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Changing patterns of gastric cancer mortality in Spain

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Summary

Time trends and the geographical variation of mortality from gastric cancer in Spain are analysed. The national (1961—1980) and the provincial (1975—1980) crude death rates as well as the age adjusted death rates were calculated using the population census (years 1960 and 1970) and the figures for national and provincial mortality. Mortality increased until 1963—1965 and then decreased significantly ($P < 0.01$). Analysis of the geographic distribution reveals that the mortality rate is significantly higher in the interior than in the coastal provinces of the country, and higher in the provinces over 600 m above sea level.

Keywords: gastric cancer; mortality; changing patterns.

Introduction

The aim of this work is to analyse the annual evolution of gastric cancer mortality in Spain (1961—1980) and its provincial (geographic) distribution (1975—1980).

Materials and methods

The population census of Spain (national and provincial) for 1960 and 1970 were used as well as the national [1,7] and provincial mortality figures (special information from the Instituto Nacional de Estadística for this research), based on death certificates. The world population pattern of the International Agency for Research on Cancer was used as the standard population (personal communication). Data published by the Instituto Nacional de Estadística in relation to the altitude were used [1].

Using a personal computer, the midyear population, crude death rate and the age-adjusted death rate by the direct method (DMDR) were calculated according to the procedure described by WHO [12].

The exponential equation of linear regression for adjusted death rates (y) versus the years of evolution (x) and the rank correlation test (Spearman) were used to evaluate the statistical significance of variations over the 20-year period studied. Student's t-test was applied to evaluate the differences between mortality rates for the coastal and inland provinces [2].

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Results

While the general mortality (resulting from all causes) in Spain decreased from 8.3/1000 inhabitants in 1961 to 7.7/1000 in 1980, mortality due to cancer increased from 119/100,000 in 1961 to 155/100,000 in 1980 and the relative weight of cancer in the general mortality increased from 14.2% in 1961 to 20.1% in 1980.

The crude death rate due to gastric cancer increased for males until 1965 and for females until 1963 and thereafter declined in both sexes until 1980 (21.3% for males and 22% for females) (Table 1).

The age-adjusted death rate increased for males from 31.5 in 1961 to 32.6 in 1963 and then decreased to 22.3 in 1980 (31.7%); for females it increased from 18.2 in 1961 to 18.7 in 1963 and then decreased to 12 in 1980 (35.9%) (Table 1).

The exponential equation of linear regression for the age-adjusted death rate over the 20-year period gives the following values: for males, $R = -0.9731$; $E = 0.034$ ($P < 0.01$); for females, $R = -0.9730$; $E = 0.041$ ($P < 0.01$). The rank correlation test of age-adjusted death rate versus the years of evolution shows that the mortality rate is decreasing significantly over the 20-year period ($P < 0.01$).

To evaluate mortality due to gastric cancer in relation to provinces we have calculated the mean of the provincial age-adjusted death rate over 6 years (1975—1980) for each province (Table 2). The highest age-adjusted death rates are the provinces of Palencia, Burgos, Segovia and Soria (males) and Burgos, Soria, Segovia and Zamora (females); the lowest age-adjusted death rates are for the provinces of Baleares, Tenerife, Tarragona and Albacete (males) and Baleares, Málaga, Tarragona and Tenerife (females). The provinces with the highest mortality rates are over 600 m above sea level and the provinces with the lowest mor-

Table 1. Gastric cancer mortality in Spain (1961—1980) : Number of deaths, crude death rates and age-adjusted death rates.

Year	Number of deaths		Crude death rate		Age-adjusted death rate	
	Males	Females	Males	Females	Males	Females
1961	4760	3757	31.97	24.04	31.54	18.28
1962	4894	3769	32.47	23.83	31.58	17.84
1963	5195	4079	34.05	25.49	32.67	18.78
1964	5230	4025	33.87	24.86	32.09	17.86
1965	5393	3895	34.51	23.79	32.32	16.82
1966	5235	3973	33.11	23.99	30.68	16.90
1967	5294	3975	33.09	23.73	30.40	16.46
1968	5169	3774	31.94	22.28	28.97	15.18
1969	5112	3914	31.23	22.86	28.00	15.45
1970	5185	3932	31.33	18.91	27.87	15.10
1971	5239	3885	29.41	18.39	27.52	14.58
1972	5085	3947	28.14	18.42	26.24	14.52
1973	5263	3861	28.69	17.71	26.62	13.81
1974	4950	3824	26.58	17.27	24.54	13.37
1975	4995	3810	26.44	16.99	24.31	13.10
1976	4972	3579	25.95	15.74	23.76	12.06
1977	4883	4307	25.13	14.77	22.90	11.24
1978	4695	3453	23.83	14.77	21.63	11.19
1979	4629	3343	23.16	14.10	20.91	10.60
1980	4995	3810	24.73	15.94	22.31	12.02

Table 2. Age-adjusted gastric cancer death rates in Spain: mean of the years 1975—1980 for each province and for all provinces [1]. The coastal provinces are underlined.

Province	Males	Females	Province	Males	Females
Alava	34.45	16.85	Lerida	28.86	13.93
Albacete	16.75	10.90	Logroño	23.55	13.96
Alicante	17.88	9.63	Lugo	24.14	14.53
Almeria	21.08	9.22	Madrid	17.63	8.79
Asturias	24.22	12.15	Malaga	19.92	7.79
Avila[a]	33.37	15.97	Murcia	18.51	9.52
Badajoz	26.52	11.96	Navarra	26.52	14.52
Baleares	13.25	5.48	Orense	26.77	13.36
Barcelona	18.91	9.68	Palencia[a]	39.63	16.29
Burgos[a]	39.46	22.06	Las palmas	17.50	8.89
Caceres	32.45	15.94	Pontevedra	28.85	14.59
Cadiz	27.51	10.74	Salamanca[a]	29.74	18.38
Castellon	22.75	10.83	Santa cruz tenerife	13.71	8.19
Ciudad real	29.55	13.10	Santander	21.10	10.40
Cordoba	16.83	8.40	Segovia[a]	36.83	21.51
Coruña	26.01	13.33	Sevilla	18.59	8.31
Cuenca[a]	29.68	13.65	Soria[a]	35.79	21.98
Gerona	22.18	10.45	Tarragona	14.65	7.95
Granada	21.21	11.04	Teruel	25.34	10.47
Guadalajara	24.81	17.93	Toledo	26.67	14.60
Guipuzcoa	20.91	10.18	Valencia	18.42	9.73
Huelva	22.57	8.67	Valladolid[a]	27.95	17.41
Huesca	17.46	11.83	Zamora[a]	33.51	19.26
Jaen	19.85	11.07	Zaragoza	23.98	13.40
Leon[a]	31.22	18.76	All provinces	22.63	11.70

[a]Altitude > 600 m (≥90% of the surface) above sea level.

tality rates are coastal, and therefore at sea level.

In both coastal and inland provinces, the mean mortality rates for males are as follows: coastal provinces (n = 21), 20.7 ± 4.1 (S.D.); inland provinces (n = 28), 27.6 ± 6.7. The difference between the two means is statistically significant using the Student's t-test and the Mann-Whitney U-test ($P < 0.001$). For females the mean mortality rates are: coastal provinces, 10.1 ± 2.1; inland provinces, 14.8 ± 3.9. The difference between the two means is statistically significant using the Student's t-test and the Mann-Whitney U-test ($P < 0.001$).

There is a strong correlation between the male and female provincial age-adjusted death rates: $r = 0.878863$ ($P < 0.001$).

Discussion

The annual decrease in age-adjusted death rate was 1.7% for males and 1.9% for females and this decreasing trend is important. We have shown this decreasing trend in a previous national study of mortality between 1951 and 1976; but the results were not internationally comparable because of the use of a non-comparable standard population (the Spanish midyear calculated population of 1963) [9]. In Spain, (1980) the mortality rates were lower than in Italy (1983) and in Portugal (1986) and higher than in the other countries of EEC [13].

In our opinion, the two fundamental causes of this decrease are the migration from the rural to the urban areas (> 10% of

population between 1961 and 1980) and the improvement of heavy transport during the 1950s and 1960s which has allowed an increasing supply of fresh foods throughout the country [1,7].

Males and females of the coastal provinces have a lower mortality rate than those of the inland provinces. It is generally accepted that cured meat is more salted in coastal than in inland provinces and this is in contrast with the observations of Sato, Hirayama, Nagai and Tuyins who have found a correlation between diet salt intake and gastric cancer [5,8,9,11].

In the Spanish provinces with the highest gastric cancer mortality rate, altitude (>90% of surface) is greater than 600 m above sea level and all are situated along the range of mountains known as Cordillera Central. There are two possible explanations for this finding: (1) the most realistic reason is the minor production, and consequent minor intake, of green vegetables in the diet; these have been shown to have a protective effect [4,6]; (2) difference in the composition of drinking water, such as increased nitrate levels, as described by Cuello et al. [3].

Conclusion

Mortality from gastric cancer in Spain is decreasing and mortality is higher in the interior of the country than in the coastal provinces.

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