Analysis of the frequency of pediatric cancer in the Western Amazon (Brazil): the case of Rondônia

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Abstract

Objective: Analyzes the frequency of cancer in children and adolescents in the State of Rondônia / Western Amazon (Brazil), attended by public health services. Method: This is a descriptive, quantitative and cross-sectional study. We used an instrument developed by Paraguassú-Chaves et al [24], semi-structured, containing a series of variables, such as sex, age, histological types, types of cancer by location of the primary tumor, lymphomas, leukemias, clinical stage of the disease, diagnosis and previous treatment, among others. We asked the Research Ethics Committee to waive the Free and Informed Consent Term, because the study did not require patient intervention or collection of biological material and there was no possibility of constraints for patients and their families. Results: From 122 cases, 56 (45.9%) were female and 66 (55.1%) were male. Regarding the distribution of patients according to the age group, 38 (31.1%) were younger than 4 years, 21 (17.2%), 5 to 9 years, 24 (19.7%) from 10 to 14 and 39 (32.0%)

from 15 to 19. The most frequent histological types by gender were myeloproliferative leukemias and myelodysplastic diseases with 39.31% of new cases, reticuloendothelial lymphomas and neoplasms 11.96%, carcinomas and other epithelial neoplasms 11.96% of cases and CNS and several cranial intra-neoplasms and intraspinal with 11.11% of new cases. Leukemia in the hematopoietic and reticuloendothelial system (C42) is the most frequent cancer in children and adolescents, with 46.2% of cancers in the studied period. 20.5% of the cases do not know the stage of the cancer and 79.5% of the patients do not have information about the stage of the disease. 99.38% of pediatric cancer cases are referred by the single public health system - SUS and only 0.11% non-SUS or private health system. 47.6% of children and adolescents who arrive at the cancer clinic of the public health system have no diagnosis or previous treatment. Conclusions: he results presented are similar to the studies carried out in Rondônia, Brazil and other countries and are in agreement with the studies by Paraguassú-Chaves et al [24], Paraguassú-Chaves et al [27] and Paraguassú-Chaves et al [28].Considering some parameters and indicators, it can be concluded that childhood cancer in Rondônia is a public health problem.

Keywords— Pediatric cancer. Children and adolescents. Neoplasms. Rondônia. Western Amazon.

I. INTRODUCTION

Pediatric cancer (cancer in children and adolescents between 0 and 19 years old) consists of a set of diseases that have specific characteristics in relation to the historical type (cells that make up the tumors) and to clinical behavior [1]. It corresponds to a group of several diseases that have in common the uncontrolled proliferation of abnormal cells and that can occur anywhere in the body. Unlike adult cancer, pediatric cancer generally affects blood cells and supporting tissues.

According to the National Cancer Institute of Brazil - INCA [2], the cancers that most affect children are those of the blood (leukemia, which affects white blood cells), those of the lymphatic system (lymphoma, which affects the ganglia) and those of the central nervous system (tumors that originate in the brain and spinal cord). This group of neoplasms has, for the most part, short latency periods, are more aggressive, grow quickly, but respond better to treatment and are considered to have a good prognosis.

The classifications used for this group of disease are based on morphology, differently from those used for tumors in adults [3].

For didactic purposes, the recognition of the distinction by the age group criterion was adopted in this study, childhood cancer (child aged 0 to 14 years) and cancer in adolescent age (aged 15 to 19 years).

According to Steliarova-Foucher *et al* [4], pediatric cancer is studied and classified by the International Classification of Childhood Cancer - ICCC and that currently the ICCC is used with the new morphological classifications proposed in the ICD-O3.

According to the American Cancer Society [5], [6], [7], [8], [9], Barr *et al* [10], Ferlay *et al* [11], [12] and Magrath *et al* [13] childhood cancer corresponds to 1% to 4% of all malignant tumors, in most populations. In developing countries, where the population of children reaches 50%, this proportion of childhood cancer represents 3% to 10% of the total neoplasms. In developed countries, this proportion decreases, reaching around 1%.

The most common tumors in childhood and adolescence are leukemias (which affect white blood cells), those which affect the central nervous system and lymphomas (lymphatic system). Among the types of pediatric cancer worldwide, leukemia is the most common in most populations (25% to 35%). In developed countries, lymphomas are the third most common type of cancer. In developing countries, on the other hand, this type is in second place, behind only leukemias [14], [15] and [16]. CNS tumors occur mainly in children under 15 years of age, with a peak in age at the age of 10 years.

Neuroblastoma (a tumor of cells in the peripheral nervous system, often located in the abdomen), Wilms' tumor (type of renal tumor), retinoblastoma (affects the retina, fundus of the eye), and germinative tumor (of the cells that originate) also affect children and adolescents. the ovaries and testicles), osteosarcoma (bone tumor) and sarcomas (soft tissue tumors).

It also affects children and adolescents with neuroblastoma (tumor of cells of the peripheral nervous system, often located in the abdomen), Wilms' tumor (type of renal tumor), retinoblastoma (affects the retina, fundus), germinal tumor (of the cells that originate the ovaries and testicles), osteosarcoma (bone tumor) and sarcomas (soft tissue tumors).

In Brazil, the median percentage of neoplasms in the RCBP in the population of children and adolescents (from 0 to 19 years old) was 3%. As in most populations, leukemias were the most frequent (26%), followed by other epithelial tumors (14%), lymphomas (14%) and CNS (13%).

INCA [17] estimated for Brazil, for each year of the biennium (2018-2019), 12,500 new cases of cancer in children and adolescents, 1,200 new cases for each year in the North Region (Brazilian Amazon) where Rondônia is geographically located.

According to Karim-Kos *et al* [18], cancer mortality in children and adolescents has different geographic patterns. While, in developed countries, neoplasia is considered the second leading cause of death in childhood, corresponding to 4% to 5% (children aged 1 to 14 years) of deaths in this age group, in developing countries, this proportion is much lower, about 1%, because deaths from infectious diseases are the main causes of death.

According to the National Cancer Institute of Brazil - INCA [19], cancer among children and adolescents is the second cause of proportional mortality in the age group from 1 to 19 years old.
According to INCA [20], pediatric cancer deaths correspond to 7.9% of all causes, and the second leading cause of death in all regions of Brazil. Only below deaths due to external causes, configuring itself as the most lethal disease.

In Rondônia, pediatric cancer has a lower incidence of cancer in relation to other age groups, with an accumulated frequency of 1.3% (female) and 3.3% (male) in agreement with [21] which concludes that cancer in children and adolescents is considered rare when compared to cancer in adults. However, it must be studied separately because it has different primary sites, histological origins and clinical behavior.

Previous studies carried out in Rondônia point to pediatric cancer as a major public health concern. Among these determinants are late notifications and diagnoses, the stages of the disease, the origin of the referral of pediatric cancer patients to specialized care and the entrance clinic according to previous diagnosis and treatment, the overload of public health units, among others.

The National Cancer Institute of Brazil [21] recognizes that cancer prevention and control in Brazil, a country of continental dimensions and strong regional differences due to its very diverse population of

behaviors, beliefs and attitudes, currently represents one of the great challenges facing public health. The description of the distribution of the most incident types of cancer over time has been one of the main strategies for establishing guidelines in public policies and especially for planning cancer prevention and control actions.

In Brazil, the distribution of different types of cancer suggests an ongoing epidemiological transition. With the recent aging of the population, which projects the exponential growth of the elderly, it is possible to identify a significant increase in the prevalence of cancer, which demands from the managers of the Unified Health System (SUS) an immense effort to offer adequate care to patients.

This perspective makes clear the need for major investment in health promotion, in the quest to modify the patterns of exposure to risk factors for cancer While there is a clear increase in the prevalence of cancers associated with the best socioeconomic status - breast, prostate and colon and rectum -, simultaneously, we have high incidence rates of tumors generally associated with poverty - cervix, penis, stomach and oral cavity, and cancers in children and adolescents that are identified as a rising problem in an emergency situation.

In this scenario, resources and efforts must be directed to guide cancer prevention and control strategies at all levels (health promotion, early detection, patient care, surveillance of cancer and its risk factors, training of human resources, communication and social mobilization, research and management of the Unified Health System - SUS).

This presupposes quality information on the incidence, mortality and survival of population groups, which will allow a better understanding of its determinants, contributing to the formulation of causal hypotheses and evaluation of the technology applied to the prevention and treatment of the disease [22].

For this reason, the research has as main objective to analyze the frequency of pediatric cancer in the State of Rondônia, Western Amazon (Brazil) from the primary data available in the public health service specialized in cancer in the State of Rondônia.

II. METHOD

The methodological design followed the characteristics of a documentary, transversal and descriptive study, based on the raw data produced and sectorized, according to the methodological model recommended by Paraguassú-Chaves *et al* [23]. The primary data were organized by the Núcleo Hospitalar de Epidemiologia - NHE of the largest public referral hospital in the state of Rondônia, based on the diagnoses made at the Hospital Especializado em Câncer, for a period of three years.

We used an instrument developed by Paraguassú-Chaves *et al* (24), semi-structured, containing a series of variables, such as sex, age, histological types, types of cancer by location of the primary tumor, lymphomas, leukemias, clinical stage of the disease, diagnosis and previous treatment, among others.

These data were inserted in statistical platforms, reviewed, (re) classified, (re) interpreted, (re) analyzed and correlated according to the descriptive and analytical methods, using frequency distribution and proportional percentages in the statistical representations, according to instrument developed by Paraguassú-Chaves *et al* (24).

The research coordinator asked the Human Research Ethics Committee to waive the Free and Informed Consent Term, because the study did not require patient intervention or collection of biological material and there was no possibility of constraints for the patient and his family. The research works with primary data from an official source of the public health service in Rondônia.

III. RESULTS

In the period of 3 years, 122 new cases of childhood and adolescence cancer were diagnosed. Of these, 56 (45.9%) were female and 66 (54.1%) in males, with a predominance of the age group from 15 to 19 with 32.0% and 0 to 4 years with 31.1%.

As for the distribution of patients by age group, 38 (31.1%) were 0 to 4 years old, 21 (17.2%), 5 to 9 years old, 24 (19.7%), 10 to 14 years old and 39 (32.0%) aged 15 to 19 years (table 1).

In the period corresponding to 3 years, 48.3% of children with childhood cancer were less than 10 years old.

Table 1: Pediatric cancer, by age and sex /Rondônia / Brazil.

Variables	**Female**		**Male**		**Total**	
00-19 anos	**af***	**rf%**	**af***	**rf%**	**af***	**rf%**
00 – 04	14	25.0	24	36.4	38	31.1
05 – 09	8	14.3	13	19.7	21	17.2
10 – 14	9	16.1	15	22.7	24	19.7
15 – 19	25	44.6	14	21.2	39	32.0
Total	56	45.9	66	54.1	122	100.0

Source: RHC / NHE / HBAP / RO. Data referring to 3 years of study.

af*: absolute frequency; **rf%:** relative frequency

The most frequent histological types by gender were leukemias of myeloproliferative diseases and myelodysplastic diseases with 18 (36.73%) cases in females and 28 (41.17%) in males, with an absolute frequency of 46 (39.31%) new cases, lymphomas and reticuloendothelial neoplasms with 6 (12.24%) new cases in females and 8 (11.76%) in males registered a total of 14 (11.96%), carcinomas and other epithelial malignancies with 3 (6.12%) cases in females and 11 (16.17%) in males, with an absolute frequency of 14 (11.96%) of cases and CNS and miscellaneous of intra-cranial and intra-spinal neoplasms with respectively 7 (14.28%) new cases in females and 6 (8.82%) in male, making up 13 (11.11%) of new cases.

Other important histological types found were malignant bone tumors (5.12%), renal tumors (5.12%), in addition to carcinomas and other epithelial neoplasms (5.98%). (table 2).

Table 2: Distribution of the most frequent histological types in the age group 0-19 years, according to sex. Rondônia / Brazil.

Histological Type	Female		Male		Total	
	af*	rf%	af*	rf%	af*	rf%
Leukemias, myeloproliferative diseases and myelodysplastic diseases	18	36.73	28	41.17	46	39.31
Reticuloendothelial lymphomas and Neoplasms	6	12.24	8	11.76	14	11.96
Carcinomas and other epithelial Malignancies	3	6.12	11	16.17	14	11.96
CNS and miscellany of intracranial and intraspinal neoplasms	7	14.28	6	8.82	13	11.11
Other malignant and unspecified neoplasms	4	8.16	3	4.41	7	5.98
Malignant bone tumors	3	6.12	3	4.41	6	5.12
Renal tumors	3	6.12	3	4.41	6	5.12
Soft-tissue sarcomas	1	2.04	3	4.41	4	3.41
Tumors of the sympathetic nervous system	1	2.04	2	2.94	3	2.56
Neoplasms of germ cells, trophoblastic and other gonadal	1	2.04	1	1.47	2	2.56
Retinoblastoma	1	2.04	0	0.00	1	0.85
Liver tumors	1	2.04	0	0.00	1	0.85
TOTAL	**49**	**100.0**	**68**	**100.0**	**117**	**100.0**

Source: RHC / NHE / HBAP / RO. Data referring to 3 years of study. **af*:** absolute frequency; **rf%:** relative frequency

For current research, the International Classification of Diseases ICD-10, in view of all records in the database used to be classified for medical diagnosis. Thus, leukemia of the hematopoietic system and classified reticulum according to ICD 10, (C42) is the most frequent cancer in both sexes with 46.26% of pediatric cancer cases, twice in male children and adolescents.

The second group of pediatric cancer by primary tumor location is brain carcinoma (C71), with 17.85% and 5.15%, respectively, in female and male children and adolescents. Also in the second group, with the same relative frequency of brain carcinoma, there are C77 lymph nodes (lymph nodes), with 7.14% and 12.89%, respectively, in female and male children and adolescents.

Among the most frequent types of cancer, they are in decreasing order of frequency: reticuloendothelial hematopoietic system - C42 with 46.25% of cases, brain carcinoma - C71 with 10.44%, lymph nodes (lymph nodes) - C77 with 10.44%, kidney - C64 with 5.97%, malignant neoplasm of bones and articular cartilage from other unspecified sites - C41 with 5.97%, connective, subcutaneous and other soft tissues - C49 with 4.47%, thyroid gland - C73 with 4.47%, bones, joints and limb cartilage - C40 with 2.98%, skin - C44 with 2.98%, placenta - C58 with 2.98%, eyes and attachments - C69 with 1.49% and thymus - C37 with 1.49% of cases (table 3).

Table 3: Distribution of the most frequent types of cancer in the 0-19 age group, depending on the genre. Rondônia / Brazil.

Histological types		**Female**		**Male**		**Total**	
Location of primary tumor	**CID-0**	**af***	**rf%**	**af***	**rf%**	**af***	**rf%**
Hematopoietic and reticuloendothelial System	C42	10	35.71	21	53.84	31	46.26
Brain	C71	5	17.85	2	5.12	7	10.44
Lymph nodes (lymph nodes)	C77	2	7.14	5	12.89	7	10.44
Kidney	C64	3	10.71	1	2.56	4	5.97
Malignant neoplasm of bones and articular cartilage from other sites not specified	C41	2	7.14	2	5.12	4	5.97
Connective tissue, subcutaneous tissue and other soft tissues	C49	1	3.57	2	5.12	3	4.47
Thyroid gland	C73	1	3.57	2	5.12	3	4.47
Bones, joints and joint cartilage of the limbs	C40	1	3.57	1	2.56	2	2.98
Skin	C44	0	0.00	2	5.12	2	2.98
Placenta	C58	2	7.14	0	0.00	2	2.98
Eyes and attachments	C69	1	3.57	0	0.00	1	1.49
Thymus	C37	0	0.00	1	2.56	1	1.49
TOTAL		**28**	**100**	**39**	**100**	**67**	**100**

Source: RHC / NHE / HBAP / RO. Data referring to 3 years of study. **af*:** absolute frequency; **rf%:** relative frequency

Precursor Cell Lymphoblastic Leukemia, NOS are the histological types most relevant in the studied period, with an absolute frequency of 20 cases and relative 29.85%, distributed by gender, with an absolute frequency 3 times higher in male children and adolescents.

Tumors of Plasmocytes (973) are in the first group of histological importance, with an absolute frequency of 19 cases and relative frequency of 28.35%, in addition to malignant lymphoma, NOS or diffuse (959), with an absolute frequency of 18 cases and a relative frequency of 26.86% and acute myeloid leukemia, NOS, with an absolute frequency of 18 cases and frequency 26.86%.

In the second group of histological importance, Hodgkin's lymphoma or mixed-cell lymphocytic depletion appears with a relative frequency of 19.40% and chronic B-cell lymphocytic leukemia / lymphocytic lymphoma also with 19.40%, both with a frequency of two, times in male children and adolescents.

Other important histological types are leukemia NOS (980) with a relative frequency of 11.94%, chronic myeloid leukemia, NOS (10.44% relative frequency), followed by Burkitt's leukemia (relative frequency of 7.46%) and large B-cell lymphomas or Burkitt's lymphoma (968) with relative frequency of 5.97%. (table 4).

Table 4: Proportional distribution of lymphomas and leukemias, by gender, according to histological type - ICD-03. Rondônia / Brazil.

Lymphomas and Leukemias	**Female**		**Male**		**Total**	
	af*	**rf%**	**af***	**rf%**	**af***	**rf%**
Precursor Cell Lymphoblastic Leukemia, NOS	5	17.85	15	38.46	20	29.85
Tumors of Plasmocytes (973)	8	28.57	11	28.20	19	28.35
Malignant, NOS or Diffuse Lymphoma (959)	10	35.71	8	20.51	18	26.86
Acute Myeloid Leukemia, NOS	8	28.57	10	25.64	18	26.86
Hodgkin's Lymphoma Mixed Cellularity or Lymphocytic Depletion	4	14.28	9	23.07	13	19.40
Chronic Lymphocytic Leukemia of B Cell / Lymphocytic Lymphoma	4	14.28	9	23.07	13	19.40
Leukemia NOS (980)	4	14.28	4	10.25	8	11.94
Chronic Myeloid Leukemia, NOS	4	14.28	3	7.69	7	10.44
Burkitt's Cell Leukemia	2	7.14	3	7.69	5	7.46
Large B-cell Lymphomas or Burkitt's Lymphoma (968)	1	3.57	3	7.69	4	5.97
Hodgkin's Lymphoma, Nodular Sclerosis	0	0.00	2	5.12	2	2.98
Lymphoid Leukemia, NOS (982)	0	0.00	2	5.12	2	2.98
Myeloid Leukemia, NOS	2	7.14	0	0.00	2	2.98
Acute Monocytic Leukemia T	1	3.57	1	2.56	2	2.98

Acute Myeloid Leukemia with Multiline Dysplasia	0	0.00	2	5.12	2	2.98
Small B-Cell Lymphoma	1	3.57	1	2.56	2	2.98
Mature B-cell Lymphoma	1	3.57	0	0.00	1	1.49
Acute Leukemia, NOS	0	0.00	1	2.56	1	1.49
Acute Leukemia, Biphenotypic	0	0.00	1	2.56	1	1.49
Lymphoblastic Leukemia of Precursor Cells Type B	0	0.00	1	2.56	1	1.49
Acute Myeloid Leukemia Type M6	1	3.57	0	0.00	1	1.49
Leukemia Cell Type	0	0.00	1	2.56	1	1.49
Acute Myeloid Leukemia with Abnormality	1	3.57	0	0.00	1	1.49
TOTAL	**28**	**100.0**	**39**	**100.0**	**67**	**100.0**

Source: RHC / NHE / HBAP / RO. **af*:** absolute frequency; **rf%:** relative frequency

Table 5 presents a summary of the proportional distribution of cancer cases in patients aged between 0 and 19 years, according to the clinical stage of the disease, the origin of the referral of pediatric cancer patients to specialized care and the clinic of entry of according to previous diagnosis and treatment.

According to table 5, in 20.5% of cases it is presented as an indeterminate phase. However, the number of patients without information reached 79.5%.

It is observed that, in Rondônia, the notifications made comprise 99.38% of the Unified Health System Program - SUS and only 0.03%, children and adolescents came on their own. 0.03% of cases do not apply and 0.45% without information. (table 5).

The pediatric oncology clinic was responsible for the first care in 65.3% of pediatric cancer cases. However, 56% of pediatric cancer cases were admitted to the pediatric oncology clinic.

When pediatric cancer is analyzed at the entry clinic, according to previous diagnosis and treatment, the results reveal that 47.6% of children and adolescents entered the specialized clinic without diagnosis and without treatment, 38% with diagnosis and without treatment and only 14.3% with diagnosis and treatment. (table 5).

Table 5. Clinical stage of the disease, origin of referral to specialized care and previous diagnosis and treatment.

Clinical stage of câncer	**rf%**
No information	79.5
Undetermined phase	20.5
Referral for treatment at the pediatric oncology clinic	**rf%**
SUS	99.38

Not SUS	0.11
Came on his own	0.03
Not applicable	0.03
No information	0.45
Previous diagnosis and treatment	**rf% (cases)**
With Diagnosis / With Treatment	14.3
With diagnosis / without treatment	38.1
Without diagnosis / without treatment	47.6

Source: RHC / NHE / HBAP / RO. **rf%:** relative frequency

At the pediatric oncology outpatient clinic, the time between enrollment (patient record) and diagnosis of the disease was 4.24 (days), from diagnosis and start of treatment (2.52) days and registration of the child and teenager to treatment (3.25) days. (table 6).

Table 6: Time interval (in days) elapsed, according to the median, between: 1st consultation-1st diagnosis; 1st diagnosis - start of treatment; 1st consultation and start of treatment, according to the clinic responsible for the first care.

Description of the Entrance Clinic	**Oncology Pediatrics MEDIAN**
Registration/Diagnosis	4.25
Diagnosis/Treatment	2.52
Registration/Treatment	3.25

Source: RHC / NHE / HBAP / RO

Table 7 shows the proportional distribution of cancer cases among patients in the state of Rondônia, according to the treatment received in hospitals in the single health system.

Other isolated therapeutic procedures showed relative frequency with greater prominence, 44.36%, after surgery with 15.22%, chemotherapy with 5.99%, other isolated therapeutic procedures + surgery with 2.63% and surgery + chemotherapy with 1.04 %.

These data refer to the procedures in all cases of cancer assisted by the public health program and not only for childhood and youth câncer,

Table 7: Proportional distribution of cancer according to the 1st treatment.

First Treatmen	rf%
Other Isolated Therapeutic Procedure	44.36
Other Isolated Therapeutic Procedures + Surgery	2.63
Other Isolated Therapeutic Procedures + Chemotherapy	0.60
Quimioterapia	5.99
Chemotherapy + Radiotherapy	0.32
Chemotherapy + Surgery	0.27
Chemotherapy + Other Therapeutic Procedures	0.21
Surgery	15.22
Surgery + Chemotherapy	1.04
Surgery + Isolated Therapeutic Procedures	0.21
Surgery + Chemotherapy + Other Procedures	0.05
Surgery + Radiotherapy	0.05
Radiotherapy	0.87
Radiotherapy + Chemotherapy	0.16
Radiotherapy + Therapeutic Procedures	0.05
Immunotherapy	0.10
No procedure	26.93
No information	0.21

Source: RHC / NHE / HBAP / RO. **rf%:** relative frequency

IV. DISCUSSION

In the Rondônia study, there was no statistically significant difference in relation to the sex of children and adolescents. As predicted by most national and international literature, there was a higher frequency in males (54.1%). Several studies published in international pediatricians, report that a higher incidence of cancer in general occurs in males, corroborating the findings in the research in Rondônia, western Brazilian Amazon. Among the most important researches are Epidemiology of childhood cancer [25], Cancer Incidence and Survival among Children and Adolescents [16] and Cancer incidence among children and adolescents in the United States [26]. 48.3% of cancers were found in children under 9 years old, 19.7% in children 10 to 14 years old and 32% in adolescents (15 to 19 years old).

Paraguassú-Chaves *et al* [24] in their article Analysis of histological frequency and pediatric cancer in Rondônia, Western Amazonia (Brazil), published in International Journal of Advanced Engineering Research and Science (IJAERS) found 42.7% in females and 57, 3% in males, with 44% in children under 9 years of age and 33.33 in adolescents from 15 to 19 years of age.

The most frequent histological types by gender were leukemias of myeloproliferative diseases and myelodysplastic diseases with 18 (36.73%) cases in females and 28 (41.17%) in males, with an absolute

frequency of 46 (39.31%) new cases, lymphomas and reticuloendothelial neoplasms with 6 (12.24%) new cases in females and 8 (11.76%) in males registered a total of 14 (11.96%), carcinomas and other epithelial malignancies with 3 (6.12%) cases in females and 11 (16.17%) in males, with an absolute frequency of 14 (11.96%) of cases and CNS and miscellaneous of intra-cranial and intra-spinal neoplasms with respectively 7 (14.28%) new cases in females and 6 (8.82%) in male, making up 13 (11.11%) of new cases.

These findings corroborate the results found by Paraguassú-Chaves *et al* [23] in the Epidemiological Profile of Rondônia, Paraguassú-Chaves *et al* [27] in the Epidemiological Profile of Cancer in Rondônia: Brazilian Amazonia, Paraguassú-Chaves *et al* [28] in Epidemiology cancer in Rondônia and Paraguassú-Chaves *et al* [24] in the analysis of histological frequency and pediatric cancer in Rondônia, Western Amazon (Brazil).

The sequential order of the highest frequencies found in this study, appear with their nuances differences in results when compared to the national study of the Population Based Cancer Registry (RCBP) and of other States and other regions of Brazil. These frequencies have already been pointed out in the study by Da Luz [3] in the Clinical-Demographic Profile of Patients Attended at the Pediatric Oncology Service of Hospital de Clínicas de Porto Alegre and in the study by De Camargo *et al* [29] Cancer incidence among children and adolescents in Brazil: first report of 14 population based cancer registries.

In the present study, leukemia of the hematopoietic and reticuloendothelial system (C42), is the most frequent neoplasia in both women and men, with 46.26% of cancers in children and adolescents.
Hematopoietic and reticuendothelial Syste. In a combination of two systems, we can define the hematopoietic and reticuloendothelial system as: hematopoiesis - it is a physiological process that guarantees the renewal of blood cells and that are produced daily in the body. It is classified into three types: erythropoiesis for red blood cells; leukopoiesis for leukocytes (which is located in the bone marrow) and thrombocytopoesis to manufacture platelets [28].

A hematopoiesis defect can cause diseases such as hemopathy - leukemia, lymphoma - or aplasia of red blood cells. The hematopoietic system is formed by a complex made up of bone marrow and other hemoforming organs and blood. Blood cells are constantly produced in the bone marrow: erythrocytes neutrophils and platelets, with strict control of growth factors.
In order for their physiological function to be fulfilled, the cellular elements of the blood must circulate in an appropriate number and structure [28].

The reticuloendothelial system (SRE) or mononuclear phagocytic system is the organic system made up of cells that, located in different parts of the organism, have reticular and endothelial characteristics and are endowed with phagocytic capacity, thus intervening in the formation of blood cells, in the iron metabolism, in addition to performing defense functions against generalized infections [28].

The studies by Paraguassú-Chaves *et al* [24] in the same place as the research on the distribution of the most frequent types of cancer in children and adolescents in Rondônia, had already pointed out the need for a deeper and more detailed investigation on the location of the primary tumor.
His proposal aims to clarify the reason for the high frequency of neoplasms of the hematopoietic and reticuloendothelial system in this child and youth population in the Amazon.

The proportional distribution of lymphomas and leukemias, by gender, according to the histological type - ICD-03, identifies the Precursor Cell Lymphoblastic Leukemia, NOS, Plasma Cell Tumors (973),

Malignant Lymphoma, NOS or Diffuse (959) and Acute Myeloid Leukemia, NOS as the most relevant histological types in the studied period.

Paraguassú-Chaves *et al* [24] in this same research source found the following sequence in decreasing order of frequency: Acute Myeloid Leukemia, NOS, Precursor Cell Lymphoblastic Leukemia, NOS, Malignant, NOS or Diffuse Lymphoma (959) and Mixed cellularity of Hodgkin's lymphoma or Lymphocytic depravity.

Kaatsch's study [25] "Childhood Epidemiology" states that leukemias are the most common type of pediatric cancer in the world and that they account for 34.1% of all childhood cancers up to 15 years of age, followed by CNS tumors (22.6%) and lymphomas (11.5%). Parkin *et al* [15], in a survey "International Incidence of Cancer in Childhood", describe that among all cancers in childhood, leukemias represent the most frequently diagnosed, being responsible, in most diseases, by 25% to 35% of all pediatric neoplasms.

In Brazil, the research by De Camargo *et al* [29] "Incidence of cancer in children and adolescents in Brazil: first report of 14 population-based cancer registries", a national study that gathered 14 population-based cancer registries (RCBP) showed that Goiânia, capital of the state of Goiás, Manaus, capital of the state of Amazonas and Curitiba, capital of the state of Paraná, were the three capitals of Brazil with the highest leukemia incidence rates. Another reference research in Brazil is the study Pediatric cancer: analysis of a hospital record ", by Silva, Pires, and Nassar [30] who, in studies carried out in hospital services in the states of Santa Catarina and Rio Grande do Sul, found 36.6% and 26.9%, respectively, of incidence for leukemia.

Braga, Latorre, Curado [31] when analyzing childhood cancer, made a comparison of the incidence, mortality and survival of children and adolescents in Goiânia (Brazil) and other countries and concluded that in most countries, children less than five years old are the most frequently affected by leukemias and that among the types of leukemia, the most common are acute and, among these, acute lymphocytic leukemia (ALL), totaling, in the white populations of North America, Oceania and Europe, from 75% to 80% of all leukemias. Sharp, Cotton and Little [32] in "Descriptive epidemiology, in: Epidemiology of Childhood Cancer" when studying the same regions highlight acute non-lymphocytic leukemia (LNLA) with 15% to 17% of cases, while chronic myeloid leukemia (CML) rarely exceeds the proportion of 4%.
In Brazil, according to the study by Braga [33] carried out in the city of Goiania (State of Goias), these frequencies were 66% for ALL, 20% for LNLA and 1.4% for LMC.

According to Ries *et al* [16] leukemias are more frequent from 1 to 9 years. For the ALL subgroup, there is a peak between 2 and 3 years, which occurred in 66% of the cases analyzed in their study.
In the second group of histological importance, Hodgkin's lymphoma or mixed cell lymphocytic depletion appears with a relative frequency of 19.40% and chronic B-cell lymphocytic leukemia / lymphocytic lymphoma also with 19.40%. The result of the research identifies Hodgkin's lymphoma or mixed-cell lymphocytic depletion and chronic B-cell lymphocytic leukemia / lymphocytic lymphoma, both with twice the frequency in male children and adolescents.

In the research by Paraguassú-Chaves *et al* [24], the second group of cancers in children aged 0 to 19 years was brain cancer (C71), with 13.6% of new cases. C77 lymph nodes (lymph nodes) better represent the second group of cancers, with 9.1% and 12%, respectively, in the period, according to Paraguassú-Chaves *et al* [24].

According to De Camargo *et al* [29], in Brazil, lymphomas appear as the second most common cancer in childhood. Paraguassú-Chaves *et al* [24] also corroborates this confirmation. Magrath *et al* [13] in their study "Pediatric cancer in low-income and middle-income countries", point out in their research that lymphomas were the second most frequent neoplasia, followed by retinoblastoma and CNS tumors.

According to Braga, Latorre and Curado [31] lymphomas, following tumors of the central nervous system, constitute the third type of neoplasia with the highest incidence in developed countries, covering 7% to 18% of cases of childhood neoplasia.

According to Howlader *et al* [14], Parkin *et al* [15] and Reis *et al* [16] in developed countries, lymphomas correspond to the third most common type of cancer. For these same authors in developing countries, this type is the second most incident, behind only leukemia.

The proportional distribution of lymphomas in histological terms is quite different in different regions of the world. Greenberg, Shuster [34] in "Epidemiology of cancer in children" state that approximately 45% of all lymphomas in children are represented by Hodgkin's lymphoma and its incidence is, more commonly, more accentuated in populations with a worse socioeconomic level, such as Kuwait, Brazil and Costa Rica, corroborated by Parkin *et al* [15]. In the studies by Braga, Latorre and Curado [31] and Latorre and [35], performed in Brazil, 44% of lymphomas were from Hodgkin.

Staging can be defined as the process by which the extent, shape and location of cancer in a person's body is determined, based on the verification of possible survival rates.

The classification of malignant neoplasms in groups obeys different variables: location, size or volume of the tumor, direct and lymphatic invasion, distant metastases, histopathological diagnosis, substance production, systemic manifestations, duration of signs and symptoms, sex and age of the patient, etc [20]. Consequently, it is essential for physicians to know the extent and location of decision making regarding their treatment behavior and to calculate the possible directions of the disease.

The data and information on the staging of cancer in children and adolescents is not sufficient for a more secure and accurate analysis. 20.5% of the cases are presented as an indeterminate phase. However, the number of patients without information reached 79.5%. Paraguassú-Chaves *et al* [24], Paraguassú-Chaves *et al* [27] and Paraguassú-Chaves *et al* [28] had already warned about this inefficiency in the health system.

The National Cancer Prevention and Control Policy guarantees comprehensive care to any cancer patient, through the High Complexity Assistance Units in Oncology (UNACON) and the High Complexity Assistance Centers in Oncology (CACON) based on laws and specific Ordinance.

In Rondônia, the notifications made comprise 99.38% of the Unified Health System Program - SUS and only 0.03%, children and adolescents came on their own. 0.03% of cases do not apply and 0.45% without information.

Other studies carried out in Rondônia have already called attention to referrals for treatment at the pediatric oncology outpatient clinic. According to Paraguassú-Chaves *et al* [23], everything suggests that private plans and non-governmental hospitals do not provide the essential services needed by cancer patients and their sick associates.

The pediatric oncology clinic was responsible for the first care in 65.3% of pediatric cancer cases. This means that 34.7% of children and adolescents have access to specialized clinical diagnosis and

treatment in other types of cancer. 47.6% of children and adolescents entered the specialized clinic without diagnosis and without treatment, 38% with diagnosis and without treatment and only 14.3% with diagnosis and treatment. One of the main cancer-related problems in children and adolescents is found in late diagnosis. These undiagnosed and untreated children and adolescents are part of the imminent risk group of death.

Paraguassú-Chaves *et al* [24], [27], [28], have already warned that cancer in children and adolescents is more aggressive and develops more quickly. For this reason, tumors are rarely identified and treatment cannot be done with surgery. This is another problem faced by children and adolescents in Rondônia.

The average cure rate for pediatric cancer in Brazil is around 70% - some types of the disease have even higher rates. However, in order to obtain these numbers, it is essential that the diagnosis be made early, with treatment carried out in specialized centers. This has not happened in Rondônia. The disease is not always discovered in its initial stage, mainly because some symptoms - such as persistent fever, rocky spots on the body, ganglia and pain in the bones or abdomen - can be confused with those of other very common ailments in childhood. This situation is an alert for public health managers.

The period of days between the patient's registration and the start of treatment attracted attention. At the pediatric oncology outpatient clinic, the time between registration (patient record) and diagnosis of the disease was 4.24 (days), from diagnosis and start of treatment (2.52) days and registration of the child and adolescent until treatment (3.25) days.

This information had a significant improvement compared to the research by Paraguassú-Chaves *et al* [24].

The data referring to the first types of procedures in cancer cases assisted by the public health program are universal and not only in childhood and youth cancer. Which, according to Paraguassú-Chaves *et al* [27], [28], is a limiting factor for a more precise analysis.

The studies by Reis *et al* [16] "Incidence and survival of cancer in children and adolescents" Kaatsch [25] "Epidemiology of childhood cancer" are similar to the present study. However, these surveys specify the frequencies of leukemias and lymphomas with more rigor and detail in some variables.

The research by Hada, Gaete and Pianovski [36] “Childhood cancer epidemiological profile of patients referred to the hospital of clinics of UFP pediatric oncology unit”, also corroborate an essential part of the results of this research in Rondônia. The results found in the research are in accordance with the projection presented by Paraguassú-Chaves *et al* [24].

v. CONCLUSIONS

In three years, 122 new cases of cancer in childhood and adolescence were diagnosed. of these, 56 (45.9%) were female and 66 (54.1%) were male. 48.3% of children with pediatric cancer were less than 10 years old.

The most frequent histological types by gender were leukemias of myeloproliferative and myelodysplastic diseases, lymphomas and reticuloendothelial neoplasms, carcinomas and other epithelial neoplasms and the CNS and several intracranial and intraspinal neoplasms.

Leukemia of the hematopoietic system and the reticulum classified according to ICD 10, (C42) is the most frequent cancer in both sexes, with 46.26% of pediatric cancer cases, twice in male children and adolescents.

Precursor cell lymphoblastic leukemia, NOS, plasma cell tumors (973), malignant lymphoma, diffuse NOS (959) and acute myeloid leukemia, NOS, are the most relevant histological types in the studied period. 20.5% of cases are presented as an indeterminate phase and without patients without information it reached 79.5%. The notifications made comprise 99.38% of the Unified Health System Program - SUS.

The pediatric oncology clinic was responsible for the first care in 65.3% of pediatric cancer cases. 47.6% of children and adolescents entered the specialized clinic without diagnosis and without treatment. A worrying indicator.

Other isolated therapeutic procedures showed relative frequency with greater prominence, 44.36%, after surgery with 15.22% r chemotherapy with 5.99%. These indicators refer to the procedures in all cases of cancer assisted by the public health program, and not only in childhood and youth cancer.

The results presented are in agreement with the data of most studies carried out in Rondônia, Brazil and other developed and developing countries. What is expected is that this research can serve as a basis for the systematization of essential data for the planning, execution and evaluation of actions for the promotion, prevention, control and treatment of pediatric cancer in Rondônia, Brazil.

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