

ORIGINAL ARTICLE

Pattern of Childhood Cancer Mortality in Mexico

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Background. Public and governmental concern regarding increasing cancer mortality trends in children in Mexico led us to investigate the current situation of childhood cancer in this country, as well as to discuss the reasons for which no decline in total and childhood cancer mortality has been documented during the past decades.

Methods. The data used for analysis of total cancer mortality and study of the trends in mortality of specific childhood cancer in Mexico were retrieved from official Mexican Cancer Mortality Statistics for the period of 1955–1995, as well as from the latest official death records of the Mexican National Institute of Statistics, Geography and Informatics.

Results. Actual mortality rates from all sites of cancer in Mexico show a tendency to increase in adults and in children over the last decades. The mortality rate due to all malignant neoplasms in the Mexican population increased significantly, from 28.1 per 100,000 inhabitants in 1955 to 52.6 per 100,000 inhabitants in 1995, whereas the rate of total mortality tended to decrease. The death rate among Mexican children under 15 years of age from all malignant neoplasms increased from 1980–1995 by 20.3%.

Conclusions. Although these findings offer some support for the suggestion that socioeconomic factors and delayed diagnosis and treatment may be the major contributors to childhood cancer death rates in Mexico, other explanations cannot be excluded. Further and more detailed research into the nature of the influence of environmental exposures, geographical distribution—including rural vs. city life—and purely biological factors concerned with the cancer situation is warranted. Predictions indicate that the increase of both total and childhood cancer mortality will continue. The pattern in the epidemiology of childhood diseases is changing in view of better national health measures to control infectious diseases, diarrheas, and neonatal problems. All these measures would lead to an increase in the incidence of childhood cancer in children who previously died of other causes. Therefore, improved registry, early diagnosis, better knowledge of the epidemiologic pattern of childhood cancer, appropriate treatment, and greater resources are necessary to solve this emerging health problem in Mexico. © 2001 IMSS. Published by Elsevier Science Inc.

Key Words: Rate of cancer mortality, Frequency of childhood cancer, Socioeconomic factors, Mexico.

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Introduction

At present, cancer represents one of the most frequent causes of human death in the world, and claims over 6 million lives each year. In Mexico, cancer is also a very important public health problem (1–5). According to the latest published data (1), it is the second cause of overall mortality

in Mexico after cardiovascular diseases, with a rate of 53.6 per 100,000 inhabitants, accounting for 49,916 adult deaths and 57.2 per 1,000,000 (1,605 deaths) for children under 15 years of age in 1996.

Childhood cancer is also the leading cause of disease-related mortality among children between 4 and 14 years of age, although the relative frequency of different types of cancer varies quite markedly from country to country. Public and governmental concern regarding increasing cancer mortality trends in children in Mexico led us to examine and provide herein an overview of incidence and mortality patterns from 1980–1995. Because of the poor reliability of cancer incidence data in Mexico in the past, the analysis is based on existing mortality data only.

The objective of the present work is to supply information in order that the international and national medical community becomes acquainted with the current situation of childhood cancer in Mexico, as well as to discuss the reasons for which no decline, in comparison with other countries, in total and childhood cancer mortality has been documented during the past decades. An analysis of trends in mortality for specific childhood cancer in Mexico is presented.

Materials and Methods

The data used for analysis of total and childhood cancer mortality in Mexico were retrieved from official Mexican Cancer Mortality Statistics for the period of 1955–1995 (1–5). A study of trends in mortality from specific childhood cancers was performed using information on childhood mortality according to cancer type for the 1980–1995 period, which was obtained from the official death records of the Mexican National Institute of Statistics, Geography and Informatics (INEGI) and related sources (2,3–12).

Analyses were performed for sex, age at death (under 1 year, 1–4 years, 5–9 years, and 10–14 years), and tumor type by histology. Mortality was analyzed in relation with

time period (1955–1990 for total cancer mortality and 1980–1995 for childhood cancer mortality), population of Mexico per 5 years, total number of deaths, number of deaths from cancer, total rate of deaths per 100,000 inhabitants, rate of deaths from cancer per 100,000 inhabitants for adults, and rate of deaths from cancer per 1,000,000 inhabitants for children. Estimates of the resident population, generally based on official censuses, were obtained from the INEGI.

Statistical methods. We compared the type-specific cancer incidence rate for each country selected by using published data. No attempt was made to model incidence and mortality data, as the table and graphics displayed were sufficient for the purpose of overall or type-specific (Tables 1 and 2) (Figures 1 and 2) and intercountry (Table 3) comparison (13). Information was processed using the Quattro-Pro 4.0 spreadsheet (Borland International, Scotts Valley, CA, USA) and the Stata statistics package 3.1 (Stata Corp., College Station, TX, USA).

Results

The total rate of mortality and of mortality from cancer for the period of 4 decades (1955–1995) in Mexico are presented in Table 1. The mortality rate for all malignant neoplasms increased significantly from 28.1 per 100,000 inhabitants in 1955 to 52.6 per 100,000 inhabitants in 1995, despite a decrease in overall mortality rate from 1,319.2 per 100,000 inhabitants in 1955 to 472 per 100,000 inhabitants in 1995 (1–5).

Most recent published registry data of deaths (1) indicated that in 1996, the mortality rate for all cases of cancer in Mexico continues to maintain a tendency to increase and had already reached 53.6 per 100,000 inhabitants (about 3% more in comparison with 1995). It is interesting to note that regional geographical variations in the distribution of mor-

Table 1. Mortality in population of Mexico, 1955–1995

Year	Population	Total number of deaths	Number of deaths from cancer	Rate of total number of deaths ^a	Rate of deaths from cancer ^a	% of deaths from cancer to total number of deaths
1955	30,892,371	407,522	8,686	1,319.2	28.1	2.1
1960	36,046,000	402,545	12,516	1,116.7	34.7	3.1
1965	42,502,170	404,163	15,441	950.9	36.3	3.8
1970	48,958,341	485,656	18,415	991.9	37.6	3.8
1975	57,974,945	435,888	21,674	751.9	37.4	5.0
1980	66,846,833	434,165	26,427	649.5	39.5	6.1
1985	77,938,296	414,003	34,974	531.2	46.3	8.4
1990	81,249,645	412,214	41,168	507.3	49.3	9.7
1995	91,158,290	430,278	48,222	472.0	52.6	11.4

^aMortality rate per 100,000 inhabitants; modified from References 1–8.

Table 2. Rate^a of cancer deaths occurring in Mexican children younger than 15 years of age (1980–1995)

Age (years)	1980	1995	% of differences for time period
<1	61.6	42.7	-30.7
1–4	51.8	65.8	+27.1
5–9	41.5	49.8	+19.9
10–14	40.5	48.0	+18.5

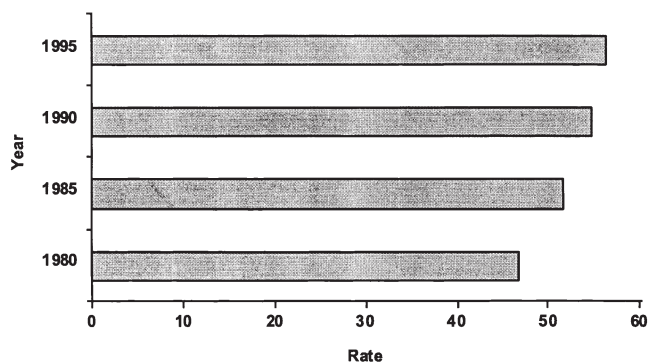
^aMortality rate per 1,000,000 inhabitants under 15 years of age.

tality from all neoplasms were found for all 32 states of the Mexican Republic. Overall cancer mortality was highest in Mexico City (11.9%) followed by the states of Jalisco (8.0%), Veracruz (7.9%), and Michoacán (4.6%); the lowest rates were reported in Quintana Roo, Baja California Sur, and Campeche (1–5). When the childhood cancer situation in Mexico was examined by mortality rate, we found the picture similar to that of the total of cancer mortality.

The death rate among Mexican children under 15 years of age (Figure 1) from all malignant neoplasms during the past decades increased by 20.3%, from 46.8/1,000,000 children in 1980 to 56.3/1,000,000 children in 1995, whereas the total rate of mortality among children under 15 years of age decreased by 30% during the same period (1–5).

Table 2 depicts the same data for the <1, the 1–4, the 5–9, and the 10–14 year age groups, respectively, from 1980–1995. The mortality rate from cancer among children from 1–15 years of age has a tendency to increase, whereas a certain decline in death cases was observed in children under 1 year of age.

Data presented in Table 3 show the frequency of various childhood cancers in Mexico in comparison with the frequency in other selected countries. The leading causes of cancer among children in all these countries were leukemia, lymphomas, and central nervous system (CNS) tumors (9–11). In developing countries such as Turkey and Mexico, the frequency of lymphomas is higher (25 and 19.5%, respectively) than in the United States and England (13 and 12%, respectively), whereas in the latter, CNS tumors are more frequent (19 and 20%, respectively) than in Mexico

**Figure 1.** Childhood cancer mortality rates in Mexico, 1980–1995. Rate of childhood cancer mortality per million inhabitants under 15 years of age.

and Turkey (10 and 11%, respectively). It is interesting to note that in Mexico one of the most frequent solid tumors in childhood cancer is retinoblastoma, accounting for 8.5% of cases, in comparison with other selected countries (1–3%). Retinoblastoma is considered by some investigators (14) to prevail in underdeveloped countries, suggesting an association with poor living conditions and possible infectious agents. No significant differences among these countries were observed in the case of osteosarcoma and Wilms' tumor.

Leukemia and lymphomas are the most common type of malignancy and the leading cause of death in children under 15 years of age in Mexico over the past decades (9–11). It was recently reported (12) that a markedly increased trend (almost three times) was observed for acute lymphoblastic leukemia (ALL). The rate of incidence per million children increased from 7.75 in 1982 to 22.19 in 1991, whereas the rate of acute nonlymphoblastic leukemia (ANLL) remained stable during this period, accounting for 1.34 and 1.29 in 1982 and 1991, respectively. Although the incidence for ALL increased in both sexes, it was more prominent in females; in the case of ANLL, a nonsignificant trend was observed for both sex groups (12).

Figure 2 displays mortality trends in childhood cancer from 1980 through 1995 for the nine most common histologic categories in Mexico. It was demonstrated that the mortality rate for all indicated sites of cancer—except lymphomas—had a tendency to increase during this period. Thus, this evidence indicates that in Mexico cancer mortality has been increasing steadily among adults and children over the past decades.

Discussion

This study has shown a significant increase in the total of cancer mortality from 1955–1995 and a leading position in frequency among the main causes of death in Mexico. According to these tendencies in Mexico, it has been predicted that the rate of cancer deaths in the year 2000 will be 55.3 per 100,000 inhabitants (6). Our finding of a high proportion of cancer mortality in Mexico confirms early studies from other investigators (7,8,15). The variations observed in the distribution of the total of cancer mortality among the different states of Mexico may be related to the population density, socioeconomic conditions, and environmental factors that characterize these states and various regions of Mexico.

This unfavorable cancer situation in Mexico differs from situations in other areas of the world, including Latin American countries. For example, in Argentina in the late 1960s the total of cancer mortality rates (150/100,000 inhabitants) was among the highest in the world; however, during the last 25 years cancer mortality declined by 15% (to 128/100,000 inhabitants in 1991) (16).

The age-standardized mortality rate of cancer for Mexican children under 15 years (1980–1990) also exhibited a

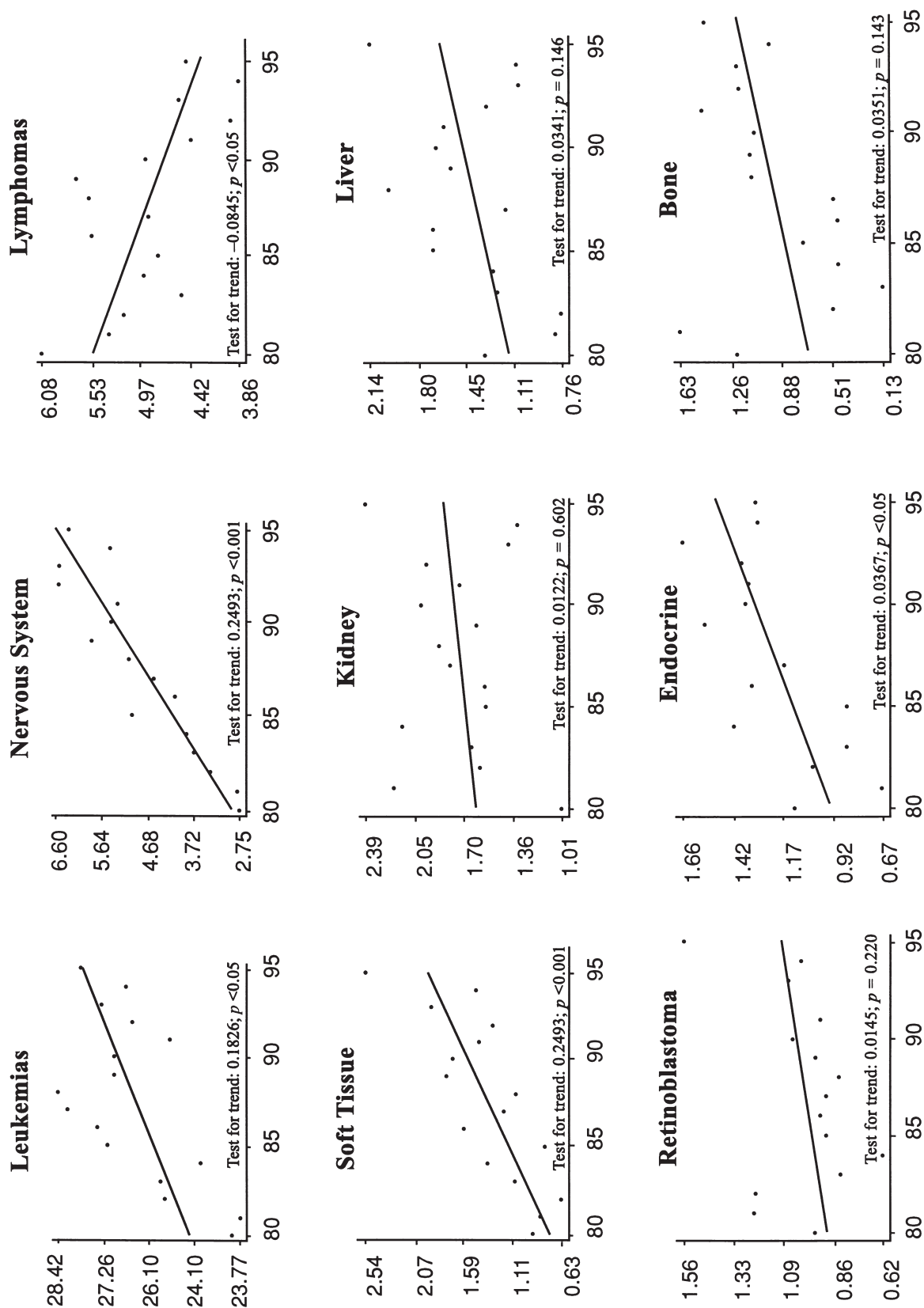


Figure 2. Specific childhood cancer mortality trends in Mexico, 1980–1995. Rate of childhood cancer mortality per million inhabitants under 15 years of age.

Table 3. Frequency (%) of childhood cancer in selected countries

Site of cancer	Mexico	United States	England	Turkey
Leukemia	34.5	30	31	22
Lymphomas	19.5	13	12	25
Central nervous system (CNS) tumors	10.0	19	20	11
Retinoblastoma	8.5	3	2	1
Osteosarcoma	6.5	5	5	3
Wilms' tumor	5.0	6	6	6
Other sites	16.0	24	24	32

Modified from References 9–11.

tendency to increase. We suggest that the observed decline in mortality among Mexican children under 1 year from 1980–1995 may be related to the economic situation, in that many women only nursed their children, to the exclusion of formula feeding. This includes the campaign for breastfeeding instead of formula that has been encouraged by the Mexican Ministry of Health over the past decade. It is known that breastfeeding offers protection through the specific antibody-dependent and broad nonspecific protective factors in human milk (proteins, glycoproteins, and lipids) associated with lower global morbidity and mortality of breast-fed infants from childhood cancer, as compared with formula-fed infants (17,18). One possible explanation for the higher mortality rate among Mexican children with cancer may be the long delay between suspicion of the diagnosis of cancer by the pediatrician and/or family practitioner and referral of the patient to a tertiary-care institution. Currently, 13 of the 32 states of Mexico do not have even a single pediatric oncologist. In terms of socioeconomic status (according to official statistical data) (19), the minimum wage in Mexico decreased by 36.1% (from \$1,623.60/US dollars (USD)/year in 1993 to \$1,033.20 USD/year in 1998) and may also be an important contributor to the unfavorable trends of cancer death rates in Mexico including childhood cancer. However, this factor alone was not sufficient to explain the situation.

Although certain types of childhood cancers in Mexico are increasing, the reasons, including the role of environmental factors in childhood cancer (20,21), are unknown. It has been suggested (12) that the frequency of childhood cancer (such as acute lymphoblastic leukemia and retinoblastoma) has increased due to the increment of toxic environmental agents in Mexico.

Genetics, population density, and the potential role of infections in the pathogenesis of childhood cancer have also been proposed (20,22,23), although attempts to identify these factors have not succeeded. Socioeconomic variables in conjunction with cultural beliefs, environmental contamination, and other factors (23–25) could to a great extent account for the patterns observed and should receive more attention in future investigations. Thus, current cancer mortality rates from all body sites in adults as well as in children show a tendency to increase in Mexico. In view of

the persistent findings, we can predict that the coming years will also witness an increase in the mortality trend of childhood cancer. Therefore, immediate attention must be given to identifying the profile of high-risk subjects, especially children. The best approach for detection and prevention of childhood cancer is to promote routine visits of this population to their pediatrician.

Childhood cancer in general is rare; however, it represents 3% of the total (adults and children) cancer problem in Mexico, in comparison with only 1% of total cancer cases in the United States (26). The relative frequency of different types of childhood cancer varies quite markedly from country to country (15,26); at present, the death rate per 100,000 children in underdeveloped countries is 6.6 in comparison with developed countries, reported at 4.0. Overall world rates of childhood cancer mortality are increasing by approximately 1% each year (27). In most developed nations, 5-year survival of all childhood cancers has increased significantly (to 70%) (26–29); unfortunately, in Mexico such data apply only to highly specialized medical institutions (9–11).

It is interesting to note that from the 1960s onward, a significant decline in childhood cancer mortality was observed in developed countries. However, patterns were much less favorable for other areas of the world, including Latin American, African, and Asian countries, whose inhabitants account for 76% of the world population. In these countries, 84% of all children are younger than 15 years of age (15,26–29). These differences can be explained by different factors; one is success in the use of chemotherapy and radiation to provide cures for childhood cancer in wealthy countries. Unfortunately, economically challenged countries cannot afford these treatments, which are costly and limited.

Various factors currently influence the cancer problem in different parts of the world. Geographical and social differences in childhood cancer occurrence have been of great interest and have contributed to the notion that most cases of cancer are caused by environmental and cultural factors (22–25). On the other hand, chemical elements—some of which the general population face constantly, such as commonly used drugs, household products, solvents, detergents, pesticides, and insecticides—have been implicated as carcinogens and are factors that may also increment the child-

hood cancer incidence (24,25). Lack of relevant information on this disease, low family income, low parental educational status, abrupt cessation of therapy, uncertainty about the child's future, fear for the child's survival, anxiety over the treatment and its effect, as well as some cultural and traditional factors are the bases for the population's interference with the successful treatment of children with cancer in the majority of underdeveloped countries (15,28,29).

There is no question that childhood cancer worldwide is on the rise. It is obvious that each country would have different trends, especially the developing nations, which face other major health problems that should be addressed. However, the pattern in the epidemiology of childhood diseases is changing in view of better national health measures to control infectious diseases, diarrheas, and neonatal problems. All these measures would lead to an increase in the incidence of cancer in children who previously died due to other causes.

Therefore, improved registry, early diagnosis, better knowledge of the epidemiological pattern of childhood cancer, appropriate treatment, and greater resources are necessary to resolve this emerging health problem in Mexico. To this end, long-term fruitful collaboration should be established with colleagues, partner institutions, and relevant organizations.

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