

## CHILD AND YOUTH CANCER: PROFILE OF DEATHS

*CÂNCER INFANTO JUVENIL: PERFIL DE ÓBITOS*

*CÁNCER INFANTO-JUVENIL: PERFIL DE MUERTES*

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This study is aimed at characterizing the deaths caused by malignant neoplasias in children and adolescents living in the state of Paraná, Brazil between 2001 and 2010. It is a quantitative, descriptive, transversal study, based on secondary data, obtained through the data processing department of the Sistema Único de Saúde from July to December, 2012. The following variables were analyzed: gender, age, race and city of residence. As a measure of association, *odds ratio* was used, confirmed by the  $\chi^2$ . The leukemia, central nervous system neoplasias and lymphomas, female gender and white race were highlight topics. Teens had about three times greater chance of dying of cancer compared to children. The child and youth neoplasia deserves special attention on the condition of vulnerability of this group, and further studies are needed to assess the association with possible risk factors.

**Descriptors:** Neoplasms; Child; Adolescent; Mortality; Pediatric Nursing.

Objetivou-se caracterizar os óbitos por neoplasias malignas de crianças e adolescentes residentes no Estado do Paraná entre os anos de 2001 e 2010. Estudo quantitativo, descritivo, transversal, baseado em dados secundários dos Sistemas de Informação de Mortalidade e Morbidade Hospitalar do Departamento de Informática do Sistema Único de Saúde, realizado de julho a dezembro de 2012. Foram analisadas as variáveis sexo, faixa etária, raça e município de residência. Como medida de associação, utilizou-se *odds ratio*, confirmado através do teste  $\chi^2$ . Destacaram-se como principais causas de óbito as leucemias, as neoplasias do sistema nervoso central e os linfomas, incidentes no sexo feminino e na raça branca. Adolescentes apresentaram um risco aproximadamente três vezes maior de óbito em comparação com as crianças. A neoplasia infanto juvenil merece atenção especial diante da condição de vulnerabilidade desse grupo, sendo necessários novos estudos para verificar associação com possíveis fatores de risco.

**Descritores:** Neoplasias; Criança; Adolescente; Mortalidade; Enfermagem Pediátrica.

El objetivo fue caracterizar las muertes por neoplasias malignas de niños y adolescentes de Paraná, Brasil, entre 2001 y 2010. Estudio cuantitativo, descriptivo, transversal, basado en datos secundarios de los Sistemas de Información de Mortalidad y Morbilidad Hospitalario del Departamento de Informática del Sistema Único de Salud, llevado a cabo de julio a diciembre de 2012. Fueron analizadas las variables: sexo, intervalo de edad, raza y ciudad de residencia. Fue utilizado el *odds ratio*, confirmado a través del test  $\chi^2$ . Se destacaron las leucemias, neoplasias del sistema nervioso central y los linfomas, para sexo femenino y la raza blanca como principales causas de muerte. Adolescentes presentaron probabilidad aproximadamente tres veces más grande de muerte en comparación a los niños. La neoplasia infanto-juvenil merece atención especial delante de la condición de vulnerabilidad de este grupo, además hay necesidad de nuevos estudios para verificar asociación con posibles factores de riesgo.

**Descritores:** Neoplasias; Niño; Adolescente; Mortalidad; Enfermería Pediátrica.

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## INTRODUCTION

The magnitude of the cancer observed in high rates of morbimortality in adults, showed to be also significant for the health of children and youths around the world. While countries under development show infectious diseases as the main causes of death, regions with better social economical conditions show statistics with neoplasia as the second main cause of general death among children from 1 to 14 years of age<sup>(1)</sup>.

The malignant tumors constituted the first cause of death resulting from a disease in boys and girls after they are five years old, although when compared to all the age ranges, they represent only 0.5 to 3% of global incidence of cancer<sup>(2)</sup>. In Brazil, for the age range from 1 to 19, the neoplasias are among the ten first causes of death<sup>(1)</sup>.

The most frequent types of neoplasia found in this population are the lymphomas, tumor of the central nervous system and the leukemia, especially the acute lymphocytic leukemia<sup>(2)</sup>.

The factors of risk for the development of child and youth neoplasia are not yet well elucidated, because, due to the low incidence in this population, the statistic studies are limited and very little is known on its etiology<sup>(1)</sup>. It is only known that some factor related to the patient such as sex, age, localization and extension of the tumor, shows a certain influence in the coefficients of mortality<sup>(3)</sup>.

Besides that, in children and in youths, the neoplasia has a more aggressive characteristic, with short periods of latency, but with a good response to the treatment<sup>(1)</sup>. So, the expectancy of life for these patients is directly related to the time of the beginning of the disease until the diagnosis and the precision of the methods used, whether by the non specificity of the symptoms which are confused with symptoms of other diseases found in this age range or by the delay in the search of medical care<sup>(2,4)</sup>.

With the delayed start of the antineoplastic treatment, the prognosis of these patients becomes more reserved which leads to a considerable increase in the rates of mortality in this group. Currently, the technological advancement allows the child cancer to have a favorable outcome, especially when it has an early diagnosis<sup>(5)</sup>. So, it is necessary and important to identify aspects peculiar to child and youth neoplasia once the process of diagnosis starts in the recognition signs and symptoms, which, not rarely, are identified by chance.

The importance of knowing the main types of malignant neoplasias, which attack children and youth, is highlighted, as well as the elucidation of the dimension of mortality by neoplasia in these populations and its distribution in the childhood and youth. So, the subsidies for public policies, which go through early diagnosis and treatment in order to prevent complications in the social, economical, personal and familiar domains, become more concrete.

Facing what was exposed, this article has as objective the characterization of the deaths caused by malignant neoplasias in children and youths living in the state of Paraná, Brazil, between the years 2001 and 2010.

## METHOD

It is a quantitative, descriptive, transversal study which covers all the deaths by neoplasia in a population within the age range from 0 to 19 years, living in the state of Paraná, Brazil, in the period from 2001 to 2010. It was decided to analyze the deaths of the last ten years because, as it is referred to a recent period, it is possible to observe the current conjuncture of the neoplasia in the state of Paraná, Brazil. The research and the grouping of the data were made between the months of July and December, 2010. In this study, a person up to nine years was considered a child, and the

people between 10 and 19 years of age were considered adolescents<sup>(6)</sup>. The information were obtained in the data bank of the Sistema de Informações sobre Mortalidade (SIM) (System of Information on Mortality), of the Health Department, of the program of the Departamento de Informática do Sistema Único de Saúde (DATASUS) (Department of Data Processing of the Unified Health System)<sup>(7)</sup>. Populational data were obtained from the Instituto Brasileiro de Geografia e Estatística (IBGE) (Brazilian Institute of Geography and Statistics), using the National Census of 2010<sup>(8)</sup>, as well as the inter-census projections for the other years.

The SIM is an important tool for national epidemiological surveillance, providing information on the mortality in all instances of the health system<sup>(9)</sup>. Even with the possibility of sub-notifications, of incomplete covering, of inadequate filling of the Death Certificates (DC) and of the losses in the transmission of the data, the SIM is still useful for the analysis of the situation of health of the population<sup>(10)</sup>.

The causes of deaths studied are classified according to the tenth revision of the International Classification of Diseases (ICD-10), chapter II: Neoplasia, categories C00 to C97<sup>(11)</sup>. The malignant neoplasias *in situ* of uncertain or unknown behavior and the benign neoplasias (D00 to D48) were not considered. The basic cause is informed by the physician in the codified DC according to the ICD-10 and registered in the SIM of the county where the death occurred<sup>(11)</sup>.

The mortality was analyzed with the help of the tool for the data collection, made up by the author, containing a guideline with the following variables: sex and age, and this was grouped in 0 to 9 years (children) and 10 to 19 years (adolescents), race/color white and non white (the latter includes dark-skinned, yellow, black and Indians), the county of residence and the cause of death. The analysis of the trend of the mortality caused

by neoplasia was made through the coefficient of mortality, which consists in the relation between the total number of deaths and that particular age range and the population in the same age range, the result was multiplied by 100,000<sup>(12)</sup>. The coefficients were extracted from the Atlas de Mortalidade por Câncer<sup>(13)</sup>, when available, the other ones were calculated through existing data. The coefficients referring to race and color of the age range studied were not calculated once the data was not available. The results were analyzed, excluding the data ignored in each variable.

The data were tabulated used the programs Tab for Win32 and Wine version 3.6b (TabWin) and Excel version 2010, produced by *Microsoft Office* besides the *Statistica software*. As a measure of association the *odds ratio* (OR) was used, with Interval of Confidence (IC) of 95% confirmed through the statistic test  $\chi^2$ , with statistic significance of 5% ( $p < 0.05$ ). This study was not taken to the analysis of any permanent committee of ethics in research, once it used information of public domain present in the data basis in the internet; therefore they are not documents which require ethical secrecy.

## RESULTS

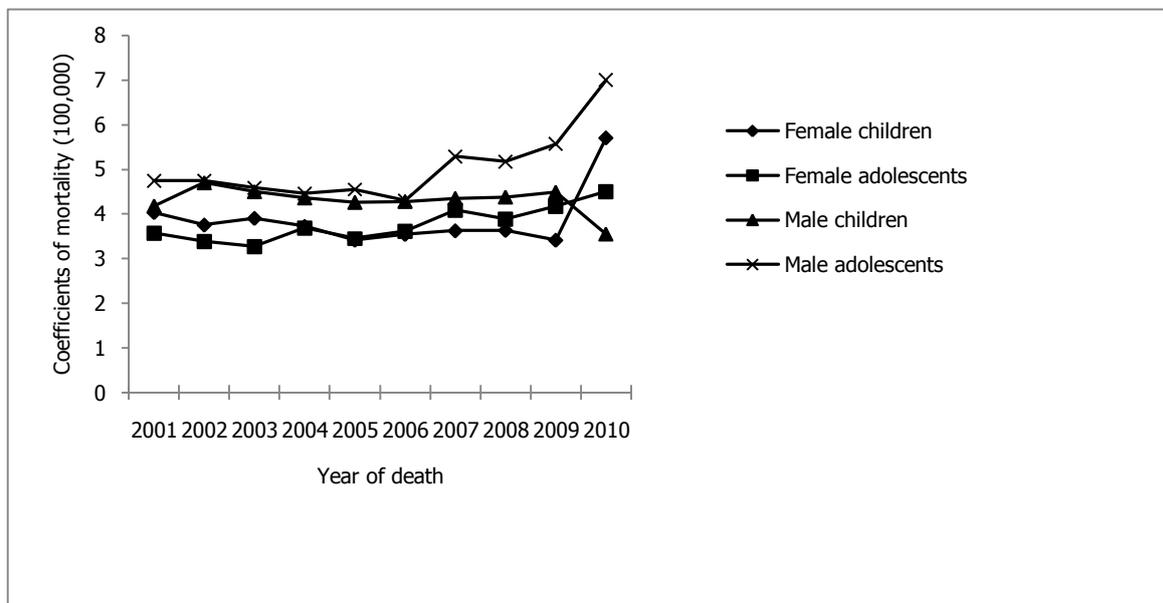
Between the years 2001 and 2010, 1,785 deaths of children and adolescents caused by neoplasia were registered in Paraná, which corresponded to 4% of all the deaths in that age range. When analyzing the other causes of death of children and adolescents, it was noticed that in the age range of 1 to 19 years the neoplasia was the first cause of death by a disease with figures lower only to those related to external causes.

The distribution of the deaths in the state of Paraná, Brazil, showed higher coefficients in the cities of Nova Esperança do Sudoeste (24.62/100,000), Grandes Rios (20.37/100,000) and Munhoz de Melo (17.30/100,000). There was no occurrence in 24% of the 399 cities of the state, while 31% of the deaths are

concentrated in five of the largest cities in the state, namely, Curitiba, Londrina, Maringá, Ponta Grossa and Foz do Iguacu.

The mortality caused by neoplasias remained high for adolescents of the male sex, keeping higher coefficients in all the periods of study, besides

presenting successive increase after 2006, reaching the coefficient of seven deaths to each group of 100,000 inhabitants in the year 2010. On the other hand, in the same year, there was an important decrease of mortality for boys, from 0 to 9 years, with a coefficient of 3.5 deaths (Figure 1).



**Figure 1** - Mortality caused by malignant neoplasias (coefficient) according to sex and age range from 0 to 19 years. Paraná, Brazil, 2001 to 2010

Source: Sistema de Informações sobre Mortalidade/ Ministério da Saúde (System of Information on Mortality/Health Department)

Regarding the female sex, the coefficients of mortality for the children were higher than the ones of the adolescents in the period from 2001 to 2004 and in the year 2010. In this case there were not high changes in the coefficients of mortality, which remained between 3.2 (for adolescents in 2003) and 5.7 (for children in 2010). The female sex presented coefficient lower than the male sex, in all the years of study, except in 2010, when the mortality for children of the female sex

increased and the coefficient of children of male sex decreased, thus inverting the outstanding positions.

In Table 1, the distribution of death caused by neoplasias according the sociodemographic characteristics is observed. There is a greater proportion of deaths in the male sex (54.6%), but the girls presented twice more the risk of death caused by neoplasias (IC:1.30 – 1.57). The percentage of deaths of white children and adolescents was higher than the non white (IC:1.10 – 1.61).

**Table 1** - Mortality caused by malignant neoplasias (N, % and coefficient) according to sociodemographic characteristics from 0 to 19 years. Paraná, PR, Brazil, from 2001 to 2010

| Characteristics | n    | %     | Coef. | p-valor | Odds ratio |
|-----------------|------|-------|-------|---------|------------|
| Sex             |      |       |       |         |            |
| Male            | 975  | 54.6  | 5.2   | <0.001  | 1.4        |
| Female          | 810  | 45.4  | 4.4   |         |            |
| Color/race*     |      |       |       |         |            |
| White           | 1430 | 80.1  | -     | 0.024   | 1.2        |
| Non white       | 157  | 8.8   | -     |         |            |
| Age range       |      |       |       |         |            |
| Children        | 813  | 45.5  | 4.5   | <0.001  | 2.4        |
| Adolescents     | 972  | 54.4  | 5.0   |         |            |
| Total           | 1785 | 100.0 | 4.8   |         |            |

Source: Sistema de Informações sobre Mortalidade/Ministério da Saúde (System of Information on Mortality/Health Department)

\*(198 cases ignored in the variable color/race)

It is worth highlighting the relation between children and adolescents of both sexes and death caused by neoplasia. In this period, adolescents (10-19 years old) presented an average of 54% of the death caused by neoplasia within the population under study, with a risk to die approximately three times higher compared to the children (IC: 2.05 – 3.62) (Table 1).

In the state of Paraná, Brazil, leukemia – with

31% of the deaths caused by neoplasia in the children and adolescents in all the decade and an average coefficient of 1.4 deaths/100,000 children and 1.6 deaths/100,000 adolescents - was the most frequent type of neoplasia; followed by the malignant neoplasia of the central nervous system (CNS), with 31% of the deaths of the children and 20% of the deaths of adolescents; and the lymphomas, with 6% (Table 2).

**Table 2** - Mortality caused by malignant neoplasia according to age and the most representative groups of the International Classification of Diseases (ICD-10). Paraná, PR, Brazil, 2001 to 2010

| Groups of categories ICD 10                                      | Children |       |      | Adolescents |       |      |
|--|----------|-------|------|-------------|-------|------|
|  | n        | %     | Coef | n           | %     | Coef |
| Leukemia (C90 - C96)   | 253      | 31.1  | 1.4  | 300         | 31.0  | 1.6  |
| Malignant neoplasias of CNS (C70 - C72)                          | 256      | 31.5  | 1.4  | 198         | 20.4  | 1.0  |
| Lymphomas (C81 - C85)  | 48       | 5.9   | 0.2  | 103         | 10.6  | 0.6  |
| Malignant neoplasia of bones and cartilage (C40, C41)            | 18       | 2.2   | 0.1  | 123         | 12.7  | 0.7  |
| Malignant neoplasia of endocrinous glands (C73 - C75)            | 82       | 10.0  | 0.4  | 37          | 3.8   | 0.2  |
| Malignant neoplasia of conjunctive tissue and soft tissues (C49) | 34       | 4.2   | 0.2  | 41          | 4.1   | 0.2  |
| Other neoplasias   | 122      | 15.1  | 0.8  | 170         | 17.4  | 0.9  |
| Leukemia (C90 - C96)   | 813      | 100.0 | 4.5  | 972         | 100.0 | 5.0  |

Source: Sistema de Informações sobre Mortalidade/Ministério da Saúde (System of Information on Mortality/Health Department)

Along those ten years there was an increase in the mortality caused by neoplasia of children and adolescents, and a positive percentage variation of 11.6% in their coefficients was observed. The highest

coefficient of mortality in all the periods occurred in the year of 2010, representing 5.30 deaths and the average coefficient of the state was 4.80/100,000.

## DISCUSSION

The study showed that the proportional mortality caused by neoplasia in children and adolescents living in the state of Paraná, Brazil, remains close to 3% of the total number of deaths within this age range, which is similar to the proportion found for the state of São Paulo, as well as for all the country of Brazil and other countries<sup>(1)</sup>. Comparing the coefficients of child youth mortality in Paraná and in Brazil, there is a preponderance of neoplasia as cause of death in the state, while the national average has higher coefficients of mortality caused by infections and parasite diseases and diseases related to the respiratory system<sup>(14)</sup>.

Even with the change of profile of child mortality in the last decades, characterized by the decrease of parasite infectious diseases and the increase of the non transmissible chronic diseases<sup>(15)</sup>, and in most part of the Northern and the Northeastern regions, the previous representation of mortality still persists, possibly as a reflex of the precariousness of the conditions of health<sup>(14)</sup>.

Studies have shown an increase of the incidence of solid tumors in the child and youth population, especially in the last four years, which was evident in several parts of the world, thus suggesting that there is an influence of new risk factors for the child neoplasia, or this increase is just a reflex of the improvement of the notifications of the information systems on health<sup>(16-18)</sup>.

The highest occurrence of death caused by neoplasia in the male sex, both in absolute figures (16,509 versus 12,753 for girls) as well as in coefficients in the country (5.2/100,000 versus 4.4/100,000) also found in the state of Paraná, Brazil, in which 975 deaths for the male sex were reported and 810 for the female sex in the analyzed period, and the coefficient was 5.16 for the former and 4.44 for the latter (girls)<sup>(7)</sup>.

Nevertheless, when the statistics test was made, it was noticed that the girls presented a higher risk of

death caused by neoplasia than the boys. This is due to the fact that, even the ones presenting lower figures of death caused by neoplasia in absolute figures, percentages and coefficients, compared with the latter, the neoplasias have higher importance as the causes of death for the female sex, representing 5% of the total number of deaths within this age range, while the boys represent only 3.5%.

So, the girls now have an increased risk rate for death caused by cancer and, consequently, the female sex became more vulnerable. Besides that, there was an increase of the coefficients of mortality for the girls within the age range from 0 to 9 years, especially for the neoplasias of the central nervous system, which increased from 1.5 to 2.1 deaths to each group of 100,000 inhabitants in the years 2009 and 2010, a fact which did not occur with children of the male sex.

The coefficient of mortality for the white race/color in the United States of America was significantly higher than the one for the black race/color<sup>(3)</sup>. In Santa Catarina, Brazil, it was observed that 407 (94.43%) of the children/adolescents belonged to the white race/color, 4 (0.93%) to the black race/color, and 20 (4.64%), belong to the dark-skinned race/color<sup>(15)</sup>. So, in this study, the mortality of the white subjects was also higher than the other races, statistically representative and having a higher *odds ratio*.

This study revealed that the rates of death of adolescents from 10 to 19 years are about three times higher than those of the children from 0 and 9. The highest coefficients are attributed to adolescent boys, which maintain increasing numbers of deaths. The neoplasias which contributed for that increase were mainly leukemia and the cartilage tumors, which presented higher coefficients for boys in the last three years of the study. In the United States of America the new cases within the age range from 15 to 19 years

(210.42 per million) outnumber the ones from 0 to 14 of age (150.97 per million)<sup>(3)</sup>, which may result in higher mortality of adolescents in that country.

As a counterpoint to neoplasias of adults, especially the ones represented by lungs, stomach, prostate and breast cancers, which cause the most deaths in Paraná for this disease<sup>(7)</sup>, the child youth neoplasias differ, among other aspects, regarding type and place, victimizing children and adolescents through other forms of the disease. In this study the leukemia, malignant neoplasias of the CNS and the lymphomas are outstanding, once they are responsible for more than half of the deaths caused by neoplasias in this period.

In Brazil it became evident that leukemia (34%), tumor of the CNS (22%) and the lymphomas (8%) were the three main causes of death by neoplasia, in the age range from 0 to 19 years, between 2001 and 2010. The tumors originated in the soft tissues, in bones, in endocrine glands, the renal tumors and others followed in the other positions<sup>(7)</sup>. These data corroborate with the ranking observed in Paraná, Brazil, minimally diverging in the percentages and the mortality caused by CNS tumors was higher in that state than in the country, while leukemia presented inverse behavior.

A research made in Colombia showed that the types of predominant neoplasias in the mortality of children and adolescents were those related to leukemia (48.6%), followed by the CNS tumor (16%) and the non Hodgkin lymphomas (7.6%)<sup>(19)</sup>. Close to these results is the study of Shanghai in which leukemia, with 34.5%, was the most common neoplasia; in the second position were the CNS tumors (20.2%), and after that the lymphomas (8.4%)<sup>(20)</sup>. So, the causes of death by child youth neoplasias are similar in Paraná and in Brazil regarding the other countries. The difference is only in percentage figures.

Unlike what absolute figures show, the largest urban centers in Paraná did not present the highest

coefficients of mortality. The cities with the higher figures of regarding deaths are the same ones that have specialized oncological centers, and the calculation of the coefficients of mortality caused by neoplasias in those places reveal rates of 2/100,000. This can be attributed to the availability of human and technological resources in those cities, providing early diagnosis with better treatment and in the increase of the survival rate.

When calculating the coefficient of mortality in all the cities of the state, some were outstanding with figures up to five times higher than the average in Paraná, Brazil. Because child neoplasias are rarely associated to the exposition of carcinogens, the territorial distribution of those should also be similar in all the counties<sup>(14)</sup>. Nevertheless, once these cities are distant and small, this fact has been attributed as the conjuncture of the discrepancy in the accessibility to diagnosis and treatments for those patients who live in the regions with minor health resources.

The differences in accessibility in health have already been elucidated, once it is known that characteristics of territorial access, organization of the services and even social demographic peculiarities can help or jeopardize the diagnosis and treatment of patients with cancer<sup>(14)</sup>. Furthermore, the subjects who discover the disease at a late stage face the disease in advanced phase, which reverberates in the need of aggressive treatment or results in the unfeasibility or therapeutical control.

## CONCLUSION

The many types of leukemia, neoplasias of the central nervous system and the lymphomas incidents in the female sex and the white race are highlighted as the main causes of death. Adolescents presented a risk of death approximately three times higher compared to children.

Under this perspective, the condition of vulnerability of children and adolescents to neoplasias shows that this group deserves special attention regarding this problem. It is very relevant to know the epidemiological characteristics of the neoplasia for this population so that the health services and the family members become aware of the signs and symptoms presented by them and so public policies can be implemented which will reach early diagnosis and a complete treatment of those subjects. For such, it is necessary to make new studies on the incidence of neoplasias as well as to verify a possible association with risk factors and its different etiologies.

### COLLABORATIONS

Marchi JA, Wakiuchi J, Mathias TAF and Fernandes CAM contributed for the conception and development of the research, writing and final approval of the version of the article to be published. Sales CA contributed to the development of the research, writing and final approval of the version of the article to be published.

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