
2016	1	1	2
2017	4	4	8
2018	11	6	17
2019	9	4	13
2020	7	11	18
2021	15	7	22
2022	4	8	12
2023	4	2	6
Total	55	43	98

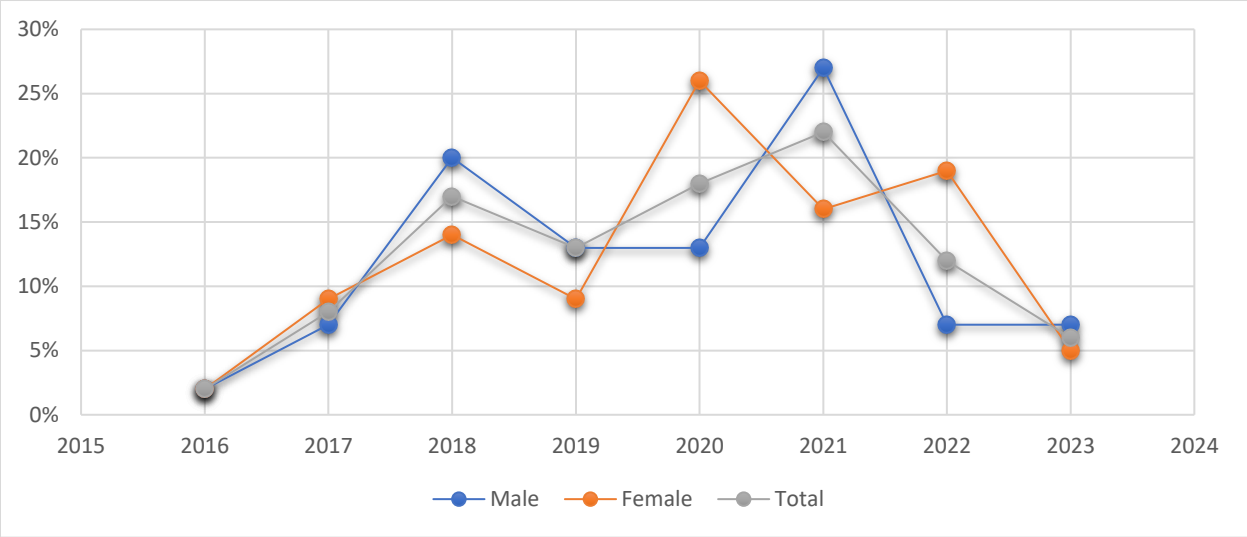

Figure 2 Description of study population by year of diagnosis

The distribution of hematological malignancies and demographic features was presented in Table 3 and Fig.3. CLL is the most prevalent HM representing 61%, followed by CML accounting for 17%, then NHL which is 11%, MM 6% and HL 3%. Approximately 58% of males and 42% of females were affected with HM. Although HM was more prevalent among older individuals, chronic lymphocytic leukemia (CLL) was more usually observed in those aged over 71 years, accounting for 23 out of 61 cases (36%). The majority of participants in this study were persons residing in urban areas. The majority of patients with HM were housewives, followed by self-employed individuals and farmers, accounting for 31 out of 88 (35%), 28 out of 88 (32%), and 13 out of 88 (15%) patients, respectively, as shown in Table 3 and Fig. 3.

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Table 3 Distribution of Hematological Malignancies by demographic characteristics

Variable	Chronic Lymphocytic Leukemia	Hodgkin Lymphoma	Non-Hodgkin Lymphoma	Multiple Myeloma	Chronic Myeloid Leukemia	Total
Age						
<40 years	3	1	2	0	6	13
41-50	3	0	3	0	2	8
51-60	14	0	3	1	4	22
61-70	18	2	0	2	5	27
71+	23	0	3	3	0	29
Total	61	3	11	6	17	99
Sex						
Male	37	2	3	5	9	57
Female	24	1	8	1	8	42
Total	61	3	11	6	17	99
Residence						
Urban	48	1	8	5	14	77
Rural	13	2	3	1	3	22
Total	61	3	11	6	17	99
Occupation						
Self employed	17	0	1	3	7	28
Farmer	9	1	2	0	1	13
Employer	3	0	1	0	1	5
Retired	4	0	1	2	1	8
Housewife	18	1	4	1	7	31
Students	0	1	1	0	0	2
Total	52	3	10	6	17	88

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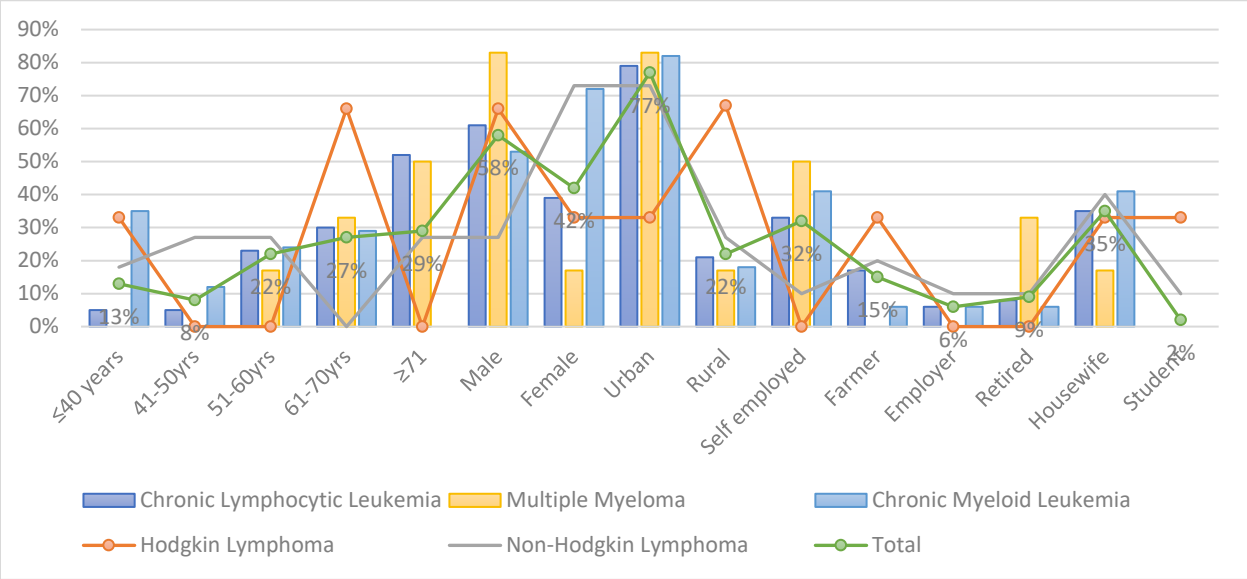

Figure 3 Description of Hematological Malignancies by demographic characteristics

As presented in Table 4 and Fig.4, most of HM were diagnosed between year of 2020 to 2021, followed by 2018, 2019, and 2017 representing 18%, 22%, 17% 12% and 8% in that order. CLL represents the most commonly diagnosed HM in 2021 accounting 14 cases out of 22 (64%) and in 2018, 16 cases out of 17 (94%).

Table 4 Distribution of Hematological Malignancies by year of diagnosis

Variable	Chronic Lymphocytic Leukemia	Hodgkin Lymphoma	Non-Hodgkin Lymphoma	Multiple Myeloma	Chronic Myeloid Leukemia	Total
Year of diagnosis						
2016	1	0	1	0	0	2
2017	7	0	1	0	0	8
2018	16	0	1	0	0	17
2019	8	0	1	1	2	12
2020	5	0	6	2	5	18
2021	14	3	1	1	3	22
2022	7	0	0	0	5	12
2023	3	0	0	2	2	6
Total	61	3	11	6	16	97

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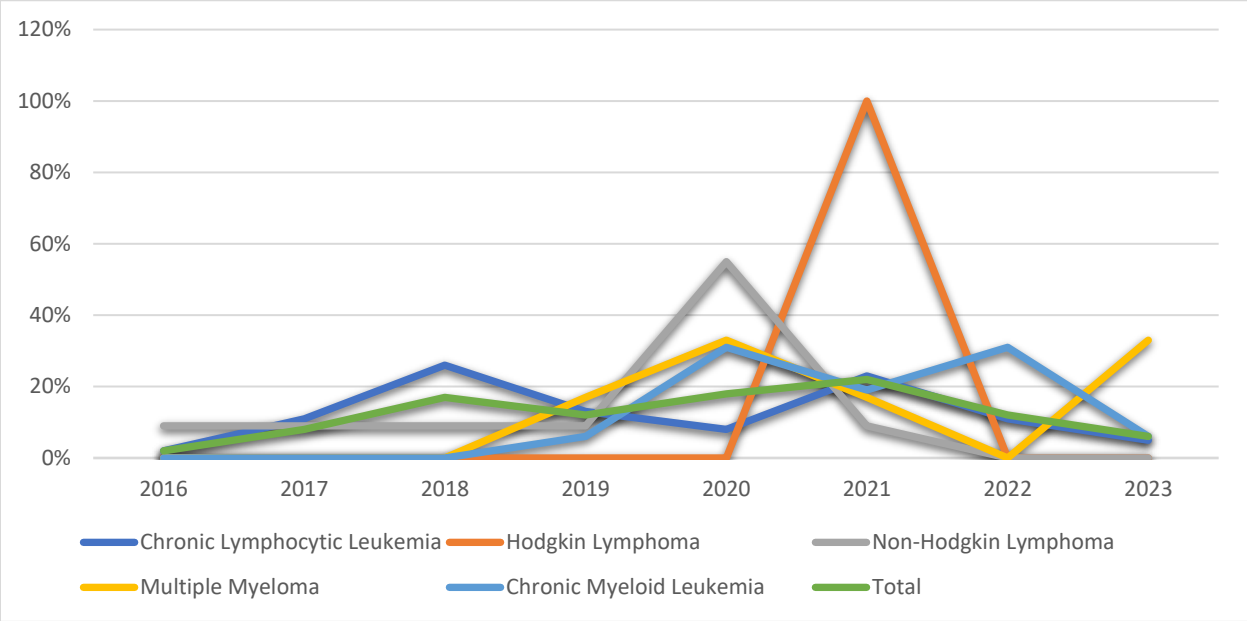

Figure 4 Distribution of hematological Malignancies by year of diagnosis

The distribution of HM according to stage of disease was 39% patients at stage 1, 27% patients at stage II, 25% patients at stage IV, and 9% patients at stage III.

Table 5 Distribution of Hematological Malignancies by stage of disease

Variable	Chronic Lymphocytic Leukemia	Hodgkin Lymphoma	Non-Hodgkin Lymphoma	Total
Stage of disease				
Stage I	17	0	0	17
Stage II	12	0	0	12
Stage III	4	0	0	4
Stage IV	8	1	2	11
Total	41	1	2	44

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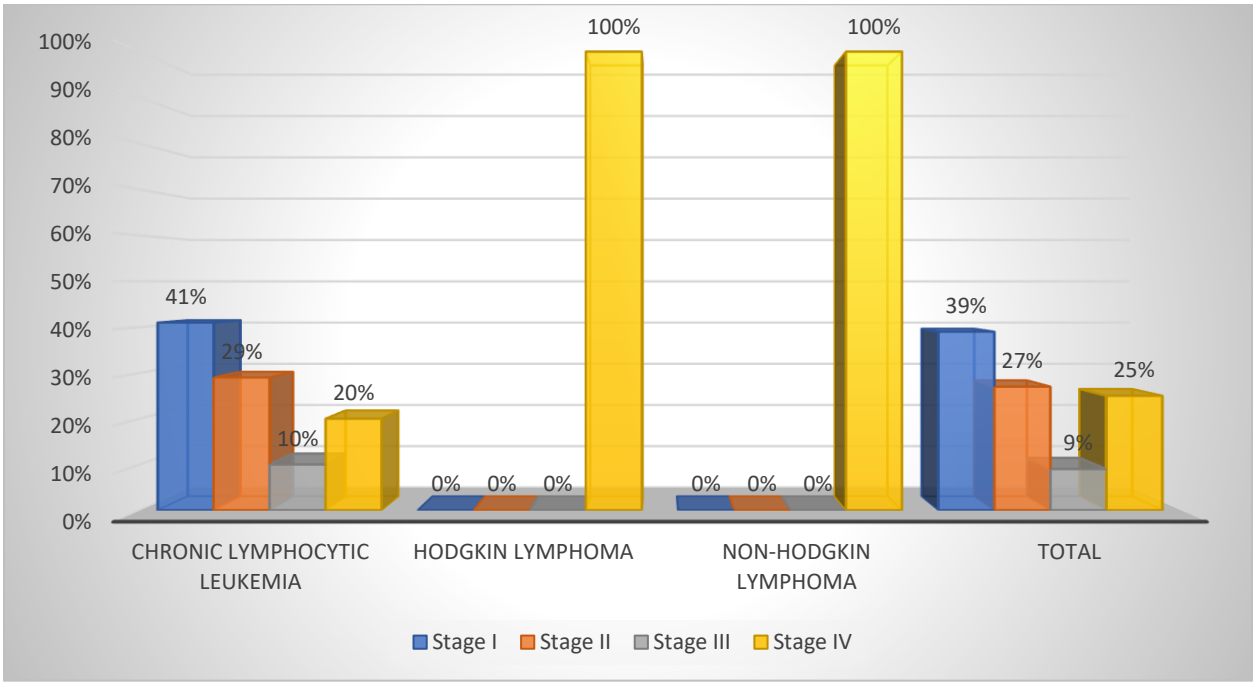

Figure 5 Destribution of Hematological Malignancies by stage of disease.

According to the distribution of HM by, the most commonly affected inhabitants setting was El-Obeid, Elnehoud and Alkhowai accounting for 40%, 9% and 5% respectively, as presented in Table 6.

Table 6 Distribution of Hematological Malignancies by tribe and Inhabitant of including cities, town and villages.

Variable	Chronic Lymphocytic Leukemia	Hodgkin Lymphoma	Non-Hodgkin Lymphoma	Multiple Myeloma	Chronic Myeloid Leukemia	Total
Inhabitant of						
Abuharaz	1	0	0	0	1	2
Abuzabad	3	0	1	0	0	4
Aldalang	1	0	0	0	0	1
Aldeain	1	0	0	0	0	1
Alhamadi	1	0	0	0	1	2
Alkhowai	4	0	0	0	1	5
Almoglad	0	0	2	0	0	2
Alrahad	1	0	0	0	0	1
Arahad	1	0	0	0	0	1
Bara	1	0	0	2	2	5
Debebat	3	0	0	0	0	3
Elfola	0	0	0	0	1	1

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Elnehoud	4	1	2	0	2	9
Elobied	28	0	4	3	4	40
HamratElsheikh	0	0	1	0	0	1
Kadogli	1	0	0	0	0	1
Kazgeal	0	2	0	0	0	2
Lagawa	1	0	1	0	0	2
South Kordofan	1	0	0	0	0	1
Umdamm	0	0	0	1	0	1
Umkarshola	1	0	0	0	0	1
Umkredim	1	0	0	0	1	2
Umrawaba	2	0	0	0	1	3
Umrawba	0	0	0	0	1	1
Wadbanda	2	0	0	0	0	2
West Kordofan	3	0	0	0	2	5
Total	61	3	11	6	17	99

Discussion:

Hematological malignancies are among the leading cancers worldwide, therefor effective management and choice of appropriate treatment of HM depend on an accurate diagnosis and differentiation, which require comprehensive haematology and pathology work, however in Sudan and due to limited health care facilities due to economic shortages, alongside the ongoing destructive conflict, there is increase of numerous cancers including hematological cancer.

The findings of the present study show a relatively higher prevalence rate of HM especially in elder ones, in this study HM are more frequent in male than female. Similar results were reported in Sudan [8]. Hence, male study participants were more exposed to different HM than females. This is due to male study participants being more exposed to different risk factors that induce HM than females. In this study there are 40 cases of HM in two year (2020-2021), which represents 41% of all HM for those years. However; CLL represents the most commonly diagnosed HM in 2021 accounting 64%, Similarly in earlier study; it was pointed out that 49% were suffering from CLL [9].

In current study CLL is the most commonly diagnosed HM followed by CML. Comparable results were reported by Elsheikh, et al. [7]. late stage at diagnosis also observed in 25% of the patients. Late presentation has been documented in Sudan [10] and in East Africa [11]. In this study the ages affected by CLL were more than 71 years old (%), These results are in coincidence with other study which stated that the average age of individuals with chronic lymphocytic leukemia (CLL) is roughly 70 years [12].

Housewives and laborers (self-employed, farmers, retired and employee) were more frequently diagnosed than among any other occupation for females and males, respectively. These data are in accordance with study from Sudan [14].

The reason for some inhabitant area (e.g. El-Obeid, Elnehoud and Alkhowai) having higher percentages of HM than other sites remain unknown. It can be speculated that the degree of urbanization accompanied by changes in lifestyle and environmental pollution might play a role. More detailed analyses are required to identify the corresponding risk factors. This study is in line with

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a study conducted on HM s in the Northwest Ethiopia [15].

Conclusion:

We concluded that CLL was the dominant type of hematological malignancies observed in Kordofan Oncology Center. The study indicated that the majority of cases were observed among males, urban residents, and elder populations aged >70 years. Special focus should be given to the highly affected population. Further more detailed studies are required in the Sudan.

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Authors contribution:

Ekhlas Alrasheid Abuelfadol[1], Mahadi Musa Mohammed[2], Ahmed Abdalla Agabeldour[3].

Abuelfadol EA: Conception, Data collection, Analysis, Approval of the final version.
Musa Mohammed M: Conception, Data collection.
Agabeldour AA: Conception, Consultation, Critical revision.

Conflict of interest:

The Authors declare no conflict of interest.

Data Availability:

The data are available from the corresponding author on request.

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