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CHILDHOOD LEUKEMIA AND ITS SOCIOECONOMIC LEVEL RELATIONSHIP: A COMPARISON BETWEEN THE EPIDEMIOLOGICAL PROFILE OF NORTE DE MINAS AND OTHER BRAZILIAN REGIONS

Leucemia infantil e sua relação com nível socioeconômico: uma comparação entre o perfil epidemiológico do Norte de Minas e demais regiões brasileiras

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Abstract: Objective: The present study aims to relate the infant mortality rate of each Brazilian region, highlighting the Northern region of Minas Gerais, with its socioeconomic level, through the Human Development Index (HDI), positioning the region in the national context. **Methodology:** Data collection through DATASUS from the years 2010 to 2015, from 0 to 19 years old. **Results:** The Brazilian regions with the highest mortality rates were the North and Northeast, with the lowest rates being the South followed by the Midwest. Northern region of Minas Gerais mortality levels were closer to the Northeast. **Conclusion:** High HDI rates are related to lower rates of infant leukemia mortality, evidencing the socioeconomic factor to a higher survival rate in childhood leukemia.

Keyword: Leukemia; Epidemiology; Mortality; Child.

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Resumo: Objetivo: O presente estudo tem como objetivo relacionar a taxa de mortalidade por Leucemia infantil de cada região brasileira, destacando o Norte de Minas, com o seu nível de desenvolvimento socioeconômico por meio do Índice de Desenvolvimento Humano (IDH), posicionando a região no contexto nacional. **Metodologia:** Levantamento de dados por meio do DATASUS dos anos de 2010 a 2015, da faixa etária de 0 a 19 anos. **Resultados:** As regiões brasileiras com maiores taxas de mortalidade foram Norte e Nordeste, já as menores taxas foram o Sul seguido do Centro-oeste. Os níveis de mortalidade do Norte de Minas foram mais próximos do Nordeste. **Conclusão:** Altas taxas de IDH estão relacionadas a menores taxas de mortalidade por Leucemia infantil, evidenciando o fator socioeconômico a uma maior sobrevida na Leucemia infantil.

Palavras-chave: Leucemia; Epidemiologia; Mortalidade; Criança.

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INTRODUCTION

Cancer is an unquestionable public health problem, especially in developed countries. The estimate for the United States, in the biennium 2016-2017, suggests the occurrence of approximately 600 thousand new cases of cancer. Except for non-melanoma skin cancer (approximately 180 thousand new cases), there will be around 420 thousand new cases of cancer.[1] For the year of 2016 10,070 new cases of leukemia in Brazil are predicted.[2] The level of incidence of childhood cancer is rare compared to the rates in adults, corresponding to just 1 to 3% of the total.[3] Among the leading causes of death in the age group from 0 to 19 years, cancer is the second largest, and leukemia the most common type (29.9%) among the neoplasias. Lymphoid is the most frequent type of leukemia, representing 64.9% of leukemias.[2]

Leukemia is a hematological malignancy of great clinical importance, which is characterized by an abnormal proliferation of leukocyte cells, originated in the bone marrow.[4-5] These cells suffer genetic mutations, which allows them to have an proliferation or reduction of differentiation advantage, invading the bone marrow stroma and subsequently spreading through the organism.[6-7]

It is classified as to time, being divided in acute and chronic. In the acute there is the rapid production of immature cells in the blood, whereas at the chronic there is a production increase in abnormal mature cells , taking months to years to progress. In relation to the cellular type involved, it is classified in myeloid or lymphoid .[1]

The childhood cancer presents itself in such a nonspecific way : fever, abdominal mass, enlarged lymph nodes, headaches and bone pain.[8] In children, the latency period is shorter than in adults, and is more invasive and fast, but the response to treatment is more efficient at this age, resulting in an improved prognosis,[3,9] with the cure rate up to 70%.[10] However, socioeconomic problems, that generate educational and public health issues, interfere in the diagnosis and treatment, frequently delayed, of childhood cancer, reducing the chances of rehabilitation.[11]

Among the possible risk factors for leukemia are some genetic syndromes (Down, Noonan, Trisomy9), high birth weight (> 3.5 Kg), prior abortion and maternal behavior (use of antihistamine, metronidazole, dipyrone, estrogen, consumption of alcohol, marijuana and hallucinogenic drugs, radiation, exposure to insecticides and pesticides).[12-13]

According to the cancer stage and the understanding on the disease, the emotional reactions of the family can be varied, with periods of optimism and hope or dismantling, impotence and perception of threat of loss. This family setting tends to be complicated by the wear and the physical, emotional and social overload, which impact the main caregiver, usually the mother.[14]

Early diagnosis and appropriate treatment has great relationship with a better cancer prognosis. The socioeconomic disparities among the Brazilian regions are associated with the diagnosis in the late phase. This occurs because there is a greater difficulty to access to health services, delaying the diagnosis of individuals with lower income. In addition, mortality data show that the chances of survival are greater in developed countries

compared to developing countries. Therefore, the higher the family income, the greater the chances of receiving an early diagnosis.[15,16]

The Human Development Index (HDI) is calculated based on income, health and education, being a general synthetic measure, of human development.[17] In North America, countries like the United States and Canada have HDI of 0.915 and 0.913, respectively. Whereas in North Africa, Brazil presents HDI of 0.755 while Argentina 0.836. Western European countries such as Germany and Switzerland reach HDI of 0.916 and 0.930, respectively. Among the Africans, South Africa has HDI of 0.666 and Angola 0.532.[18] Therefore, it is possible to make an inverse relationship between the HDI of a region and the rate of mortality by leukemia.

The infant-juvenile cancer has great clinical importance and social aspects, being leukemia the greatest scope. Considering that there are variations in epidemiological indicators due to socioeconomic inequality that lead to a late diagnosis and poor treatment, changing the prognosis and thus the mortality rate, the objective of this study was to relate the rate of mortality by Infantile leukemia of Brazilian regions with the Human Development Index (IDH).

METHODOLOGY

A survey by means of notification data present in the Department of Informatics of SUS (DATASUS) was carried out. The data collected were from the period 2010 to 2015, with a focus on Northern macro-region of Minas Gerais State. In this region, data were collected from each place of hospitalization, with number of inpatients according to gender, age (less than 1 year, 1 to 4 years, 5 to 9 years, 10 to 14 years and 15 to 19 years). In addition to mortality data according to the same ages group.

In the national context, the data extracted from the DATASUS were concerning the death rate by age group and region of the country (North, Northeast, Southeast, South and Center-west),in the period from 2010 to 2015.

The data of the Human Development Index of Brazilian regions were extracted from the Atlas of Human Development in Brazil, made available by the Institute for Applied Economic Research (IPEA) and the United Nations Development Program (UNDP).

RESULTS

Between the period from 2010 to 2015 a total of 2114 persons aged 0 to 19 years of age were admitted by neoplasms in the macro region of North of Minas Gerais State. The incidence in male sex was a little higher, 1,118 cases and female 996 cases. The mortality rate was higher in children younger than 1 year (4.76) followed by the range from 10 to 14 years, that presented a rate of 4.38 In general the mortality rate due to neoplasias was 3.36 (Table 1).

Table 1- Frequency of hospital admissions and mortality rate due to cancer by age and sex in the macro region of the North of Minas Gerais State, from 2010 to 2015.

Age	Male	Female	Total	Mortality rate
Lower than 1 year	39	24	63	4.76
1 to 4 years	242	234	476	2.31
5 to 9 years	319	266	585	3.25
10 to 14 years	260	220	480	4.38
15 to 19 years	1258	252	510	3.33
Total	1118	996	2114	3.36

Source: DATASUS

In the macro region of North of Minas Gerais State, in this same period from 2010 to 2015 of the total of 2114 notifications for neoplasia 667 cases were leukemia, representing 31.5% of the cases of cancer in the age range between 0 to 19 years of age. There was a higher number of cases in male sex, with a total of 386 cases compared with the female, 281 cases. The age group that there was a higher mortality rate was from 10 to 14 years of age, with a rate of 7.32. In the early ages the mortality rate was reduced if compared to those in more advanced ranges, with 1.1 at ages 1 to 4 years. The general mortality rate was equal to 3.75 (Table 2).

Table 2- frequency of hospitalizations and mortality rate by leukemia in the macro region of the North of Minas State according to gender and age from the years 2010 to 2015.

Age	Male	Female	Total	
Lower than 1 year	2	0	2	0.00
1 to 4 years	71	110	181	1.10
5 to 9 years	133	126	259	3.09
10 to 14 years	105	18	123	7.32
15 to 19 years	105	27	102	5.88
Total	386	281	667	3.75

Source: DATASUS

The survey also covered the general results on mortality rates from all regions of the country between the age ranges from 0 to 19 years between the years from 2010 to 2015. The region with higher mortality was the North, with 5.9, followed by the Northeast (3.52), Southeast (2.64), South (2.46) and Center-west (2.28).

In the North, Northeast and South the highest mortality rates were within the age range of children under one year of age, with 10.1, 7.07 and 7.04, respectively. On the other hand, in the Southeast and Center-West, the highest rates of mortality were between 15 to 19 years (Table 3).

Table 3- Mortality rate of leukemia per region in Brazil according to age range, from 2010 to 2015.

Age	North	Northeast	Southeast	South	Center-West
Lower than 1 year	10.1	7.07	3.79	7.04	3.94
1 to 4 years	4.33	2.43	1.64	1.55	1.34
5 to 9 years	5.57	3.11	2.04	2.01	1.38
10 to 14 years	7.74	3.08	3.04	2.72	3.13
15 to 19 years	7.29	5.93	4.09	3.85	4.59
Total	5.9	3.52	2.64	2.46	2.28

Source: DATASUS

All over Brazil, in the period from 2010 to 2015 a total of 336881 people aged between 0 to 19 years of age were admitted by neoplasias. The largest number of inpatients was in Southeast, with 129524 people. The lower number of inpatients was observed in the Northern region with the equivalent of 17577 patients (Table 4).

Table 4 - Hospitalizations due to neoplasia, by age according the Brazilian regions, 2010 -2015.

Age	North	Northeast	Southeast	South	Center-West
Lower than 1 year	758	5015	5132	2592	1002
1 to 4 years	3895	25313	29425	12451	6067
5 to 9 years	3908	23830	28463	11983	5905
10 to 14 years	4081	24442	31205	14105	5478
15 to 19 years	4935	28355	35205	16542	6700
Total	17577	106955	129524	57673	25152

Source: DATASUS

In the period from 2010 to 2015, the total number of hospitalizations due to leukemia in Brazil was 91701. The region with the highest number of inpatients was the Southeast with 38002 people and the lowest was the north with 5543 patients (Table 5).

Table 5 - Admissions by leukemia, by age according to the region in Brazil, from 2010 to 2015.

Age		Northeast	Southeast	South	Center-West
Lower than 1 year	99	382	738	199	127
1 to 4 years	1871	7602	10644	4386	2533
5 to 9 years	1671	7658	11111	4179	2681
10 to 14 years	969	5214	8896	3566	1757
15 to 19 years	933	3608	6613	2934	1330
Total	5543	24464	38002	15264	8428

Source: DATASUS

The Brazilian regions are distributed in five ranges of IDHM: very high human development (0.800-1), high human development (0.700 - 0.799), medium human development (0.600 - 0.699), low human development (0.500 - 0.599) and very low human development (0.000 - 0.499). The regions South, Southeast and Center-West except DF, which is located in the range of very high development, in addition to the Northern states such as Roraima and Pará, are in the range of high human development. The Northeast region and the other states of the northern region fall into the classification of medium development.

DISCUSSION

According to INCA 20151's newsletter, the occurrence of leukemia among the neoplasias from 0 to 19 years is 29.9%. The present study shows variation of this frequency according to the regions of the country. The Northern region of Minas Gerais presented percentage of 31.53 %, similar to the Northern region of Brazil, a fact which highlights the importance of leukemia in this region. There is a strong relationship between the mortality rates for several types of cancer, including Leukemia, and factors such as early diagnosis and standardization of therapeutic protocols.[19] With the improvement of these factors, the cure rate of acute lymphoblastic leukemia increased in the last years around 80%.[20] The highest incidences of leukemia occur in developed countries such as those of North America and Western Europe.[21] The survival rate in developed countries is higher with 43% in North America and Western Europe, while Sub-Saharan Africa has a survival rate of 14% and South America 24%.[22]

A higher socioeconomic development and the consequent increase in life expectancy seem to justify the inverse relationship between the mortality rate due to cancer and high social indicators.[15]

From the data values of HDI of the Atlas of Human Development, allying to the results of studies carried out through the DATASUS, there was an inverse relationship between the rate of mortality and the values of HDI. In regions of lower HDI, North and Northeast, the highest rates of mortality by leukemia, of 5.9 and 3.52, were obtained respectively In the Southeast, South and mid-west regions, areas of higher HDI, lower rates of mortality are present: 2,64; 2,46 and 2,28, respectively.

In the northern region of Minas Gerais, only the municipalities of Montes Claros, Pirapora and Bocaiuva are in the range of high human development, the remaining are in the medium range of human development or low human development.[23] This diversity in the pattern of development, in which there is a predominance of

rates of medium human development, is related to the rate of mortality by leukemia in the region (3.75). Although it is located in the Southeastern region of Brazil, where there is a predominance of high human development by the HDI, North of Minas is an exception in that region, presenting HDI and mortality rates closer to the Northeast than the Southeast.

CONCLUSION

Higher survival rate in Infantile Leukemia is directly related to an appropriate treatment and early diagnosis, which are made possible by means of favorable socioeconomic conditions. Therefore, it can be stated that there is a well-established relationship between the levels of HDI and the rate of mortality by Infantile leukemia, having this relationship an inversely proportional basis.

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