

<https://doi.org/10.18233/apm.v45i5.2964>

The overwhelming problem of childhood cancer in Mexico.

El abrumador problema del cáncer infantil en México

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Abstract

Childhood cancer is the second cause of mortality of the population between 4 and 15 years. More than 20 million new cases of cancer in the world are expected by the year 2025, and 80% of the load will be on countries of low to middle income. In the past two decades, significant changes have been observed in patterns of incidence, prevalence, survival, and childhood cancer mortality in Mexico.

An extensive review of all the published studies in Mexico by various health institutions revealed a steady 18-year trend of 150 new cases/million/year. The prevalence showed that acute leukemias constitute a 50% of all childhood cancer cases, followed by lymphoma (Hodkin and non-Hodgkin), and primary malignant brain tumors. A significant survival rate was observed in 8 thousand children with acute lymphoblastic leukemia with an overall 5-year survival rate of 62%, with a range of 45 to 73%. The national mortality rate for all types of cancer was 5.2/100,000/year, which is higher than what is reported in most middle-income countries. In the face of the current results, the need arises to modify how we approach this group of diseases by integrating a socio-educational healthcare of the Mexican children who are currently treated under unfavorable conditions. The current sanitary authorities must be aware of the importance of the transmission and adjustment of the care received by children with these diseases at a national level, to be in line with international standards.

KEYWORDS: Childhood Cancer, Morbidity, Mortality, leukemia, lymphoma.

Resumen

El cáncer infantil es la segunda causa de mortalidad en la población de 4 a 15 años. Para el año 2025 se esperan más de 20 millones de casos nuevos de cáncer en el mundo, y el 80% de la carga corresponderá a países de ingresos bajos y medios. En las últimas dos décadas en México, se han observado cambios significativos en los patrones de incidencia, prevalencia, supervivencia y mortalidad por cáncer infantil. Una revisión exhaustiva de todos los estudios publicados en México por diversas instituciones de salud reveló una tendencia en los últimos 18 años que reporta 150 casos nuevos/millón/año. La prevalencia mostró que las leucemias agudas constituyen el 50% de todos los casos de cáncer infantil, seguidas del linfoma (Hodgkin y no Hodgkin) y los tumores cerebrales malignos primarios. Se observó una tasa de supervivencia significativa en 8 mil niños con leucemia linfoblástica aguda a 5 años de 62%, con un rango de 45 a 73%. La tasa nacional de mortalidad por todos los tipos de cáncer fue de 5.2/100,000/año, que es superior a la reportada en la mayoría de los países de ingresos medios. Ante los resultados actuales, surge la necesidad de modificar la forma de atender este grupo de enfermedades integrando una atención socioeducativa a la niñez mexicana que actualmente es atendida en condiciones desfavorables. Las autoridades sanitarias actuales deben estar conscientes de la importancia de la adecuar la atención que reciben los niños con estas enfermedades a nivel nacional, para estar acorde a los estándares internacionales.

PALABRAS CLAVE: Cáncer infantil, morbilidad, mortalidad, leucemia, linfoma.

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Received: 25 June 2024

Accepted: 02 Septiembre 2024

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This article should be cited as: Rivera-Luna R, Olaya-Vargas A, Velazco-Hidalgo L, Cárdenas-Cardós R, Galván-Díaz C, Ponce-Cruz J, García-Vicera J, Melchor-Vidal Y. The overwhelming problem of childhood cancer in Mexico. Acta Pediatr Mex 2024; 45 (5): 503-510.

INTRODUCTION

Childhood cancer is an important global public health problem, especially in low and middle-income countries (LMIC). The main challenges that emerge from limited hospital infrastructure and resources are diagnosis and treatment. According to different international sources, 400,000 new cases of children (0-19) with this disease are estimated to be diagnosed every year in the future.¹

Cancer in the Mexican pediatric population is a public health problem, because its incidence, prevalence, and mortality are a challenge to the health system. We currently know that the incidence in LMIC is growing, and very soon these countries will be even more challenged regarding diagnosis and care of this vulnerable population.² Researchers in LMIC have been recently studying this biological phenomenon, highlighting the importance of implementing and projecting improvements in the educational programs of family doctors and pediatricians, opening pediatric oncology residencies, and training specialized nursing staff and paramedic personnel, to optimize the health care provided to children with this disease.

The mortality rate of childhood cancer at a global scale, and especially in Mexico, could be reduced if prevention or early detection were possible systematically. Seventy-five percent of childhood malignant neoplasms are curable with therapeutic managements, including surgeries, radiotherapy, chemotherapy, and molecular therapy currently available in high-income countries. However, the knowledge about prevention and early detection in LMIC is limited. This situation is due to the restriction of financial and technical resources, and the limited epidemiological knowledge of these countries.

Undoubtedly, prevention and early detection require specialists in the field, besides the close

participation of the local and federal healthcare services, to ensure that family doctors and the pediatricians are aware of these growing health problems. The approach to this must be through sharing knowledge between epidemiologists and pediatricians specialized in oncology and hematology, with the implementation of continuous medical education programs for family doctors, and for the population in general. With these modifications, pathological entities which are susceptible of early detection will be identified more efficiently, benefitting the community and the patients.

One of the functions of the childhood cancer early detection campaigns is to promote the timely and precocious diagnosis, but also prevention in the few cases where pediatric oncology norms can be issued. However, it is also important to reduce the elevated financial costs by educating the general population. In countries like Mexico, the problem of childhood health and cancer is one of the underdevelopments which are necessary to solve. It is likely that at some point, the solution for this problem will be found, especially in the open population, with the recent creation of "IMSS-Bienestar" (IMSS-Wellbeing).

The Mexican population is of 130 million people, according to the last census by the National Institute of Statistics, Geography, and Informatics (INEGI).³ Forty-three percent of the population are under 18 years, situation which makes the federal health authorities consider childhood cancer as a national healthcare problem, because the incidence of cancer in children under 18 years in Mexico is of 150 cases per million/year.⁴ With these numbers, it is possible to conclude that there were 7,686 new cases of children under 18 in the year 2021 in the open population, and that therefore, the theoretical accumulated number increases every year.⁴⁻⁶ These numbers show a trend that is out of proportion with respect to the number of specialists, who can hardly meet this growing demand.



It is fundamental to know the metrics to understand the magnitude of the childhood cancer problem. Mexico has an area of 2 million square meters, and a GDP of 4%, from which only 0.29% is allotted for research related to health, cancer included. According to the World Bank,⁷ Mexico is among the 15 biggest world economies, and it is the second in Latin America, it has an income per capita of 4,400 American dollars/year, and only 120 doctors and 190 nurses per 100,000 inhabitants. Additionally, there are 390 pediatric oncologists, and fewer than 150 pediatric hematologists, registered in the Oncology Mexican Council in all the country. However, the geographical distribution isn't a harmonious and strategic one, especially if we consider that 201 pediatric oncologists are based in the Mexican Institute of Social Security (*IMSS*), Institute of Security and Social Services for State Workers (*ISSTE*), Secretariat of National Defense (*SEDENA*), Mexican Oil (*PEMEX*), and Secretariat of the Navy (*SEMAR*), while the remaining 189 specialists are tending to the integral care of the open population.

There are currently 58 hospitals dedicated to the care of children with cancer. These hospitals are part of the so-called Wellbeing System, from Tijuana in *Baja California* (north), to Merida in *Yucatán* (south). So, a uniform regional distribution of hospitals must be aimed at, as part of the plans of the health sector, to be able to better care for this population. On the other hand, the participation of the private sector in the healthcare of these children is minimal.

The prevalence of cancer in Mexico reveals that 5% of all the malignant diseases in the general population⁸ occur in people under 18 years, probably a higher rate than that of industrialized countries. However, despite the low prevalence of these diseases in the context of cancer in the general population, the notion that there are more than 33 million Mexicans under 18 years cannot be overlooked, making this an important health problem.⁹

Current situation of cancer healthcare from the perspective of the health system

Pediatric cancer (ages 0-18) is on the healthcare state agenda as one of its priority activities. The functions of the health system for the care of childhood cancer were organized in Mexico since 2005-2019, so it has been possible to analyze the situation and estimate the challenges and gaps in the offer and demand of services. The objective was to analyze the offer, the demand, and the use of services for childhood cancer, the treatment results, and the total rate of survival and mortality¹⁰ in the population covered by the Health Secretariat.

There are specific policies for the care of childhood cancer which have been implemented through the National Center for Childhood and Adolescence (*CENSIA*), and the Childhood and Adolescence Cancer Program.⁶ This program is closed since 2019.

The *Imss-Bienestar* System was created to treat catastrophic diseases, among them childhood cancer.¹¹ This initiative will be federally funded with resources for investing in human capital, financing, equipment, and training. The General Health Council, the Economic Analysis Unit, the General Board of Directors for Planning and Development, Quality and Education in Health and Epidemiology, will be collaborating on this task.

The oncological services and healthcare for the open population is provided by 54 certified hospitals, whose productivity, according to data from the Health Secretariat, is of 7,500 new patients yearly. The service is provided through treatments specific to each institution, however, the treatments of choice are not always available all of them, due to an intermittent lack of supply of oncological medications at a national level. Currently, there is no standardized action plan, but in the year 2023, the development of

new protocols started to treat both children and adults, in an open health system.

As for the specialized staff, the numbers show important gaps between Mexico and the United States, for example with the Children's Oncology Group¹² in the U.S., which can serve as a lead to create in Mexico a national cooperation group that would benefit Mexican children with cancer, by establishing specific and technically robust metrics, to allow finding unmet needs in specialized centers and professional staff.

EPIDEMIOLOGY

Childhood cancer was not one of the 10 main causes of mortality in the pediatric population in Mexico for 4 decades. Therefore, it was not considered a public health problem. However, in less than 2 recent decades there have been extremely significant changes in the patterns of incidence, prevalence, survival, and childhood cancer mortality. These epidemiological transitions have put cancer as the second cause of death among children between 4 and 15 years.¹³

The overall survival for childhood cancer in Mexico can give us an idea of the magnitude of the disease: **(Figures 1 and 2).**

The thorough information from the National Cancer Registry of the Mexican population between 0 and 18 years is necessary for a better development of the healthcare programs.⁴ The necessity of a registration of childhood cancer tumors is a must to develop good health practices. This is already done in high-income countries, but it is limited in low and middle-income countries. This way, we can see that Mexico is among the countries with higher incidence of childhood cancer at a global scale.

The incidence of childhood cancer between 0 and 18 years is 150/million/year, with acute leukemia standing out with 50%¹⁴ of the child-

hood malignant diseases. This implies the continuous development of new state/national institutions for these patients, and the training of medical and paramedical human resources. The Centers for Disease Control and Prevention (CDC) of the United States¹⁵ report that the age-adjusted incidence rate rose every year between 2003 and 2014, with 173.7 cases/million in 2014 in ages between 0-19. This measurement has been done in Mexico through the General Directorate of Epidemiology⁴ since 2010. Undoubtedly, in the past 20 years, these tools have become specialized axes aiming at synchronization, standardization, and medical care for Mexican childhood cancer patients in the open healthcare system. Independently of other branches of the healthcare system, like IMSS¹⁶ and ISSSTE.

The mortality of children between 0 and 18 years in Mexico is high in comparison with that of some countries, included industrialized countries.¹⁷⁻¹⁹ **Table 1**

To understand the greater Mexican health situation, we must outline the current children's healthcare, starting from 2019. It is now a different healthcare system which has brought changes to a previous childhood cancer national program.²⁰ Years back, we had 60 accredited hospitals at a national level which had a pediatric oncology department. Nearly 28% of the medical institutions in Mexico which were previously certified have lost their accreditation for childhood cancer treatment, which is a consequence of the decrease of funding by the state/federal government, the national scarcity of chemotherapy, and the overwhelming incidence, mortality, and financial cost of the COVID-19 pandemic in the general population. All these factors have had a negative impact on the services provided for the treatment of childhood cancer, mainly for patients who are in the social healthcare system, which treats 50% of all the children with cancer in Mexico.

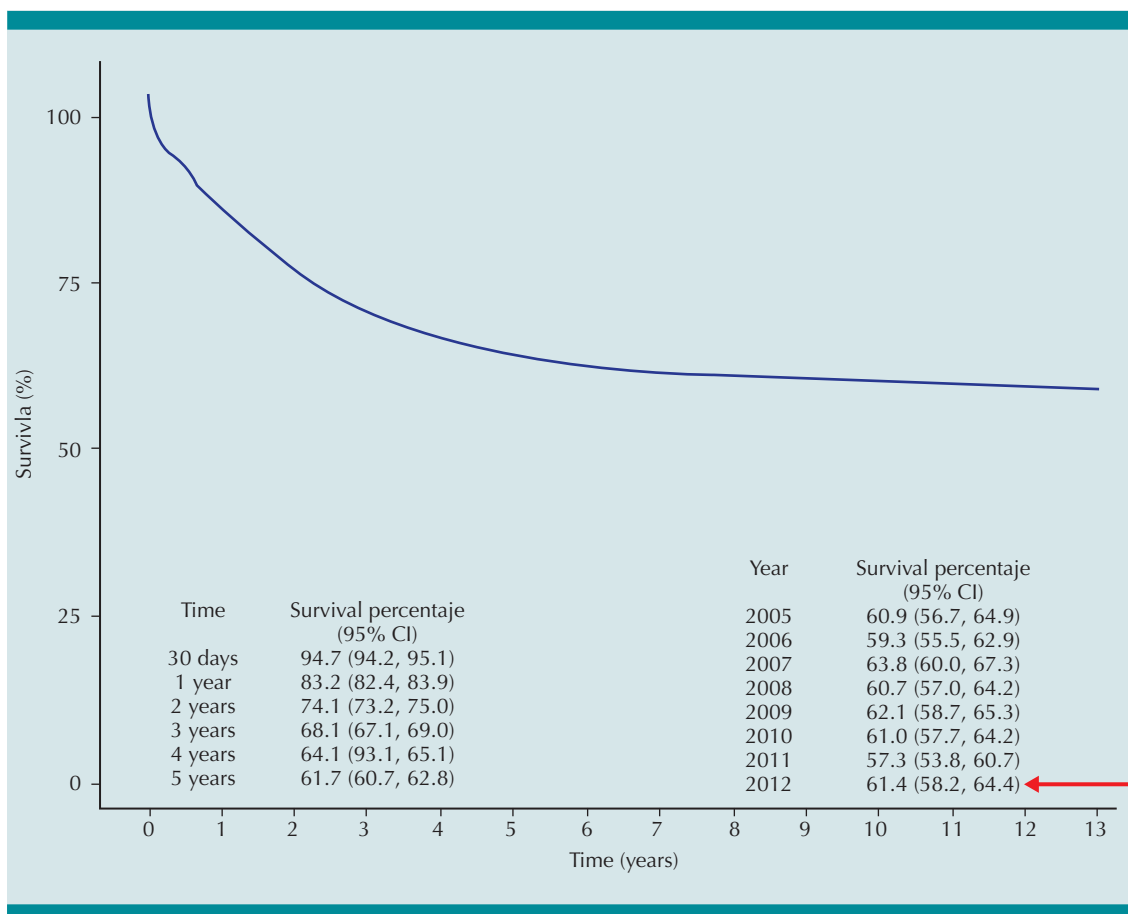


Figure 1. Supervivencia general a 5 años entre 8,977 niños con LAL* tratados bajo el Seguro Popular para financiar tratamientos de alto costo, 2005 – 2019.

*ALL: Acute Lymphoblastic Leukemia

The aforementioned causes a high rate of abandonment at a national level. In the states of the south, such as Guerrero, Oaxaca, Chiapas, Quintana Roo, Veracruz, and Tabasco, as well as in center states like Michoacán, and other northern states, the rate of abandonment is 50% in the first three months after cancer diagnosis, especially in the southern states.²¹

It is necessary to highlight the problematic outcome that is happening in middle-income countries such as Mexico,²²⁻²³ where childhood cancer, from the perspective of healthcare, can-

not get past the responsibility that parents and government face after the COVID-19 pandemic, the unemployment rate, and consequently, all the sociodemographic difficulties related with this subject.

Recent findings reveal that some childhood cancers have similar biological origins, independently of their country of origin. According to current data from the U.S.,²⁴ almost 50% of the children with cancer have leukemia, and Hispanic/Latino children are the ones with the highest incidence, with shared biological

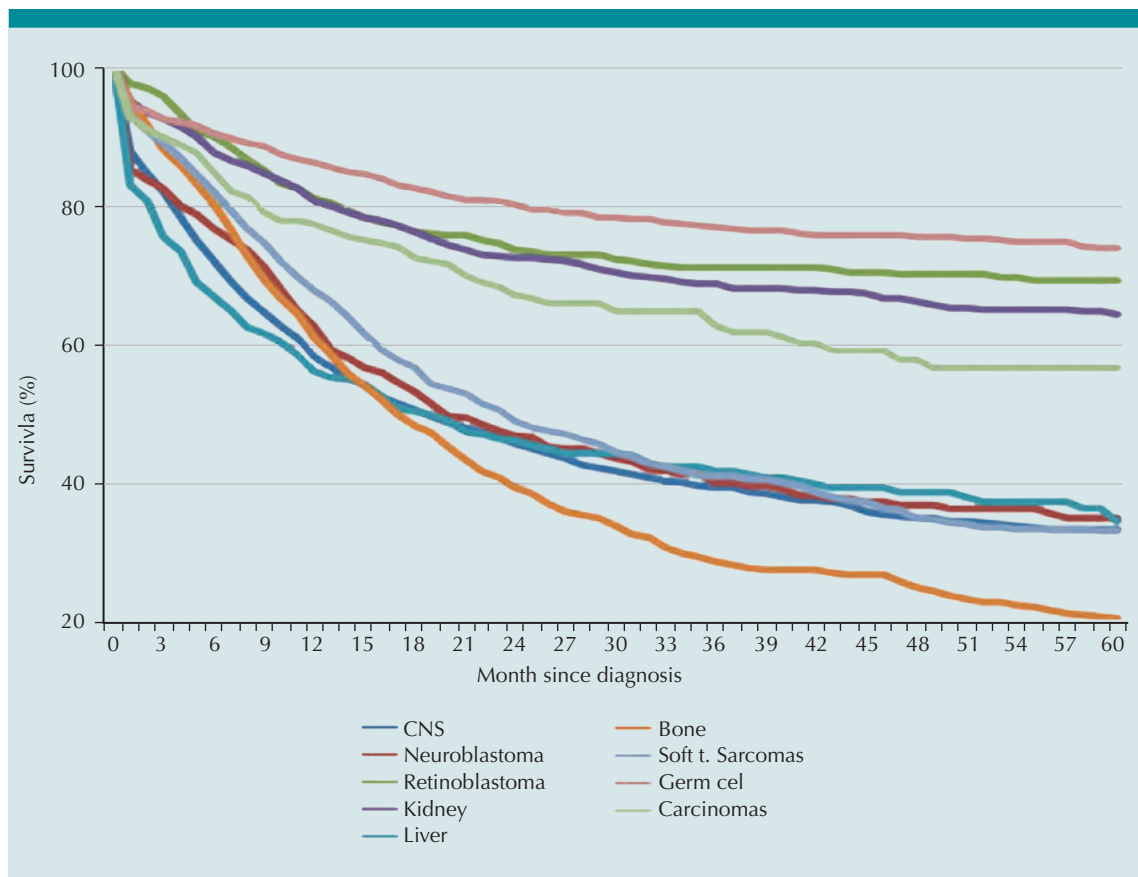


Figure 2. Overall 5-year survival in Mexican children with cancer (2019)⁴

Table 1. Childhood cancer mortality trend (standardized mortality rate)¹⁹

Country	Boys	Girls
Mexico	5.2	4.6
United States	2.5	2.2
Canada	2.6	2.14
Puerto Rico	1.2	1.7
Uruguay	2.7	2.6
Panama	4.2	4.6

characteristics, and bad response to treatment, leading to high mortality. This number is similar in Mexican children with acute lymphoblastic leukemia.²⁵ Therefore, we consider that these findings are mostly related to ethnicity and a

particular biological substrate found in Hispanic and Mexican children.²⁶

Many negative factors have an impact of the results obtained with Mexican children with cancer,²⁷ and this causes mortality to be higher than in most middle-income countries.²⁸ The main factors are poverty, illiteracy, children who belong to ethnic groups which are not mixed, unemployed parents, social inequality, malnutrition, large family groups, long distances between certified hospitals, lack of means of transportation, and scarcity of chemotherapy.

Finally, we consider that Mexico has a real load of childhood cancer,²⁹ however, Mexico is not

the exception, the problem is worrying at a global scale, especially in developing countries. To solve this issue, the Mexican federal government has established several key initiatives to support the accreditation of hospitals for the treatment of childhood cancer, such as the promotion of treatment guidelines, the availability of medication used in chemotherapy, the creation of a National Registration of Childhood Cancer, the supply of equipment to pediatric oncology medical units, and the promotion of training programs in pediatric oncology, which have become an effective way of standardizing and improving the study programs of specialists. Only with the effort of Mexican healthcare professionals and the Federal Government will these actions improve results for all Mexican children.

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