Cancer in Costa Rica

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ABSTRACT

Data from the national tumor registry of Costa Rica for the years 1979–1983 have been used to calculate incidence rates for the major cancer sites by age, sex, urban-rural residence, and geographic region. Recent trends in mortality rates are also presented. Results are compared with data from elsewhere in Latin America, U. S. A., Europe, and Japan. Stomach cancer is the most frequent neoplasm in Costa Rica; although rates are declining, they are second only to those observed in Japan. There are marked variations in risk by region, suggesting important environmental influences in etiology. The cervix is the major female site; rates are declining in young women, probably due to the introduction of screening programs, although these do not seem to account for the geographic variations in invasive cancer incidence. Breast and prostate cancer show moderate rates, while those for colon and rectum cancer are low; increases in mortality rates for these sites are small, and involve mainly the older age groups. In contrast, rates of lung cancer are increasing dramatically in both sexes. In the childhood age group, very high incidence rates are observed for two neoplasms: Hodgkin’s disease and acute lymphocytic leukemia.

INTRODUCTION

Of the 30 countries with the lowest infant mortality rates and longest life expectancies at birth, only two, Cuba and Costa Rica, are developing countries, and Costa Rica has the lowest per capita income of them all (1). From 1960 to 1980 there was a notable improvement in health-related indices in Costa Rica, as the result of a series of interrelated factors, the principal ones being compulsory social security, the extension of health services to almost the entire population, as well as an increase in the per capita income and a higher level of education (2, 3). At present the principal causes of mortality in the country are not those related to underdevelopment (infectious and parasitic diseases) but those associated with development, i.e., cardiovascular disease (29% of total deaths in 1984) and cancer (20%) (4).

In this paper, we present information on the incidence of cancer in Costa Rica, for the period 1979–1983, derived from the National Tumor Registry. The results are compared with those of other Latin American countries, and of some industrialized countries. Changes occurring in the pattern of cancer as shown by the time trends in the mortality rates for the major sites between the periods 1973–1977 and 1978–1982 are also presented. A more detailed presentation of these data has been published (5).

MATERIALS AND METHODS

The Country. Costa Rica lies on the Central American isthmus and covers an area of 51,000 km². In 1983 it had 2,470,000 inhabitants, 36% of whom were below 15 and 4% above 65 years of age. 56% of the population live in rural areas.

This small country includes several different climatic regions. Most of the land is forested or used for agriculture and the main sources of wealth are cattle raising and agriculture. The most important crops are coffee, bananas, and sugar cane.

Costa Rica is one of the few Latin American countries with a socialized health care system which covers almost the entire population (2). In 1983, the crude mortality rate was 3.8 per 1000 inhabitants, infant mortality was 18.6 per 1000 live births and life expectancy at birth was 73.3 years (6).

Incidence Rates. 1977 saw the creation of the NTR1 which receives general information on all cases of cancer occurring with the country (7). The sources of information used are: reports of discharges of patients with cancer and outpatient reports from all hospitals (public and private), copies of pathology reports which mention cancer, reports of autopsies, and death certificates. Several features of Costa Rica are conducive to successful and comprehensive national registration of cancer, including: (a) a state health system which covers almost the whole population; (b) the small size of the country with good systems of communications; (c) pathology, radiotherapy, and chemotherapy services centralized in three large hospitals in the capital and in a few major cities.

Incidence rates have been calculated based upon all new cancer cases diagnosed during the period 1979–1983 in Costa Rica; these data were taken from tabulations produced by NTR. The population used was an estimate for the midpoint of this period (8). The age-adjusted rates and their standard errors were calculated by direct method, using the world population (9).

A special study was performed on the variation in incidence of the major cancer sites by geographic region, and by urban or rural residence. The incidence data were those for 1980–1983, obtained from the NTR, and the denominators were the average age-sex specific populations for the same period (8). Costa Rica consists of seven provinces but for the study of geographic variation these were further divided, so that 12 regions, bringing together neighboring cantons with similar socioeconomic and ecological characteristics were created (Fig. 1). The distribution of cantons into urban or rural was based upon the classification established by the National Planning Office (10).

The incidence rates of childhood cancer (ages 0–14) are those from “International Incidence of Childhood Cancer” (11), which relate to the period 1980–1983.

Mortality Rates. Mortality data were taken from tables published by the vital statistics section of the Central Institute of Statistics and Census of Costa Rica. Mortality rates for the most frequently occurring cancers were calculated for the periods 1973–1977 and 1978–1982. The denominator used for calculating these rates was the population estimated for the midpoint of each period (8).

RESULTS

During the period 1979–1983, 14,850 new cases of cancer were registered in Costa Rica. Tables 1 and 2 show the incidence rates by site, sex, and age. The most frequent cancers were stomach, skin, prostate, and lung in men, and skin, cervix, breast, and stomach in women.

Table 3 presents the age-standardized rates for the three most common cancer sites (excluding skin) in males and females in Costa Rica in comparison with incidence rates recorded elsewhere in Latin America, and also for Los Angeles (U. S. A.), Denmark, Zaragoza (Spain), and Osaka (Japan).

Table 4 shows the ratio of the age-adjusted incidence rates

1 To whom requests for reprints should be addressed.

2 The abbreviation used is: NTR, National Tumor Registry.

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1.1 San José province - urban cantons
1.2 San José province - rural cantons
2.1 Alajuela province - central cantons
2.2 Alajuela province - southern cantons
2.3 Alajuela and Heredia provinces - northern cantons
3.0 Cartago province
4.1 Heredia province - southern cantons
5.1 Guanacaste province - excl. Nicoya peninsula
5.2 Guanacaste province - Nicoya peninsula
6.1 Puntarenas province - northern cantons
6.2 Puntarenas province - southern cantons
7.0 Limón province

* Regions with average altitude over 1000 m (remainder below 400 m)
i Industrial activities
m Maritime activities (seaport, fishing)

Fig. 1. Regions of Costa Rica.

for the major cancer sites in Costa Rica in urban and rural populations, together with the corresponding 95% confidence intervals.

The regional variation in incidence of stomach cancer is shown in Fig. 2, and for four other major sites [lung (males), breast, cervix, and prostate] in Fig. 3.

Fig. 4 shows the percentage change in mortality rates of the most important cancers for each sex between the periods 1973–1977 and 1978–1982, for three broad age groups (25–44, 45–64, and 65 and over).

Table 5 shows the age-standardized incidence rates of cancer in children in Costa Rica together with the corresponding rates from other registries in Latin America and in some industrialized countries.

**Gastric Cancer.** The age-adjusted incidence of gastric cancer in Costa Rica was 57.5 per 100,000 for men and 26.1 for women (Tables 1 and 2), a sex ratio (men/women) of 2.3. 91.5% of the cases of gastric cancer were confirmed histologically. These rates are the highest in Latin America, and internationally they are second only to those in Japan (Table 3). Fig. 2 shows the considerable variation in the age-adjusted rates (both sexes combined) of gastric cancer between different regions of Costa Rica. For men the rate varied from 84.2 per 100,000 in the region of highest incidence to 25.4 in the lowest. In women the corresponding rates were 45.7 and 10.0 per 100,000. The regions with significantly raised incidence rates are situated in the highland area of the center of the country, and the regions with significantly low rates are in the coastal areas. Mortality rates of gastric cancer are declining in all age groups, with the exception of young women (Fig. 4).

**Cancer of the Uterine Cervix.** The age-adjusted incidence rate of invasive cancer of the cervix was 33.2 per 100,000 (Tables 1 and 2). This high rate is similar to those observed in other Latin American and Caribbean countries (Table 3). Incidence increases progressively with age, although the rate of increase is much lower after 50 years of age. The detection rate of carcinoma in situ of the cervix is, by contrast, maximal in the age group 35–44 (Tables 1 and 2). Although there is very little difference in incidence between urban and rural populations (Table 4), quite large differences exist between the incidence rates of invasive cancer in different regions of the country (Fig. 3). The possibility that this might be due to the differential availability of screening services was investigated by studying the regional variations in the detection rate of carcinoma in situ.
Overall, the ratio of the age-adjusted rates of invasive/in situ cancer was 0.9, and there was no correlation (positive or negative) between the in situ and invasive cancer rates for the different regions. Some regions have high rates for both types of cancer, while region 7.0 has the lowest rate for in situ cancer (P < 0.01) but the highest for invasive cancer (P < 0.01), with a ratio of invasive/in situ rates of 2.1. Mortality rates have declined in young women, but have increased in those aged 65 and over (Fig. 4).

Breast Cancer. The age-adjusted incidence of breast cancer was 31.3 per 100,000 (Table 2), with 90.8% of the cases having been confirmed histologically. This ratio is similar to that of other areas of the Caribbean and Northern Latin America (Cali, Martínez, Cuba, and Puerto Rico), but lower than that found in...
The four most developed cities in the country (San José, Caracas, Buenos Aires, and Rio de Janeiro) have significantly higher rates of cancer compared to rural areas (P < 0.01) (Table 3). The age-adjusted rate for urban areas is significantly higher than that of rural areas, with a ratio of 2.1 (Table 4). There is considerable geographic variation in incidence, from 11.9 to 43.3 per 100,000.

Table 3  Comparison of the age-standardized rates for certain cancers in Costa Rica with other countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stomach</td>
<td>Lung</td>
</tr>
<tr>
<td>Argentina, La Paz, 1980</td>
<td>18.6</td>
<td>40.3</td>
</tr>
<tr>
<td>Bolivia, La Paz, 1978-1979</td>
<td>13.9</td>
<td>7.5</td>
</tr>
<tr>
<td>Brazil</td>
<td>44.6</td>
<td>22.3</td>
</tr>
<tr>
<td>Colombia, Cali, 1977-1981</td>
<td>49.6</td>
<td>25.4</td>
</tr>
<tr>
<td>Cuba, 1973-1977</td>
<td>12.4</td>
<td>44.4</td>
</tr>
<tr>
<td>Martinique, 1981-1982</td>
<td>25.3</td>
<td>11.1</td>
</tr>
<tr>
<td>Peru, Lima, 1978</td>
<td>26.4</td>
<td>18.2</td>
</tr>
<tr>
<td>U. S., 1978-1982</td>
<td>17.6</td>
<td>18.1</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>14.7</td>
<td>31.5</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>8.6</td>
<td>62.8</td>
</tr>
<tr>
<td>Hispanic</td>
<td>15.6</td>
<td>86.9</td>
</tr>
<tr>
<td>Other white</td>
<td>20.8</td>
<td>34.2</td>
</tr>
<tr>
<td>Spain, Zaragoza, 1978-1982</td>
<td>14.3</td>
<td>56.5</td>
</tr>
<tr>
<td>Denmark, 1978-1982</td>
<td>76.9</td>
<td>36.5</td>
</tr>
<tr>
<td>Costa Rica, 1980-1983</td>
<td>57.5</td>
<td>16.0</td>
</tr>
</tbody>
</table>

Table 4  Ratio of age-standardized rates for urban versus rural residents, with 95% confidence intervals

<table>
<thead>
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<th>ICD 9th</th>
<th>Site</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>151</td>
<td>Stomach</td>
<td>1.1 (1.0-1.2)</td>
<td>1.2 (1.0-1.4)</td>
</tr>
<tr>
<td>153</td>
<td>Colon</td>
<td>1.7 (1.1-2.4)</td>
<td>2.1 (1.4-3.1)</td>
</tr>
<tr>
<td>154</td>
<td>Rectum</td>
<td>1.9 (1.2-2.8)</td>
<td>1.6 (1.1-2.3)</td>
</tr>
<tr>
<td>162</td>
<td>Lung</td>
<td>1.9 (1.6-2.4)</td>
<td>1.8 (1.3-2.5)</td>
</tr>
<tr>
<td>174</td>
<td>Breast</td>
<td>2.1 (1.8-2.4)</td>
<td>1.0 (0.9-1.2)</td>
</tr>
<tr>
<td>180</td>
<td>Cervix</td>
<td>1.0 (0.9-1.1)</td>
<td>1.0 (0.9-1.1)</td>
</tr>
<tr>
<td>233.1</td>
<td>Cervix in situ</td>
<td>1.0 (0.9-1.1)</td>
<td></td>
</tr>
<tr>
<td>185</td>
<td>Prostate</td>
<td>1.5 (1.2-1.7)</td>
<td>1.0 (0.9-1.1)</td>
</tr>
</tbody>
</table>

Fig. 2. Incidence of stomach cancer (both sexes) by region (age-standardized rate, per 100,000).

in Western industrialized countries, in Argentina and in Brazil (Table 3). The age-adjusted rate for urban areas is significantly greater (P < 0.01) than that of rural areas, with a ratio of the urban/rural rates of 2.1 (Table 4). There is considerable geographic variation in incidence, from 11.9 to 43.3 per 100,000. The four most developed cities in the country (San José, Caracas, Buenos Aires, and Rio de Janeiro) are within the regions with higher rates of breast cancer, with the country's capital lying in region 1.1. The coastal regions are the least developed and poorest regions in the country and have the lowest rates. Mortality rates are increasing only in older women (Fig. 4).

Lung Cancer. The age-adjusted incidence of lung cancer in Costa Rica was 16.0 per 100,000 for men and 6.4 for women. 83% of the cases were confirmed histologically. The ratio of urban/rural rates was 1.9 for men and 1.8 for women (Table 4). The urban region of the province of San José (region 1.1) which contains the country's capital has the highest incidence rates of lung cancer (Fig. 3). Mortality is increasing in both sexes (Fig. 4).

Prostate Cancer. Cancer of the prostate is the third most common cancer of males, with an age-standardized incidence rate of 26.2 per 100,000. The highest incidence is found in region 7.0 (Fig. 3) on the Atlantic coast, where the great majority of the black population of Costa Rica reside (it is known that the risk of prostatic cancer is high in populations of African descent (see, e.g., Los Angeles Blacks and Martinique in Table 3)). Information on race is not collected by the registry, so that it is not possible to study incidence rates or ratios according to this variable. Incidence rates are also higher in urban dwellers (Table 4), reflected in the significantly raised incidence in the region of the capital, San José (region 1.1, Fig. 3). There appear to be only small increases in mortality rates over time (Fig. 4).

Other Cancers. The annual registration rate of skin cancer (except melanoma) in Costa Rica was 36.0 per 100,000 in men and 36.4 in women over the period 1979–1983 (Tables 1 and 2). Since no special efforts are made to detect new cases of skin cancer (often treated without the hospital system) these figures are underestimates of the true incidence rates. 97% of the cases were confirmed histologically. The most frequent site was the face (73% of cases in men and 76% in women). 78.5% of the cancers registered were basal cell carcinomas.

The incidence of both colon and rectum cancer is rather higher in females than in males. The age-standardized rates are however low, rather similar to those observed in other Latin American and Caribbean populations, but much lower than those in Europe and North America. Rates are higher in urban than in rural dwellers (Table 4).

Childhood Cancer. Between 1980 and 1983, 491 cancers in children below 15 years of age were registered in Costa Rica. The age-adjusted incidence rates were 154.7 per million in boys and 119.3 in girls. More than 87% of these cancers were confirmed histologically.

The highest age-specific rates were observed in the 1–4 years age group in both sexes. This is due mainly to the leukemias which have a very high rate of incidence in Costa Rica (Table 5). The registry records were checked to ensure that these high incidence rates were not due to duplicate records. 75.4% of the leukemias in boys and 74.5% in girls were of the acute lymphocytic type. Acute lymphocytic leukemia has the highest age-specific rate in the age group 1–4 years and the maximum number of cases occur at 4 years. Acute nonlymphocytic leukemia (mainly myeloid leukemia) has much lower rates (8.7 per million in boys and 8.9 per million in girls) and the maximum incidence is in the 10–14-year age group.

Lymphomas are the second most frequently occurring cancer in children and are more common in boys (sex ratio of the age-adjusted rates is 2.3, compared to 1.3 for all cancers). Hodgkin's disease is relatively frequent and in boys it has the highest incidence between 5 and 9 years of age while for girls it was...
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Prostate (ICD-9 185)

Fig. 3. Incidence rates by region (age-standardized, per 100,000). Breast, cervix: females. Lung, prostate: males.

highest between 10 and 14 years. Non-Hodgkin's lymphoma appears to be most frequent between 2 and 6 years of age.

DISCUSSION

At the present time the general health indicators in Costa Rica are similar to those of developed countries. The cancer pattern is in many respects, however, similar to that of the developing world (15), with high rates of gastric and cervix cancer. Nevertheless, the trends in mortality are similar to those of developed countries. Thus the mortality rates for cancers of the lung, breast, and prostate are increasing while the mortality rate for gastric cancer is decreasing. The observed trends in mortality are unlikely to be due to changes in classification of neoplasms. Although the 9th revision of the International Classification of Diseases was introduced in 1980, the only change for the sites considered in Fig. 4 was the exclusion of cancers of the intestinal tract (part unspecified) from rubric 153 (colon). The problem of cancer in Costa Rica will increase in future years due to a projected increase in the number of inhabitants above 60 years of age, and to changes in the way of life as the country becomes more urbanized and industrialized. The marked geographic variations in incidence observed in such a small country are also of considerable interest, and the fact that these are quite different for the major cancer sites suggests that they are real, and not due to referral patterns or to differential ascertainment by the registry. In fact, it is probable that the National Tumor Registry achieves good coverage of the population, and is relatively complete. Some indices of quality of registration (14) are shown in Table 6. The ratio of mortality to incidence is 50% (60% if skin cancer is excluded) for all sites combined, and 84.2% of cases are registered on the basis of a histological (or cytological) examination.

The decreasing mortality from gastric cancer is similar to that observed elsewhere in the world (16). This decline is due to a fall in incidence, possibly resulting from environmental changes in Costa Rica, since the survival rate of patients has not improved significantly over the last 20 years. The regions with significantly higher incidence rates are in the central area while those with the lowest rates are in the peripheral areas.
Colon and Rectum cancer. The fact that such large regional differences are present in the Central Valley of Costa Rica and certain soil characteristics occurred there in younger individuals. Sierra and Barrantes (18) found a significant relationship between the age-adjusted rates in such a small country with a relatively homogenous population suggests the need for further study of environmental variables and customs of the different regions.

Fig. 4. Percentage change in age-specific mortality rates between the periods 1973–1977 and 1978–1982.

These findings have already been reported by other investigators (17, 18). Salas (19) found that intestinal metaplasia of the gastric mucosa was three times more prevalent in the central area of the country than in the coastal regions, and that it occurred there in younger individuals. Sierra and Barrantes (18) found a significant relationship between the age-adjusted rates of gastric cancer in Costa Rica and certain soil characteristics such as pH and content of potassium, iron, and zinc. This study also discovered that place of birth is a risk factor for gastric cancer. The fact that such large regional differences are present in such a small country with a relatively homogenous population suggests the need for further study of environmental variables and customs of the different regions.

Costa Rica, like elsewhere in Latin America and the Caribbean, has high incidence rates of cancer of the uterine cervix. This cancer is a priority problem in these countries. The estimated total number of cases of cervix cancer in Latin America and the Caribbean is approximately 49,000 per year (15). Some authors consider these populations to be at high risk due to the tendency for women to have only one or two sexual partners during their life while the men tend to be promiscuous, having multiple relations and partners (20). To this is added the fact that a great proportion of women in these countries begin to have sexual relations at very early ages. Another factor of importance is the lack of programs to detect and treat the preinvasive forms of this disease (21).

Sierra and Barrantes (22) have failed to find a correlation between the incidence rates of invasive cancer of the cervix and some socioeconomic indicators at the level of cantons (level of education, fertility, and income per capita). However, they did find a low but significant correlation with the rates of gonorrhea at canton level, probably because behavioral factors that favor gonorrhea are also involved in the etiology of cancer of the cervix. This relationship has also been found in other studies (23).

In Costa Rica, cancer of the cervix is the second most frequent cause of death from cancer in women. Mortality rates have shown clear declines since 1965 in all but the oldest age groups (over 65), so that crude mortality (all ages >20) had halved in the subsequent 20 years, from 36 per 100,000 to 18 per 100,000 (24). The most striking declines were in women under 50 probably because screening tests are carried out mainly on women who attend prenatal and family planning clinics, a relatively young population. The ratio of Papanicolaou smears per 100 women is highest between ages 25 and 44 (24), and age-specific rates of detection of in situ cancers are also maximal at those ages. On the other hand, most elderly women have never had a Papanicolaou test, or have not been tested for many years, so that mortality rates at these ages show no change, or in recent years even an increase.

In comparison with the national average, region 7.0 has significantly raised rates of invasive cancer and significantly lower rates of cancer in situ. This suggests a lack of early detection by screening programs. The differences in the rates of invasive cancer between the coastal areas and the interior of the country (the Central Valley) coincide with observations made by Oberle et al. (25), that a greater proportion of women in the Central Valley have received a Papanicolaou test than those in the peripheral areas. However, the geographical vari-

### Table 5 Age-standardized incidence rates (per million) of childhood cancers in Costa Rica, and in 10 other registries. Both sexes

<table>
<thead>
<tr>
<th>Registry &amp; period</th>
<th>Acute lymphocytic leukaemia</th>
<th>Acute nonlymphocytic leukaemia</th>
<th>Hodgkin's disease</th>
<th>Other lymphomas</th>
<th>Brain &amp; spinal neoplasms</th>
<th>Neuroblastoma</th>
<th>Retinoblastoma</th>
<th>Wilms' tumor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age stand. rate (sex ratio m/f)</td>
<td>44.7 (1.13)</td>
<td>8.8 (0.98)</td>
<td>10.8 (1.92)</td>
<td>13.9 (2.58)</td>
<td>14.0 (1.79)</td>
<td>4.6 (1.21)</td>
<td>3.7 (0.85)</td>
<td>5.1 (0.47)</td>
</tr>
<tr>
<td>Brazil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fortaleza 1978–1980</td>
<td>28.1</td>
<td>5.9</td>
<td>6.5</td>
<td>20.3</td>
<td>13.0</td>
<td>6.0</td>
<td>8.3</td>
<td>10.3</td>
</tr>
<tr>
<td>Sao Paolo 1969–1978</td>
<td>14.2</td>
<td>5.9</td>
<td>8.6</td>
<td>20.2</td>
<td>21.4</td>
<td>7.8</td>
<td>5.9</td>
<td>7.2</td>
</tr>
<tr>
<td>Colombia, Cali 1977–1981</td>
<td>31.6</td>
<td>4.9</td>
<td>6.1</td>
<td>12.2</td>
<td>16.8</td>
<td>5.4</td>
<td>6.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Cuba 1970–1981</td>
<td>13.6</td>
<td>3.3</td>
<td>4.8</td>
<td>17.5</td>
<td>11.8</td>
<td>5.2</td>
<td>3.6</td>
<td>5.1</td>
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<tr>
<td>White</td>
<td>32.9</td>
<td>6.1</td>
<td>6.2</td>
<td>8.7</td>
<td>24.9</td>
<td>12.5</td>
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<tr>
<td>Black</td>
<td>14.8</td>
<td>5.2</td>
<td>4.7</td>
<td>4.5</td>
<td>22.0</td>
<td>10.2</td>
<td>5.1</td>
<td>11.1</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>28.6</td>
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<td>6.3</td>
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<td>15.7</td>
<td>6.3</td>
<td>4.1</td>
<td>7.2</td>
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<tr>
<td>Spain, Zaragoza 1973–1982</td>
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<td>Denmark 1978–1982</td>
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<td>4.0</td>
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<td>30.9</td>
<td>9.6</td>
<td>2.2</td>
<td>7.3</td>
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<tr>
<td>Japan, Osaka 1971–1980</td>
<td>21.0</td>
<td>9.7</td>
<td>0.7</td>
<td>7.6</td>
<td>24.1</td>
<td>9.0</td>
<td>5.3</td>
<td>4.0</td>
</tr>
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</table>

* Source: Reference 11.
Couraging young people to start smoking. In almost all Latin American countries the tobacco companies have stepped up intensive publicity campaigns aimed in particular at en
gaging young people at earlier ages (27), and tobacco companies are employ
ing extensive publicity campaigns aimed in particular at encour-
gaging young people to start smoking. In almost all Latin American countries the tobacco companies have stepped up their campaigns and tobacco consumption is increasing. This trend has been denounced by the World Health Organization (28) and by the Pan American Health Organization (29).

The incidence rates of acute lymphocytic leukaemia in Costa Rica, at 1.6 per 100,000 (5) is also elevated by international standards, the rate for white children in the U. S. being 1.3 in 1977 (30). A previous study (31) reported an even higher frequency of Hodgkin’s disease than observed in the present data (11.7% of childhood cancers, compared to 7.9%). Although high rates of childhood acute lymphocytic leukaemia are normally associated with low infant mortality from infectious diseases (32), childhood Hodgkin’s disease, in contrast, is a feature of populations living in areas of low environmental sanitation (33). The coexistence of high rates for both diseases in Costa Rica is therefore of considerable interest.

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REFERENCES

21. Restrepo, E., Gonzalez, I., Roberts, E., and Litvak, I. Epidemiologia y control...
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