

## MAPPING OF THE MAIN TYPES OF NEOPLASMS AMONG CHILDREN AND ADOLESCENTS ACROSS THE REGIONAL HEALTH AGENCIES FROM THE RIO DE JANEIRO STATE, BRAZIL

Mapeamento das principais neoplasias infanto-juvenis nas regionais de saúde do Rio de Janeiro

Cartografía de las principales neoplasias infanto-juveniles de las regiones de salud de Rio de Janeiro

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### ABSTRACT

**Objective:** The study's purpose has been to analyze the main types of malignant neoplasms among patients aged up to 19 years old across the regional health agencies from the *Rio de Janeiro* State. **Methods:** This ecological study analyzed the most frequent neoplasms using data from *Sistema de Informação Hospitalar do Sistema Único de Saúde* (SIH/SUS) [Hospital Information System of the Brazilian Unified Health System] referring to the year 2017. The data were analyzed by calculating relative frequencies. The mapping was performed through the use of TabWin software. **Results:** A total of 2,662 cases of malignant neoplasms among people aged up to 19 years old were distributed across the regional health agencies of *Rio de Janeiro* State. The *Metropolitana I* [Metropolitan I] regional health agency presented the highest proportion of cases, and leukemia was the most predominant type of childhood and adolescent cancer. **Conclusion:** Through the data collected from the SIH/SUS, this study showed that it is possible to implement strategies for implementing public policies, aiming at implementing measures to prevent, diagnose and treat childhood and adolescent cancer so that survival rates can increase, these patients' quality of life can improve, and infant mortality rates can decrease.

**Descriptors:** Health information systems, neoplasms, morbidity.

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## RESUMO

**Objetivo:** Analisar os principais tipos de neoplasia malignas em pacientes de 0 a 19 anos de idade nas regionais de saúde do estado do Rio de Janeiro.

**Método:** Estudo ecológico que analisou as neoplasias mais frequentes através dos dados contidos no Sistema de Informação Hospitalar em 2017. Os dados foram analisados através do cálculo da frequência relativa. O mapeamento realizado no TabWin. **Resultados:** foram observados 2.662 casos de neoplasias malignas na população de 0-19 anos de idade residentes nas regionais de saúde do Estado do Rio de Janeiro, sendo a Metropolitana I a de maior proporção e a leucemia o tipo de câncer infanto-juvenil mais frequente. **Conclusão:** apropriação desses dados torna possível concretizar estratégias para a construção de políticas públicas, visando medidas de prevenção, diagnósticas e tratamento vislumbrando maior sobrevida, melhor qualidade de vida e redução da taxa de mortalidade infanto-juvenil.

**Descritores:** Sistemas de Informação em Saúde; Neoplasias; Morbidade.

## RESUMEN

**Objetivo:** Analizar los principales tipos de neoplasia malignas en los pacientes de 0 a 19 años de edad en las regionales de salud del estado de Rio de Janeiro. **Método:** Estudio ecológico que analizó las neoplasias más frecuentes a través de los datos contenidos en el Sistema de Información Hospitalar en 2017. Los datos fueron analizados por el cálculo de la frecuencia relativa. La cartografía fue realizada por medio del TabWin.

**Resultados:** fueron observados 2.662 casos de neoplasias malignas en la población de 0-19 años de edad residentes en las regiones de salud del Estado de Rio de Janeiro, teniendo la Metropolitana I la región de mayor proporción y la leucemia el tipo de cáncer infantil juvenil más frecuente. **Conclusión:** apropiación de estos datos torna posible concretizar estrategias para la construcción de políticas públicas, mirando medidas de prevención, diagnósticas y tratamiento vislumbrando mayor sobrevida, mejor calidad de vida y reducción de la tasa de mortalidad infantil juvenil.

**Descritores:** Sistemas de Información en Salud; Neoplasias; Morbilidad.

## INTRODUCTION

Cancer can be defined as abnormal and disordered growth of cells, which invade tissues and organs. These cells can spread to other parts of the body. Over 100 diseases can be classified as cancer. Cancerous cells can accumulate and form malignant tumors or neoplasms.<sup>1</sup>

According to estimates, 600,000 new cases of cancer are expected to occur in Brazil in the 2018-2019 biennium. The distribution of the cancer incidence by geographical region shows that the South and Southeast Regions account for 70% of new cases. Nevertheless, according to the *Registros de Câncer de Base Populacional* (RCBP) [Population-Based Cancer Registries], the estimate of the incidence of tumors in Brazilian children and adolescents is 3%. So, it is understood that 12,500 new cases of cancer will arise among children and adolescents (1-19 years old). Additionally, the Southeast (5,300) and Northeast (2,900) Regions will have the highest number of new cases, while the North Region will have the lowest (1,200).<sup>2</sup>

In developed countries, the rate of childhood and adolescent cancer has decreased considerably, reaching approximately 1%. Cancer is the second cause of death

among children, corresponding from 4% to 5% of the deaths among children aged from 1 to 14 years old. However, in developing countries, in which the child population is approximately 50%, childhood cancer accounts for 3-10% of the total neoplasms.<sup>3-5</sup>

On the other hand, cancer corresponds to the second cause of death among children and adolescents, with emphasis on the North Region occupying the fifth position.<sup>6</sup> Childhood and adolescent cancer is an uncommon event accounting for 1% of all malignant neoplasms, including all forms of cancer affecting individuals aged under 19 years old.<sup>7</sup>

Neoplasms in children and adolescents have a short latency period, high proliferation rates, and high invasive character. However, it responds better to treatment if diagnosed early, presenting up to 80% chance of cure.<sup>8</sup>

Nonetheless, cancer is a highly dangerous disease due to its great physical and psychological impact on the affected population and its relatives. But, it is possible to diagnose the disease in early stages. Consequently, treatment of cancer can begin early, increasing the chance of cure and survival, considering that most malignant neoplasms in this age group are highly curable.<sup>7</sup>

Leukemia is the most common type of cancer among children and adolescents worldwide, and lymphoma is the third most common type in developed countries and the second in developing countries.<sup>9</sup> Similarly, leukemia (26%) is the most predominant type of cancer in Brazil, followed by epithelial tumors (14%), lymphoma (14%) and central nervous system (CNS) cancer (13%). The demographic and epidemiological changes in the world show an increasing impact on cancer cases in the coming decades.<sup>4</sup>

Bearing in mind the aforesaid, having information about the incidence of cancer is essential to implement national and regional policies on cancer control and guide research on the pathology. In this perspective, the *Sistemas de Informações em Saúde* (SIS) [Health Information Systems] is comprised of the RCBP and the *Registros Hospitalares de Câncer* (RHC) [Hospital Cancer Registries]. The SIS also provides information about the types of cancer, as well as its mortality and incidence rates. The SIS is the basis for national programs aiming at creating strategies and programmatic actions toward combating diseases.<sup>10</sup>

Hence, research on cancer is necessary in view of its high morbidity and mortality rates among children and adolescents worldwide. Thus, this study sought to analyze the main types of neoplasms among patients aged up to 19 years old distributed across the regional health agencies of *Rio de Janeiro* State, Brazil.

## METHODS

This ecological study analyzed the most frequent types of neoplasms among patients aged up to 19 years old distributed among the regional health agencies of *Rio de Janeiro* State in 2017. To this end, data from the *Sistema de Informação Hospitalar do Sistema Único de Saúde* (SIH/SUS) [Hospital

Information System of the Unified Health System] were used. The data referred to groups of people and not individuals. Moreover, the study unit is a certain geographical area. Raw and/or time-series data from one area were compared with data from other areas.<sup>11</sup>

Brazil is divided into 5,570 municipalities, of which 92 are located in the *Rio de Janeiro* State. The Brazilian municipalities were covered initially by 337 regional health agencies as established by the *Norma Operacional da Assistência à Saúde* (NOAS) [Operational Standard for Health Care] in accordance with the Ordinance No. 95/GM on January 26<sup>th</sup>, 2001.<sup>12</sup> The number of regional health agencies increased from 337 to 438 as Stated by Resolutions published in 2013 and 2014. The main changes occurred in the States of *Rondônia*, *Amazonas*, *Tocantins*, *Bahia*, and *São Paulo*. There are nine regional health agencies in *Rio de Janeiro* State: *Baía da Ilha Grande* [Big Island Bay], *Baixada Litorânea* [Coastal Flat Land], *Centro-Sul* [Center-South], *Médio* [Middle] *Paraíba*, *Metropolitana I* [Metropolitan] *I*, *Metropolitana II*, *Noroeste* [Northwest], *Norte* [North], and *Região Serrana* [Mountainous Region].

Data collection took place in May 2018 using the SIH/SUS, which processes the records of hospitalized patients before sending them to the Health Ministry. Then, these records are included in the National Database for dissemination purposes.<sup>13</sup>

The SIH/SUS data used in this research referred to the period from January 2017 to December 2017 available through the TabNet software of the *Departamento de Informática do Sistema Único de Saúde* [Information Technology Department of the Unified Health System] (DATASUS). The following variables were selected: malignant neoplasms, regional health agencies of *Rio de Janeiro* State, gender, race, age (0 to 19 years old) and year (2017).

The data were analyzed by calculating the relative frequency and measures of central tendency. The study results were presented in charts and maps. The mapping was performed through TabWin software, which is free and available on DATASUS website. The maps were generated by means of the geographic network available from the *Instituto Brasileiro de Geografia e Estatística* (IBGE) [Brazilian Institute of Geography and Statistics].

This study was not submitted to the Research Ethics Committee because unidentified secondary data from the SIS were used in accordance with the Resolution No. 466/2012, which regulates research involving human participants.<sup>14</sup>

## RESULTS

In 2017, it was observed that 37 types of neoplasms affected people aged up to 19 years old across the regional health agencies of *Rio de Janeiro* State. Of these types, 29 were malignant and eight were benign. Considering the 3,254 cases of neoplasia in this population, 2,662 were malignant. As can be seen in **Table 1**, the highest proportion was found in *Metropolitana I* regional health agency with 1,612 cases (60.6%).

**Table 1** - Distribution of malignant neoplasms among people aged up to 19 years old across the regional health agencies of *Rio de Janeiro* State.

| REGIONAL HEALTH AGENCIES          | N            | %          |
|-----------------------------------|--------------|------------|
| 33001- <i>Baía da Ilha Grande</i> | 69           | 2.6        |
| 33002- <i>Baixada Litorânea</i>   | 87           | 3.3        |
| 33003- <i>Centro Sul</i>          | 34           | 1.3        |
| 33004- <i>Médio Paraíba</i>       | 137          | 5.1        |
| 33005- <i>Metropolitana I</i>     | 1612         | 60.6       |
| 33006- <i>Metropolitana II</i>    | 243          | 9.1        |
| 33007- <i>Noroeste</i>            | 134          | 5.1        |
| 33008- <i>Norte</i>               | 258          | 9.7        |
| 33009- <i>Serrana</i>             | 97           | 3.6        |
| <b>TOTAL</b>                      | <b>2,662</b> | <b>100</b> |

Source: SIH/SUS (2018).

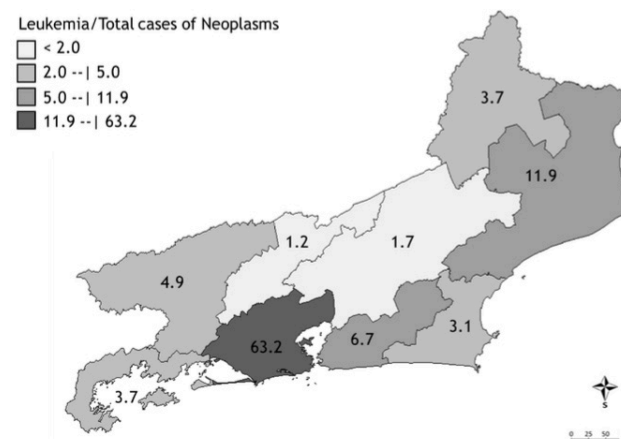
Considering the total cases in *Metropolitana I*, 703 (43.6%) were leukemia. A total of 1,113 cases of leukemia were found, most of them in *Metropolitana I* (63.2%). **Table 2** and **Figure 1** show that the lowest proportion was observed in *Centro-Sul* (1.2%).

**Table 2** - Distribution of leukemia cases among people aged up to 19 years old across the regional health agencies of *Rio de Janeiro* State.

| REGIONAL HEALTH AGENCIES          | N            | %            |
|-----------------------------------|--------------|--------------|
| 33001- <i>Baía da Ilha Grande</i> | 41           | 3.7          |
| 33002- <i>Baixada Litorânea</i>   | 34           | 3.1          |
| 33003- <i>Centro-Sul</i>          | 13           | 1.2          |
| 33004- <i>Médio Paraíba</i>       | 54           | 4.9          |
| 33005- <i>Metropolitana I</i>     | 703          | 63.2         |
| 33006- <i>Metropolitana II</i>    | 75           | 6.7          |
| 33007- <i>Noroeste</i>            | 41           | 3.7          |
| 33008- <i>Norte</i>               | 133          | 11.9         |
| 33009- <i>Serrana</i>             | 19           | 1.7          |
| <b>TOTAL</b>                      | <b>1,113</b> | <b>100.0</b> |

Source: SIH/SUS (2018).

**Figure 1** - Spatial distribution of leukemia cases among people aged up to 19 years old across the regional health agencies of *Rio de Janeiro* State.



Source: SIH/SUS (2018).

In relation to the profile of this population, males (57.9%) and white people (42.2%) constituted the highest proportion of cases of neoplasms. No information about the race of the patient with neoplasm was found in a high proportion of cases (29.8%), which may compromise data analysis (Table 3).

**Table 3** - Distribution of variables associated with the profile of the population aged up to 19 years old with malignant neoplasms across the regional health agencies.

| GENDER         | N     | %    |
|----------------|-------|------|
| Male           | 1,553 | 57.9 |
| Female         | 1,126 | 42.1 |
| RACE           | N     | %    |
| Black          | 233   | 8.7  |
| White          | 1,132 | 42.2 |
| Brown          | 1,008 | 37.6 |
| Indigenous     | ----  | ---- |
| Yellow         | 43    | 1.6  |
| No information | 263   | 29.8 |

Source: SIH/SUS (2018).

## DISCUSSION

Childhood and adolescent cancer involve all malignant neoplasms that affect people aged up to 19 years old. According to the World Health Organization (WHO), although cancer incidence rates in this age group are higher in developed countries, approximately 84% of this population lives in developing countries. In addition, the number of underreported cases in developing countries, in which children often do not have access to cancer diagnosis, should be taken into account.<sup>15</sup>

Cancer, having high morbidity and mortality rates in adults, has also impacted the health of children and adolescents in the world. Malignant tumors are the first cause of death from disease among people aged five years old or more. In Brazil, neoplasms are among the top ten causes of death among people aged 1 to 19 years old, justifying the importance of gaining knowledge about the main types of malignant neoplasms that affect this age group.<sup>16</sup>

Unlike adult cancer, whose classification depends on its primary site, childhood cancer is classified according to its histology. Thus, the malignant neoplasms affecting this group are categorized into 12 large groups and 47 subgroups based on their morphology according to the International Classification of Childhood Cancer. Approximately 80% of the children in the world live in medium- and low-income countries, in which most diseases affecting this age group occur, including childhood cancer. Childhood cancer incidence rates also change according to the level of development of the country.<sup>17</sup>

In this study, it was shown that males had the highest proportion of cancer cases among children and adolescents, which is also observed in other studies.<sup>16,17</sup> However, in one of them, which was carried out in the *Paraná* State, Brazil,

showed that females were approximately twice as likely to die from cancer.<sup>16</sup>

Furthermore, the study findings evidenced that leukemia is the most frequent type of malignant neoplasms among the regional health agencies of *Rio de Janeiro* State. According to a study carried out in Colombia,<sup>18</sup> the most prevalent types of malignant neoplasms in children and adolescents are leukemias. Other studies also corroborate these findings.<sup>16,19</sup>

Leukemia is the most common type of childhood cancer in the entire world. They correspond to 34.1% of all malignant neoplasms in people aged up to 15 years old.<sup>20</sup> In this context, the National Cancer Institute,<sup>21</sup> which addresses childhood and adolescent cancer, reports that leukemia, especially acute lymphoid leukemia (ALL), is the most predominant type of malignant neoplasms in the study population. Other studies corroborate the same findings<sup>22</sup> by highlighting that leukemia is the most prevalent type of cancer in Latin America.

The etiology of leukemia is still complex and its cause is not fully known. Nevertheless, it can be inferred that leukemia stems from the association between genetic and environmental factors.

In this perspective, patients with genetic syndromes, such as Down syndrome, are 20 to 30 % more likely to develop leukemia (trisomy of chromosome 21). Moreover, the occurrence of CNS tumors and sarcomas in patients with neurofibromatosis (von Recklinghausen's disease) is favored.

Acute leukemia is characterized by a short latency period, and symptoms often appear acutely within a few weeks.<sup>23</sup> On the other hand, studies indicate that exposing children to benzene and pesticides is a major risk factor for childhood leukemia.<sup>24</sup>

It is possible to observe associations between environmental factors and the development of childhood tumors such as leukemia, CNS tumors, and non-Hodgkin's lymphoma, and neuroblastoma. Among these factors are crops; exposure to pesticides (especially during pregnancy), solvents and magnetic fields; maternal nutrition; use of vitamins during pregnancy; parents' work; and use of tobacco and alcohol.<sup>25</sup>

There are biological risk factors for cancer. Among them is exposure to certain viruses, such as Hepatitis B and C, Papillomavirus (HPV), Epstein Barr, and Human Immunodeficiency Virus (HIV). Genetic factors and the child's age are important as well.<sup>24</sup>

The study results revealed that *Metropolitana I* is the regional health agency with the highest proportion of malignant neoplasms in *Rio de Janeiro* State, followed by *Norte*. *Rio de Janeiro* State is one of the 27 federal units in Brazil. Located in the Southeast Region, *Rio de Janeiro* State is the third most populous State with approximately 15,989,929 inhabitants in 2010 according to the results of the 2010 demographic census of the *Instituto Brasileiro de Geografia e Estatística* (IBGE) [Brazilian Institute of Geography and Statistics]. The vast majority of this population is covered by the *Metropolitana I* regional health agency and lives in the municipality of *Rio de Janeiro*. On the other hand, the *Baía da Ilha Grande* regional health agency covers the smallest number of people.<sup>26</sup>

Nonetheless, although the cases are registered as if they occurred in areas covered by these agencies, it is verified that except for *Metropolitana I*, which has the largest number of oncology units, the other agencies have little or no unit specialized in providing care for children and adolescents with cancer. Thus, the study results showed significant inequality of access across the regional health agencies in *Rio de Janeiro* State. Most of the people with cancer who are receiving treatment live in areas covered by the *Metropolitana I* regional health agency due to the centralization of care at the tertiary level.

Access barriers to health care can be geographic, organizational, cultural, etc., making it easier or more difficult to use health care services. In this study, it was possible to identify geographical barriers because users were more likely to go to health care units that were already offering care for a high number of people in the capital of *Rio de Janeiro* State.<sup>27</sup> “It is known that, due to the difficulty of accessing health care services, patients seek care in other locations, which impairs RCBP coverage”<sup>28-50</sup>

According to the *José Alencar Gomes da Silva* National Cancer Institute, even though many of the Brazilian specialized health care services share similar features with those of countries with more resources, the regional differences in terms of access to services are still evident.<sup>29</sup>

In most cases, the treatment of children and adolescents with cancer starts late, greatly impairing the prognosis for treatment. Consequently, mortality rates in this group increase. However, with the help of technological advances, favorable outcomes have been achieved in cases of childhood and adolescent cancer, especially when diagnosed early.<sup>16</sup>

Effective, structured, and organized primary care provided by the service network makes it possible for the user to access diagnostic technologies. Additionally, qualified primary care teams are essential to the early identification of cancer in children and adolescents. Consequently, these patients can be referred to specialized services for treatment because the rates of survival or cure reach 80% if treatment is started early.<sup>30</sup>

Studies on epidemiological issues, especially in oncology, are important for decision-making and health care policies. The reason is that they provide information that enables the analysis of the different types of health problems. Hence, it is necessary to make efforts to systematize and qualify information about childhood and adolescent cancer so that more knowledge about the subject, which is so scarce at present, can be accumulated despite the fact that the number of cases of cancer, as well as the number of deaths from this disease, is high among people aged up to 19 years old.

## CONCLUSIONS

Herein, it was possible to identify leukemia as the main type of malignant neoplasm among patients aged up to 19 years old and had the highest proportion of cases across all regional health agencies. Furthermore, *Metropolitana I* stood out as the regional health agency with the highest number of cases.

Through the data collected from the SIH/SUS, this study showed that it is possible to implement strategies for implementing public policies according to the population's real needs. The objective is to implement measures to prevent, diagnose, and treat childhood and adolescent cancer so that survival rates can increase, these patients' quality of life can improve, and infant mortality rates can decrease.

Moreover, all health care professionals should be trained to associate the clinical findings with the patient's profile so that these professionals can provide qualified care for the population.

Furthermore, it was possible to observe that epidemiological studies act as a basis for evaluating the quality of services and creating cancer control strategies and programs for the public health sector. When it comes to pediatric oncology, it is necessary to conduct more studies on childhood and adolescent cancer.

Although this study achieved the proposed objective, its limitation was the lack of studies addressing each regional health agency of *Rio de Janeiro* State constituted. However, this study is useful because it provided an overview of malignant neoplasm cases in *Rio de Janeiro* State. The need to continue developing research along these lines is reiterated, contributing to new discussions regarding the effective adoption and implementation of strategies to combat childhood and adolescent cancer, aiming at providing qualified care so that morbidity and mortality rates among the children and adolescents can be reduced.

It is expected that this study contributes to more qualified care for the children and adolescents during cancer diagnosis because the early diagnosis of the disease is considered as a determining factor for a good prognosis.

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