

Cancer in Costa Rica

Rafaela Sierra,¹ Donald Maxwell Parkin, and Georgina Muñoz Leiva

Institute of Health Research, University of Costa Rica, San José, Costa Rica [R. S.]; the International Agency for Research on Cancer, 150 cours Albert-Thomas, Lyon, France [D. M. P.]; and the National Cancer Registry, Statistics Department, Ministry of Health, San José, Costa Rica [G. M. L.]

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 forest 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 NTR² 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

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

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¹ To whom requests for reprints should be addressed.

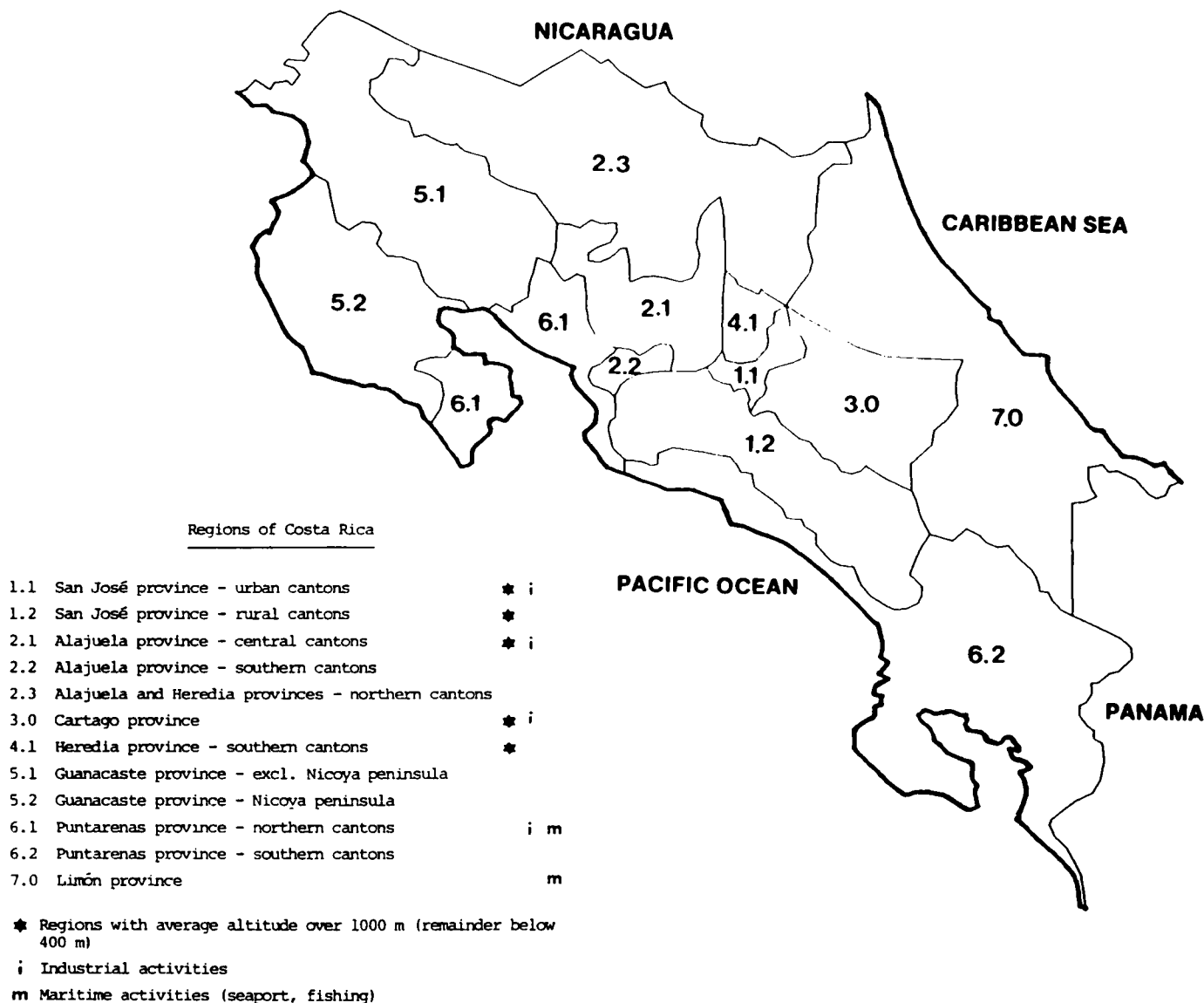


Fig. 1. Regions of Costa Rica.

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*

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Table 1 Cancer incidence, Costa Rica 1979-1983: Males

ICD 9th	Site	Numbers (5 years)		Average annual incidence per 100,000 by age-group								Crude rate	ASR ^a (world)
		All ages	Age unk.	<15	15-24	25-34	35-44	45-54	55-64	65-74	>75		
141	Tongue	54	0	0.0	0.0	0.0	0.7	1.3	6.7	12.4	19.1	0.9	1.8
143-145	Mouth	50	0	0.0	0.0	0.2	0.7	1.0	4.7	9.4	26.1	0.8	1.6
146-149	Pharynx	94	0	0.5	1.0	0.8	0.4	4.6	5.1	11.6	24.3	1.6	2.4
150	Oesophagus	117	2	0.0	0.0	0.0	0.4	3.1	11.0	32.7	48.7	2.0	3.9
151	Stomach	1771	18	0.0	0.3	1.6	19.6	60.3	162.5	414.9	723.2	30.0	57.5
153	Colon	146	2	0.0	0.3	0.9	1.6	5.4	11.4	29.8	55.6	2.5	4.5
154	Rectum	143	0	0.0	0.5	1.0	1.1	4.6	16.5	24.7	46.9	2.4	4.4
155	Liver	171	2	0.3	0.6	1.9	2.4	4.9	9.4	35.6	57.4	2.9	5.0
156	Gallbladder, etc.	91	0	0.0	0.0	0.2	0.5	1.8	10.2	16.0	53.9	1.5	3.0
157	Pancreas	191	0	0.0	0.1	0.1	1.3	5.1	20.1	45.8	83.4	3.2	6.3
161	Larynx	150	0	0.0	0.0	0.0	0.7	6.2	16.5	35.6	53.9	2.5	4.9
162	Lung and bronchus	486	0	0.0	0.1	0.2	2.9	14.1	58.2	133.0	139.1	8.2	16.0
171	Connective tissue	84	0	0.5	1.0	0.7	1.1	2.8	4.3	10.9	17.4	1.4	2.1
172	Melanoma of skin	77	0	0.0	0.1	0.6	1.5	2.8	8.6	10.2	26.1	1.3	2.3
173	Other skin	1187	54	0.0	1.0	3.6	14.9	44.9	89.3	215.8	235.4	20.1	36.0
185	Prostate	759	6	0.0	0.0	0.0	0.2	3.8	37.4	204.2	627.6	12.9	26.2
186	Testis	130	1	0.4	2.3	4.9	4.0	2.3	3.9	0.7	3.5	2.2	2.4
188	Bladder	272	5	0.0	0.1	0.3	1.3	7.2	24.0	66.1	132.1	4.6	8.9
189	Other urinary	83	0	0.5	0.0	0.3	0.4	3.1	10.6	10.2	20.9	1.4	2.4
191	Brain	152	0	1.7	1.4	1.3	5.1	5.6	4.3	10.9	10.4	2.6	3.3
193	Thyroid gland	105	0	0.2	1.0	2.7	2.0	4.4	4.3	11.6	13.9	1.8	2.5
200	Lymphosarcoma, etc.	87	0	0.6	0.7	1.0	0.9	1.3	6.3	13.1	19.1	1.5	2.2
201	Hodgkin's disease	141	0	1.5	1.6	2.8	3.6	3.6	3.9	9.4	7.0	2.4	2.9
202	Other lymphoma	117	1	1.6	0.6	1.2	0.7	2.8	5.5	13.1	24.3	2.0	2.7
203	Multiple myeloma	66	0	0.0	0.0	0.0	0.4	2.3	6.7	18.2	22.6	1.1	2.2
204	Lymphatic leukaemia	171	0	4.1	1.9	1.5	1.0	1.5	2.8	8.0	17.4	2.9	3.0
205	Myeloid leukaemia	158	0	1.4	1.7	2.0	4.7	3.8	5.9	12.4	22.6	2.7	3.5
	Others	216	2	1.1	2.9	1.8	2.9	5.1	11.0	30.5	46.9	3.6	5.3
140-208	All sites	7269	93	14.4	19.2	31.6	77.0	209.7	561.1	1446.8	2578.8	123.0	219.2

^a ASR, age-standardized rate.

Table 2 Cancer incidence, Costa Rica 1979-1983: Females

ICD 9th	Site	Numbers (5 years)		Average annual incidence per 100,000 by age-group								Crude rate	ASR ^a (world)
		All ages	Age unk.	<15	15-24	25-34	35-44	45-54	55-64	65-74	>75		
141	Tongue	29	0	0.0	0.0	0.2	0.2	0.8	2.3	5.2	12.2	0.4	0.8
143-145	Mouth	27	0	0.0	0.1	0.0	0.0	0.0	1.9	7.2	12.2	0.5	0.8
146-149	Pharynx	31	0	0.1	0.5	0.3	0.0	0.8	0.8	5.8	8.2	0.5	0.8
150	Oesophagus	55	1	0.0	0.0	0.0	0.0	2.3	6.5	9.1	19.0	1.0	1.6
151	Stomach	908	3	0.0	0.2	2.8	11.4	34.9	81.2	160.6	298.9	15.7	26.1
153	Colon	180	1	0.0	0.1	1.4	1.7	6.7	15.3	28.0	63.8	3.1	5.0
154	Rectum	174	1	0.0	0.2	1.0	3.1	6.4	16.8	28.0	43.5	3.0	4.9
155	Liver	93	0	0.1	0.3	0.5	2.4	2.8	4.6	15.6	31.2	1.6	2.5
156	Gallbladder, etc.	191	1	0.0	0.0	0.3	1.1	6.4	16.0	44.2	62.5	3.3	5.6
157	Pancreas	118	1	0.0	0.0	0.1	0.2	3.6	11.1	26.0	43.5	2.0	3.5
161	Larynx	33	0	0.0	0.1	0.0	0.0	1.5	4.6	5.9	6.8	0.6	1.0
162	Lung and bronchus	219	1	0.0	0.0	0.1	2.0	7.4	23.3	42.9	67.9	3.8	6.4
171	Connective tissue	58	0	0.6	0.7	0.5	1.3	1.3	3.1	3.3	8.2	1.0	1.2
172	Melanoma of skin	73	0	0.0	0.1	1.2	2.4	4.4	4.2	5.9	14.9	1.3	1.9
173	Other skin	1324	38	0.0	0.5	6.1	18.7	51.3	92.3	209.0	505.3	23.9	36.4
174	Breast	1144	3	0.0	0.2	8.8	35.1	79.3	91.9	128.1	167.1	19.7	31.3
180	Cervix uteri	1281	15	0.0	1.2	18.0	46.7	78.0	92.7	125.5	131.8	22.1	33.2
182	Corpus uteri	185	1	0.0	0.0	0.6	2.6	12.1	21.0	30.0	23.1	3.2	5.4
183	Ovary	222	1	0.3	1.8	2.6	4.2	13.6	14.9	24.1	21.7	3.8	5.6
184	Other fem. genital	105	0	0.0	0.2	0.5	1.3	5.1	7.2	19.5	31.2	1.8	3.0
188	Bladder	57	0	0.0	0.0	0.0	0.2	1.3	5.3	9.8	29.9	1.0	1.7
189	Other urinary	73	0	0.6	0.0	0.9	0.9	2.3	5.0	11.1	9.5	1.3	1.8
191	Brain	101	1	1.1	0.8	1.4	1.7	2.8	6.5	8.5	4.1	1.7	2.2
193	Thyroid gland	147	0	0.1	1.0	4.1	3.7	8.0	8.0	9.8	10.9	2.5	3.4
200	Lymphosarcoma, etc.	63	0	0.3	0.3	0.5	0.2	2.8	2.7	12.4	14.9	1.1	1.7
201	Hodgkin's disease	93	0	0.8	1.8	1.1	1.7	1.8	4.2	7.2	5.4	1.6	1.9
202	Other lymphoma	73	0	0.6	0.6	0.8	1.3	2.6	2.7	8.5	9.5	1.3	1.7
203	Multiple myeloma	73	1	0.0	0.0	0.5	0.7	3.3	5.3	16.9	14.9	1.3	2.1
204	Lymphatic leukemia	124	1	3.9	0.9	0.5	0.4	1.3	0.8	3.9	8.2	2.1	2.0
205	Myeloid leukemia	140	1	1.0	2.0	1.5	1.7	5.4	7.3	11.1	17.7	2.4	3.1
	Others	187	5	1.8	1.8	2.0	3.5	4.9	7.2	13.7	31.2	3.2	4.0
140-208	All sites	7581	76	11.3	15.4	58.3	150.4	355.2	566.7	1036.8	1729.2	131.9	202.6
233	Cervix uteri (in situ)	1833	14	0.0	12.5	86.6	100.2	53.1	29.0	30.6	19.0	31.6	36.4

^a ASR, age-standardized rate.

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 rate is similar to that of other areas of the Caribbean and Northern Latin America (Cali, Martinique, Cuba, and Puerto Rico), but lower than that found

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

Sources: Lima, La Paz, La Plata (12), Cuba (13), Others (14).

Country	Males			Females		
	Stomach	Lung	Prostate	Stomach	Cervix	Breast
Argentina, La Plata, 1980	18.6	40.3	20.7	8.7	20.1	82.2
Bolivia, La Paz, 1978-1979	13.9	7.5	12.5	10.3	57.8	17.8
Brazil						
Fortaleza, 1978-1982	44.6	22.3	30.8	16.7	46.5	50.0
Sao Paulo, 1978	53.6	36.5	33.0	25.1	35.1	65.5
Colombia, Cali, 1977-1981	49.6	25.4	30.6	26.3	48.2	34.8
Cuba, 1973-1977	12.4	44.4	18.9	6.6	17.1	28.5
Martinique, 1981-1982	25.3	11.1	50.1	10.9	29.3	31.1
Peru, Lima, 1978	26.4	18.2	15.7	16.5	33.7	24.4
U. S., 1978-1982						
Puerto Rico	17.6	18.1	30.7	8.6	15.6	35.1
Los Angeles						
Hispanic	14.7	31.5	43.0	6.7	18.5	41.8
Other white	8.6	62.8	49.6	4.0	8.2	77.3
Black	15.6	86.9	82.6	6.4	14.1	59.1
Spain, Zaragoza, 1978-1982	20.8	34.2	17.0	10.4	6.1	34.7
Denmark, 1978-1982	14.3	56.5	27.7	6.7	18.5	63.1
Japan, Osaka, 1979-1982	76.9	36.5	5.1	35.9	16.0	19.7
Costa Rica, 1980-1983	57.5	16.0	26.2	26.1	33.2	31.3

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

ICD 9th	Site	Males	Females	Both sexes
151	Stomach	1.1 (1.0-1.2)	1.2 (1.0-1.4)	1.1 (1.0-1.2)
153	Colon	1.7 (1.1-2.4)	2.1 (1.4-3.1)	1.9 (1.4-2.4)
154	Rectum	1.9 (1.2-2.8)	1.6 (1.1-2.3)	1.7 (1.3-2.3)
162	Lung	1.9 (1.6-2.4)	1.8 (1.3-2.5)	1.8 (1.5-2.1)
174	Breast		2.1 (1.8-2.4)	
180	Cervix invasive		1.0 (0.9-1.2)	
233.1	Cervix in situ		1.0 (0.9-1.1)	
185	Prostate	1.5 (1.2-1.7)		

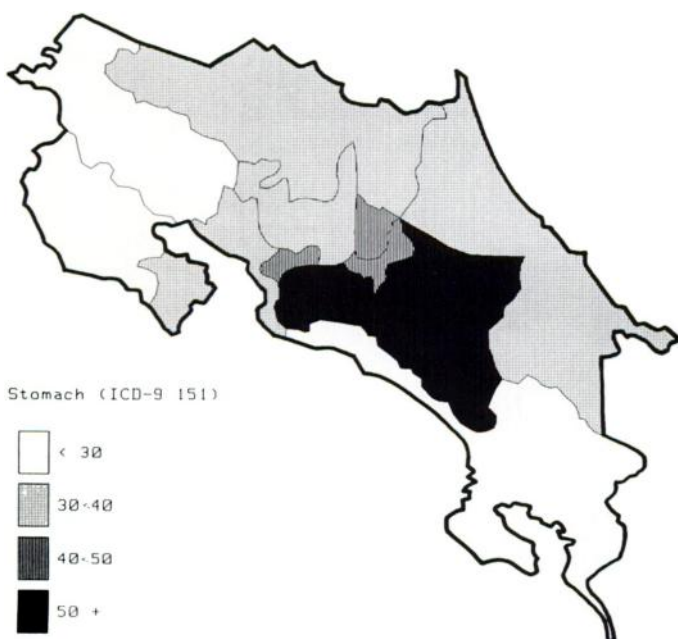


Fig. 2. Incidence of stomach cancer (both sexes) by region (age-standardized rate, per 100,000).

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, Cartago, Heredia, and Alajuela) are within the regions with higher

rates of breast cancer, with the country's capital lying in region 1.1 where the rates are the highest ($P < 0.01$) in the country (Fig. 3). 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

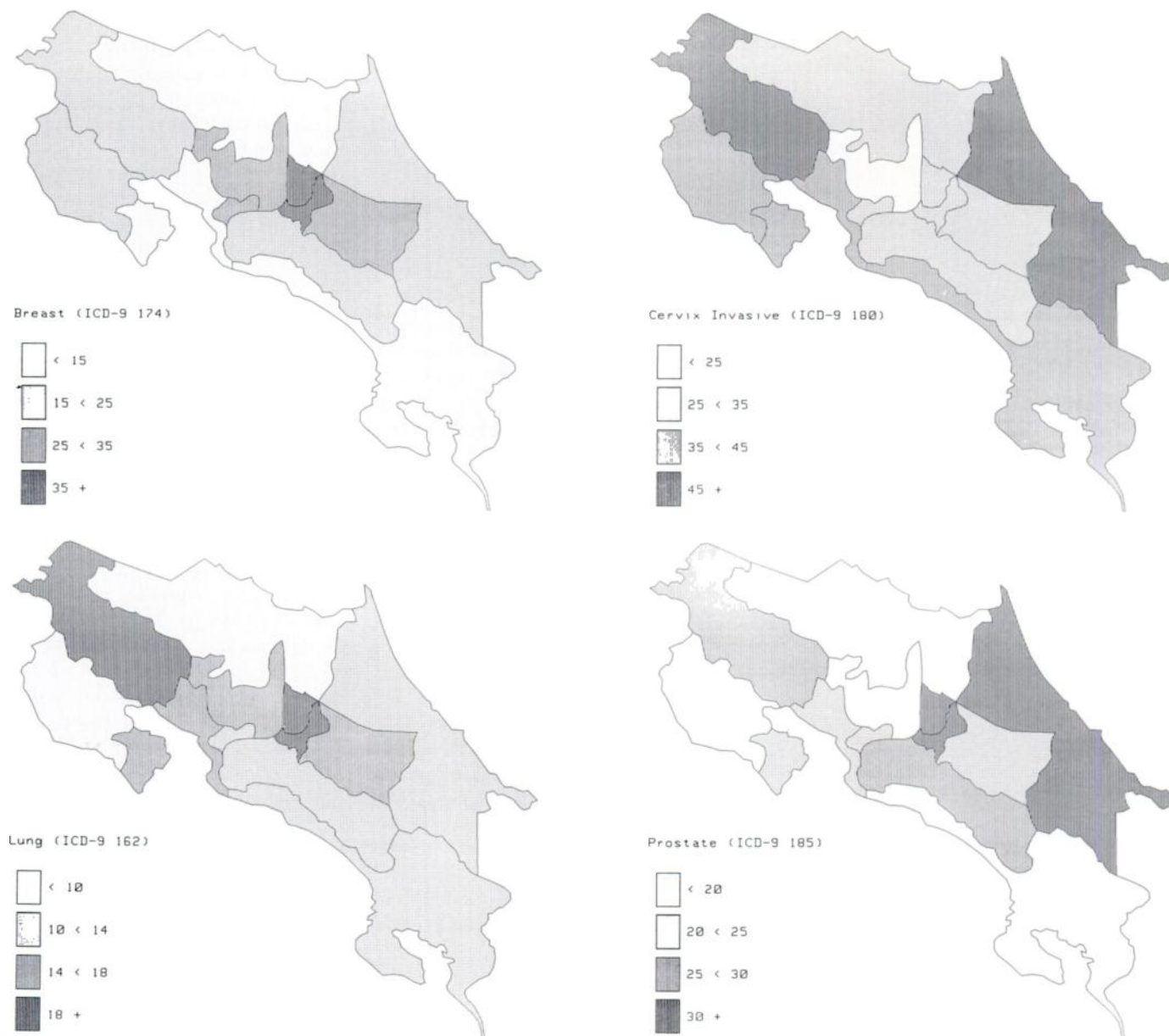


Fig. 3. Incidence rates by region (age-standardized, per 100,000). Breast, cervix: females. Lung, prostate: males.

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.

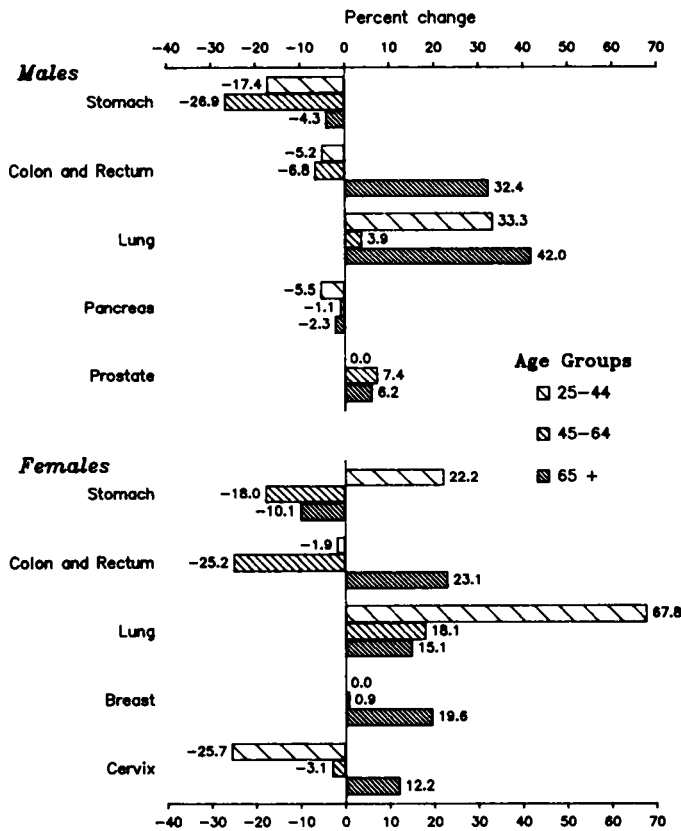


Fig. 4. Percentage change in age-specific mortality rates between the periods 1973-1977 and 1978-1982.

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*

Registry & period	Acute lymphocytic leukaemia	Acute nonlymphocytic leukaemia	Hodgkin's disease	Other lymphomas	Brain & spinal neoplasms	Neuroblastoma	Retinoblastoma	Wilms' tumor
Costa Rica 1980-1983								
Age stand. rate (sex ratio m/f)	44.7 (1.13)	8.8 (0.98)	10.8 (1.92)	13.9 (2.58)	14.0 (1.79)	4.6 (1.21)	3.7 (0.85)	5.1 (0.47)
Brazil								
Fortaleza 1978-1980	28.1	5.9	6.5	20.3	13.0	6.0	8.3	10.3
Sao Paulo 1969-1978	14.2	5.9	8.6	20.2	21.4	7.8	5.9	7.2
Colombia, Cali 1977-1981	31.6	4.9	6.1	12.2	16.8	5.4	6.7	6.0
Cuba 1970-1981	13.6	3.3	4.8	17.5	11.8	5.2	3.6	5.1
U. S., SEER 1973-1981								
White	32.9	6.1	6.2	8.7	24.9	12.5	4.0	8.9
Black	14.8	5.2	4.7	4.5	22.0	10.2	5.1	11.1
Puerto Rico	28.6	6.6	6.3	8.4	15.7	6.3	4.1	7.2
Spain, Zaragoza 1973-1982	27.2	4.9	5.2	16.4	24.2	9.8	0.0	6.9
Denmark 1978-1982	30.1	5.7	4.0	7.8	30.9	9.6	2.2	7.3
Japan, Osaka 1971-1980	21.0	9.7	0.7	7.6	24.1	9.0	5.3	4.0

* Source: Reference 11.

Table 6 *Indices of quality of registration*

Site	Basis of diagnosis		Deaths/registrations ^a
	Histology/cytology	Clinical diagnosis	
Stomach	76.3	8.6	75
Colon	74.5	12.7	73
Rectum	86.8	5.8	41
Liver	50.7	17.2	123
Gallbladder	64.2	15.1	85
Lung	67.3	10.4	92
Skin	97.2	2.1	1
Breast (female)	92.5	5.0	32
Cervix	95.3	2.3	27
Prostate	87.3	5.8	47
All sites	84.2	5.5	50

^a 1980-1982.

ations in incidence of invasive cancer cannot be due simply to differences in the intensity of screening, since we found no correlation between rates of invasive cancer and detection rates of carcinoma *in situ*. There must therefore be differences in the actual risk of disease in different areas. The high risk regions differ in cultural and environmental terms from the rest of the country, affecting variables such as promiscuity and age of first sexual relationship. In region 2.1, where the incidence rate of invasive cancer is significantly lower ($P < 0.01$) than the national average, according to the 1984 Population Census, 43.2% of couples were married and 3.9% lived in common-law marriage. In region 7.0, with a rate significantly higher than average ($P < 0.01$), 29% were married and 20% lived in common-law marriage.

The high rates of cancer of the uterine cervix and the economic crisis affecting the populations of Latin America mean that there is an urgent need for rationalization of resources to establish more effective programs to detect and control this cancer.

The highest rates of breast cancer in Costa Rica occur within the urban sector of the country. A recent case-control study (26) in Costa Rica has confirmed that there is a decreased risk of breast cancer with increasing parity, and found a decrease also in older parous women in relation to age at first birth. The authors suggest that the decline in fertility in Costa Rica since 1960 would be expected to be reflected by rising incidence rates of breast cancer in younger women. However, there has been little change in mortality at these ages between the periods 1973-1977 and 1978-1982, possibly because the cohorts of women with the greatest change in fertility were still too young. Furthermore, mortality rates in women over 65 are increasing, so that crude mortality has risen at an average annual rate of 1.9% in the 25 years since 1960 (24).

Lung cancer is most frequent in the urban areas of Costa Rica. Although incidence rates are at present rather low when compared to those in Europe and North America, mortality rates are increasing and will probably continue to do so at a greater rate given the facts that young people are starting to smoke at earlier ages (27), and tobacco companies are employing intensive publicity campaigns aimed in particular at encouraging 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 leukemic and Hodgkin's disease in childhood are the highest recorded in the world, and high rates are found also in other hispanic populations, notably in Los Angeles (11). The mortality rate for childhood

lymphocytic leukemia 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 leukemia 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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Rafaela Sierra, Donald Maxwell Parkin and Georgina Muñoz Leiva

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