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Cancer incidence and mortality in Portugal

P.S. Pinheiro[a,*], J.E. Tyczyński[b], F. Bray[b], J. Amado[c], E. Matos[c], D.M. Parkin[b]

[a]*South Regional Cancer Registry (ROR-Sul), Rua Prof. Lima Basto, 1099-023 Lisbon, Portugal*
[b]*Unit of Descriptive Epidemiology, International Agency for Research on Cancer, 150 cours Albert-Thomas, 69372 Lyon cedex 08, France*
[c]*Vila Nova de Gaia Cancer Registry (RVNG), Centro Hospitalar, Rua Conceição Fernandes, 4434-502 Vila Nova de Gaia, Portugal*

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Abstract

In this paper, we present estimates of national cancer incidence in Portugal in 1996–1998, predictions for the year 2000, and interpret the recent cancer mortality trends in light of observations from epidemiological research and risk factor patterns. In Portugal, national mortality data from vital statistics are available from 1960, while cancer registration has been mandatory since 1988, when three regional cancer registries covering the mainland of the Portuguese Republic were set up. Up until now, however, none of these registries has been able to produce data with an acceptable completeness of registration—hence this study. Mortality data from Portugal for 1996–1998 and incidence data for 1990–1995 from Vila Nova de Gaia (RVNG) (the most complete of the Portuguese cancer registries), 14 Italian registries and nine Spanish registries were assembled to produce the best possible estimates of numbers of incident cases for each age group and gender. A total of 19 880 new cancer cases are estimated to have been diagnosed among men in the year 2000, and nearly 17 000 new cancer cases in women. The most common cancer among Portuguese men in 2000 is cancer of the colorectum (3173 new cases), followed by cancers of the prostate (2973), lung (2611), stomach (2206) and urinary bladder (1360). In women, breast cancer is the most common cancer (4358) followed by cancers of the colorectum (2541), stomach (1494) and corpus uteri (1083). The overall age-standardised cancer mortality rate for men in Portugal increased steeply (1.4% annually) during the period 1988–1998, with prostate cancer (3.6% annually), colon and rectum (3.3%) and lung (2.4%) mostly contributing. Among women, the overall cancer mortality rate was stable (a non-significant decrease of approximately 0.2% per year). These remarkable results, particularly in males, demonstrate the need for a comprehensive national programme against cancer. Since the increasing epidemic of lung cancer (in men), as well as other tobacco-related cancers, is observed in Portugal, the important component of such a programme should be a nationwide tobacco control programme. Improving accessibility to highly effective diagnostic and treatment procedures for cancer in general and colorectal and prostatic cancers in particular should be a priority in the fight against cancer.

Keywords: Cancer; Incidence; Mortality; Portugal; Registration; Completeness

1. Introduction

During the last 25 years, Portugal has experienced major social changes and economic restructuring. From a mainly agricultural, poor population with low levels of education, Portugal has developed into an increasingly urban society of the 21st century, and moved into the economic mainstream of Europe.

The impact of this gradual transformation on lifestyles has produced adverse changes in the prevalence of some of the established risk factors for cancer, such as tobacco smoking, alcohol drinking, and dietary and reproductive patterns, which have resulted in increases in the incidence and mortality from cancer. Offsetting this, increasingly available resources for healthcare may have had a beneficial effect on outcome (survival) of cancer patients.

This paper reports an European Network of Cancer Registries (ENCR) sponsored study of the quality (completeness and validity) of the data from the Portuguese Cancer Registries, estimates of national cancer incidence in 1996–1998, and predictions for the year 2000. In addition, trends in cancer mortality are examined in light of the most recent epidemiological research and risk factor patterns.

In Portugal, the most comprehensive source of information on cancer has been from mortality statistics

* Corresponding author.
E-mail address: ppinheiro@ipolisboa.min-saude.pt (P.S. Pinheiro).

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based on the compulsory certification of death. Cancer registration has developed since 1988, when, following legislation, three regional cancer registries covering the mainland of the Portuguese Republic, and approximately 95% of the population, were established. They are: RORENO in Oporto (covering the Northern region with a population of 3.5 million people), RORCENTRO in Coimbra (the Central region, 1.7 million people) and RORSUL in Lisbon (the Southern regions of Lisbon and Tagus Valley, Alentejo and the Algarve, 4.2 million). Population-based registration was begun in the three registries in 1988, 1990 and 1989, respectively. The registries obtain information on cancer patients from multiple sources, including hospitals and health centres, pathology reports, and clinicians in public and private health institutions. Data collection is mainly passive and based on the contributions by medical collaborators in each health institution. Historically, death certificates have not been used for cancer registration procedures, either because of legal restrictions, or due to a lack of resources.

A fourth Portuguese population-based registry in Vila Nova de Gaia (RVNG) was established in 1981, and covers a single urban municipality of 260 000 people, adjacent to the city of Oporto. Its catchment area is included within the RORENO registry, and it covers 7.4% of the population at risk in this region. Except for RVNG, death certificates have never been used for cancer registration procedures, either because of legal restrictions, or due to a lack of resources.

2. Patients and methods

2.1. Materials

Cancer mortality data by primary site, gender and 5-year age group at the national and regional level were obtained from the Instituto Nacional de Estatística (INE) in Portugal for the period of 1988–1998. Incidence data were obtained from the Portuguese cancer registries, RORENO (1988–1995), RORCENTRO (1990–1994), RORSUL (1989–1995) and RVNG (1987–1995). National mortality data for the period 1960 to 1998 were extracted from the World Health Organization (WHO) [1] databank (via the web site http://www-depdb.iarc.fr/who/mortality.htm).

Age- and gender-specific national and regional population figures for the period 1988–1998, and population projections for the year 2000, were obtained from INE.

2.2. Quality control of the registries' data

All data provided by the Portuguese registries were subjected to quality control appraisal through the assessment of completeness and validity indicators.

Completeness was evaluated by an examination of the mortality–incidence ratios (M:I ratio). The M:I ratio, which compares the number of deaths attributed to a specific cancer and the number of incident cases in the same time period, can be interpreted as an indirect indicator of general survival if registration is complete and no marked temporal changes in incidence rates are present [2]. However, when the M:I ratio exceeds the value 'expected' for a particular cancer (and country or region) or when it is greater than 100, the possibility of under-registration must be considered.

The M:I ratios obtained for each Portuguese registry were compared with those of an Italian (Varese), a Spanish (Granada) and a Swiss (Geneva) registry, all three contributing to the EUCAN database estimates for 1995 [3].

Validity was assessed by such standard indicators such as the proportions of cases registered which were microscopically-verified (MV%), of unknown primary site, or with missing information (unknown gender, age and site of primary tumour), as well by using internal consistency checks (unlikely or impossible combinations of codes).

In Europe, there are variations in the accuracy of certification of deaths from cancer of the uterus, with varying proportions of deaths being recorded as 'uterus cancer, not otherwise specified' (ICD-9 179) rather than to the specific sites, uterine cervix (ICD-9 180) or uterine corpus (182). As with other European studies [4–6], we have made an adjustment to the Portuguese data to allow for this misclassification. The number of 'unspecified' deaths were re-allocated to either uterine cervix or uterine corpus cancer according to estimates of the age-specific proportions in countries where the percentage of uterus NOS is low (Nordic countries and United Kingdom (UK)). These estimates take into account incidence and survival information from these countries [4]. For purposes of consistency, the corresponding incident cases were reallocated in the same way from the rubric 179 to 180 and 182, although the proportion of uterus cancers registered as 179 was very much smaller (3–9%) than for mortality (56% in 1991–1993).

2.3. Estimating the numbers of incident cases and rates

Estimates of cancer incidence were made for the 24 most common primary sites, as well as for all cancers combined (excluding non-melanoma skin cancers). The estimation procedure made use of national mortality data and the ratio of age (5-year age groups) and gender-specific numbers of incident cases to deaths, based on appropriate cancer registry data. Specifically, national incidence (I) can be estimated as a product of national mortality (M) and age-specific ratios of registry incidence (i) and mortality (m) using the following expression:

$$I = M \times \frac{i}{m}$$

This is a standard approach which has been used in a number of previous publications estimating incidence in the European Union (EU) [3–5].

The site- and age-specific ratios of incidence and mortality were based upon the data for 1990–1995 from RVNG, from 14 Italian and nine Spanish registries. Firstly, within each country, the incidence and mortality data were aggregated in such a way to take account of both the number of years contributed by each registry and the size of the population covered. A single set of ratios was obtained by summing the three datasets, with each given a relative weighting of one-third. It was decided not to use data from the other Portuguese registries because of a suspected incompleteness of registration (see Results).

Due to small numbers, RVNG data were not used for the calculation of the incidence:mortality ratios for the following sites: cervix uteri, oesophagus, Hodgkin's disease, larynx, liver, melanoma, multiple myeloma, testis and thyroid. Due to the small number of deaths, mortality data from testis and thyroid cancers and Hodgkin's disease were smoothed using corresponding age-specific (5-year) national rates of Italy and Spain combined, prior to the incidence calculations. For prostate cancer, the ratios obtained from the Italian registries were not used as the prostate-specific antigen (PSA) effect (characterised by the steep increase in the incidence of prostate cancer following the adoption of opportunistic PSA screening) was considered not to be appropriate for the Portuguese experience.

The final estimates of cancer incidence in Portugal were calculated by applying the fitted ratios to official mortality data for the period 1996–1998. The estimates of the numbers of cancers in the year 2000 were based on the age-specific incidence rates of 1996–1998, applied to the age-specific population projections for the year 2000.

2.4. Mortality trends

Portuguese cancer mortality data for the period 1988–1998 were used to calculate annual age-specific and age-standardised (European standard population) mortality rates over time for each site, gender and region [7]. WHO mortality data were used for the calculation of long-term age-standardised mortality trends (1960–1998). Estimates for 1995 were compared with mortality in other European countries [3,6].

Estimation of the average annual percentage change in rates and the corresponding significance tests for differences in trend were performed using a Poisson regression model in Stata [8]. For this purpose, age was combined into seven age groups (0–14 years, 15–34 years, 35–44 years, 45–54 years, 55–64 years, 65–74 years, 75+ years) and year of death was coded as a continuous variable, allowing for direct estimation of the mean annual percentage increase or decrease in the mortality rate adjusted for age. Cumulative risk, a measure of the risk of an individual developing a given cancer before reaching the age of 75 years, was also calculated [9].

Table 1
Mortality/incidence ratios (*100) for the populations covered by the Portuguese regional registries (1991–1993), RVNG local registry (1990–1995) and Granada (Spain), Varese (Italy) and Geneva (Switzerland) (1988–1990) registries by primary site and gender

	RORENO	RORCENTRO	RORSUL	RVNG	Granada	Varese	Geneva
Men							
Stomach	79	113	111	74	81	78	61
Colorectum	41	60	65	55	52	40	46
Liver	269	178	224	93	158	88	64
Pancreas	262	300	229	124	104	99	97
Lung	124	150	134	80	95	89	82
Prostate	62	122	125	57	79	45	45
Leukaemia	144	102	122	144	65	86	67
Women							
Stomach	79	118	127	72	88	79	76
Colorectum	45	65	73	47	53	39	50
Liver	384	264	302	68	172	112	117
Pancreas	232	284	243	100	92	98	90
Lung	154	163	136	97	126	89	88
Breast	34	58	50	38	43	36	39
Uterus NOS	416	236	728	550	850	775	143
Cervix uteri	10	16	20	21	34	14	41
Corpus uteri	8	16	16	12	19	8	28
Leukaemia	162	108	131	128	82	76	82

NOS, not otherwise specified.

3. Results

3.1. The quality and completeness of data

There were large differences in the M:I ratios between the Portuguese registries, and other cancer registries in Southern Europe (Granada, Varese, Geneva), especially for cancers associated with poor survival like liver, pancreas and lung (Table 1). In the case of RNVG, however, the M:I ratios were very similar to those in the comparison registries. Data from the three Portuguese regional registries (RORENO, RORCENTRO and RORSUL) showed significantly higher M:I ratios than the other registries for most cancers. In the absence of a rapidly declining incidence, high M:I ratios could be due to an underregistration of incident cases, very poor survival and/or inaccurate death certification.

A recent study showed that cancer survival is poorer in Portugal than it is in Italy, Spain or Switzerland for breast, cervix uteri, prostate and colorectal cancers [10]. However, the size of the difference would result in only slightly higher M:I ratios for the Portuguese registries. There has been no study of the accuracy of stated cause of deaths on death certificates in Portugal. However, we do not think that over-reporting of lung, liver and pancreatic cancers as the established cause of death is likely to occur to a greater extent in Portugal than in the rest of Europe; mortality rates for these cancers are lower in Portugal than in the other European countries. It seems more likely that there is a degree of underregistration in the Portuguese cancer registries.

None of the three regional registries used death certificates as a data source, which contributed to the incompleteness of their registration. The smallest registry, RVNG, has access to death certificates and thus is likely to have better coverage than its larger counterparts.

The MV percentages in the RORSUL are similar to those observed in the Granada registry, except for cancers with high fatality rates (Table 2). For lung, liver and pancreatic cancers, the MV percentages resemble those of Geneva and Varese and are higher than in Granada. This is partly due to the fact that death certifications only (DCOs) are not used as a source of information in RORSUL, so that histologically-verified cancers make up a higher proportion of the registered cases.

The proportion of cases with missing or unspecified morphology (8000 and 9990, ICD-O-1) reflects potential problems in both ascertainment (diagnostic investigations performed) and in coding (registration methods). It is approximately 10% in the Portuguese registries, with the exception of RORENO where it is only 3%. This is due to the fact that in the latter, private pathology laboratories are important data sources, contributing a substantial proportion of the total number of cases.

The percentage of cases of unknown primary site varies between 2.8 and 3.5%, and is lower that in countries with more established registries (in 1992: Australia 4.0–5.4, Spain 4.1–7.7, UK 4.7–7.0), indicating a good performance on this indicator.

Overall, the validity of the Portuguese data is quite acceptable and comparable to the data of more established registries. However, completeness is a major problem. Many cancers, especially those with poor survival, are probably underregistered. Non-use of death certificates as a source of information on cancer cases, as well as too much dependence on voluntary reporting, contribute to this problem.

Table 2
Proportion (%) of microscopically-verified (MV) cases by site

	RORSUL	Granada	Varese	Geneva
Men				
Stomach	84	80	93	98
Colorectum	84	88	95	97
Liver	75	25	61	76
Pancreas	53	33	58	82
Lung	85	69	87	95
Prostate	84	73	91	94
Leukaemia	93	98	95	98
Women				
Stomach	84	73	90	94
Colorectum	82	81	89	95
Liver	70	18	55	72
Pancreas	50	39	47	72
Lung	85	63	75	91
Breast	90	92	96	96
Cervix uteri	97	97	98	99
Corpus uteri	98	96	98	98
Leukaemia	93	90	93	95

3.2. Incidence estimates

If the rates of 1996–1998 are applied, a total of 19 880 new male cancer patients are estimated in 2000 (Table 3). The most common cancer among Portuguese men in 2000 is cancer of the colorectum (3173), followed by cancers of the prostate (2973), lung (2611), stomach (2206) and urinary bladder (1360) (Table 3).

Among women, there were nearly 17 000 new cancer cases (Table 3), with breast cancer being the most common (4358) followed by cancers of the colorectum (2541), stomach (1494) and corpus uteri (1083) (Table 3).

3.3. Cumulative risk (incidence and mortality)

Based on estimated incidence and mortality rates in 1996–1998, the risks of a Portuguese individual developing (up to the age of 75 years old) or dying from a given cancer are shown in Table 4. In males, the risk of developing cancer was highest for colorectal cancer

(4.7%) and lung cancer (4.3%). For females, the highest risks were for breast cancer (5.7%) and colorectal cancer (2.7%). The highest risk of dying was from lung and prostate cancer in males (4.0 and 3.0%, respectively) and from breast and large bowel cancers in females (3.1 and 2.4%, respectively).

3.4. Mortality trends

In Portugal, the incidence of and mortality from cancer have increased progressively in the last three decades. In 1960, cancer accounted for some 9% of deaths; in 1998, the figure was nearly 20%. Cancer kills a larger proportion of males (22%) than females (17%). The leading cause of death in Portugal—cerebrovascular diseases (CVD)—accounted for 21% of all deaths in 1998, compared with the 20% attributable to cancer.

In men, mortality from cancer (all sites combined) increased by 1.4% a year in the period 1988–1998 (Table 5); this represents about a 10% higher rate in 1996–1998 than in 1988–1990 (Fig. 1). The highest rates of increase were for cancers of the prostate (3.6% annually), colon–rectum (3.3%), oral cavity and pharynx (2.5%) and lung (2.4%), while there was a decrease in stomach cancer mortality (−2.2%) (Table 5). Other cancers for which mortality increased significantly included non-Hodgkin's lymphoma (4.2%), multiple myeloma (4.2%), kidney (3.6%), and liver cancers (1.8%).

Among women, mortality from cancer (all sites) was almost constant during the period 1988–1998 (non-significant decrease of approximately 0.2% per year). The stability resulted from the net effect of decreases in mortality from stomach and cervical cancers (Table 5), and increases in the rates of ovarian cancer and non-Hodgkin's lymphoma and, to a lesser extent, of lung and colorectal cancers (Fig. 2).

3.5. Comparison with the EU and other countries

Overall cancer mortality in males (ASR 229.1 per 10^5) is lower in Portugal than in Southern Europe ((SE), i.e. Southern Europe: Albania, Bosnia Herzegovina, Croatia, FYROM (Macedonia), Greece, Italy, Malta, Portugal, Slovenia, Spain, Yugoslavia) (245.4 per 10^5) and in the EU as a whole (260.4 per 10^5) (Table 6). Portugal had higher mortality rates than both SE and the EU for stomach cancer, oral cavity and pharynx and prostate (compared with SE only). Relatively lower mortality rates were found for liver, lung, bladder and kidney.

Table 3
Estimated number of new cancer cases among men and women in Portugal in 2000

Primary site	Men		Women	
	No. cases	Standardised rate[a] (/100 000)	No. cases	Standardised rate[a] (*100 000)
All sites	19 880	379.5	16 955	261.0
Oral cavity	1150	23.0	196	2.8
Oesophagus	427	8.5	102	1.3
Stomach	2206	41.9	1494	20.6
Colorectum	3173	60.1	2541	35.6
Liver	386	7.3	184	2.5
Pancreas	459	8.7	412	5.3
Larynx	924	18.7	63	1.0
Lung	2611	50.4	511	7.5
Skin melanoma	193	3.8	299	5.0
Breast	–	–	4358	73.0
Cervix	–	–	958	17.0
Corpus	–	–	1083	17.6
Ovary	–	–	607	9.9
Prostate	2973	53.0	–	–
Testis	170	3.4	–	–
Bladder	1360	25.7	529	7.1
Kidney	463	8.9	254	3.8
Brain	456	9.3	318	5.4
Thyroid[b]	60	1.2	411	7.3
Non-Hodgkin's lymphoma	844	16.6	624	9.5
Hodgkin's disease	103	2.0	94	1.7
Multiple myeloma	250	4.7	229	3.2
Leukaemia	510	9.8	431	6.6
All other sites	1162	22.1	1263	17.2

[a] Standardised rates to the European standard population.

[b] For thyroid cancer in women, the small number of deaths did not allow accurate estimates to be made. For this specific site, the EUCAN 96 estimate of a standardised incidence rate of 4.9/100 000 and 269 new cases should be considered more indicative.

In females, overall cancer mortality in Portugal (122.7 per 10^5) is close to that observed in SE (124.0 per 10^5) and lower than that estimated for the EU (147.3) (Table 6). Mortality rates were higher for stomach and cervical cancer compared with both SE and EU, but overall death rates were lower in Portugal for liver, lung, ovary and kidney cancers.

4. Discussion

4.1. Incidence estimates

In order to estimate incidence for the whole country, pooled IM ratios based on the best available data from RVNG, together with selected Italian and Spanish registries were applied to the national mortality data. One might argue that the equal weighting of each (one third) gives too much weight to RVNG given that it covers only one municipality—Vila Nova de Gaia with 250 000 people (2.5% of the total population). However, since 1987, this registry has been the only existing source of incidence data in Portugal considered to be complete. This municipality is widely thought to represent a growing suburban population of the 1990s in the two large urban regions of Lisbon and Oporto (together aggregating nearly 46% of the total population of Portugal), having experienced a rapid influx of population during the last two decades as inhabitants from the rural areas moved to the city in search of jobs.

In terms of estimating incidence, the relative frequency of each cancer in any geographical area is not a key factor. The fitted I:M ratios specific for age, gender and tumour site are surrogates of survival (or correctly expressed as $1-\{1/[I/M]\}$). The importance of the RVNG data in the pooling is therefore its contribution to estimating the survival experience in Portugal. A recent study has shown that cancer survival in Portugal is worse than in Italy and Spain [10]. The contribution of data from these countries (for the period of 1990–1995) to the fitted I:M ratios may thus lead to a slight overestimation of survival and therefore to an inflated number of estimated new cases. Nevertheless, the number of estimated cases obtained in this study will reflect more accurately the number of actual cases. The reason for this is that had more recent data been available (for example, the second half of the 1990s) then improvements in cancer survival in Portugal (Dr P.S. Pinheiro, Instituto Português de Oncologia Lisboa) would have come into effect.

Table 4
Cumulative risk (0–74 years) of an individual developing cancer and total cumulative risk of any individual dying from cancer in Portugal

Men	Suffer from	Die of	Women	Suffer from	Die of
Any cancer	25.9	21.6	Any cancer	18.4	16.8
Colorectal	4.7	2.7	Breast	5.7	3.1
Lung	4.3	4.0	Colorectal	2.7	2.4
Prostate	3.2	3.0	Stomach	1.4	0.9
Stomach	3.2	2.8	Lung	0.6	0.5
Bladder	1.9	0.8	Cervix	1.3	0.7
Oral	1.9	0.8	Corpus	1.5	0.5

4.2. Cancer mortality in Portugal and comparison with the EU

For full appraisal of the cancer burden, and for monitoring the effectiveness of intervention (prevention, early detection and treatment), national-level incidence data are ideal. However, the Portuguese data are inadequate for the purpose at present, so, to study trends in cancer, we used national mortality data. Mortality data reflect, of course, not only changes in incidence, but also changes in survival, as a result of early diagnosis (sometimes due to screening) or more effective therapy.

Since the 1960s, overall mortality rates have been increasing continuously in men, whereas in women, they have remained stable since the early 1970s (Fig. 3). In 1995, cancer mortality rates in Portugal were still lower than most European countries [6]. In males, they were only higher than those of Austria, Greece, Finland and Sweden, and in females only above those in Greece and Spain. However, the rates for four of the five major

Table 5
Percentage annual change in mortality in men and women between 1988 and 1998 in Portugal

	Men		Women	
	%	*P* value	%	*P* value
All sites	+1.4	<0.001	0.0	NS
Oral cavity	+2.5	<0.001	+0.2	NS
Oesophagus	−0.9	NS	−4.0	<0.001
Stomach	−2.2	<0.001	−3.0	<0.001
Colorectum	+3.3	<0.001	+0.8	0.008
Liver	+1.8	<0.001	+0.6	NS
Pancreas	+0.9	0.04	+1.1	0.03
Larynx	−0.4	NS	−0.8	NS
Lung	+2.4	<0.001	+0.9	NS
Skin melanoma	+3.0	0.02	+5.0	<0.001
Breast	–	–	+0.4	NS
Cervix	–	–	−1.7	0.001
Corpus	–	–	+0.5	NS
Ovary	–	–	+3.0	<0.001
Prostate	+3.6	<0.001	–	–
Testicle	−0.4	NS	–	–
Bladder	+0.8	NS	−0.4	NS
Kidney	+3.6	<0.001	+1.3	NS
Brain	+1.4	0.02	−0.5	NS
Thyroid	−0.3	NS	+0.8	NS
Non-Hodgkin's lymphoma	+4.2	<0.001	+3.3	<0.001
Hodgkin's disease	+0.7	NS	+2.0	NS
Multiple myeloma	+4.2	<0.001	+3.6	<0.001
Leukaemia	+0.5	NS	+1.1	0.05

NS, non significant.

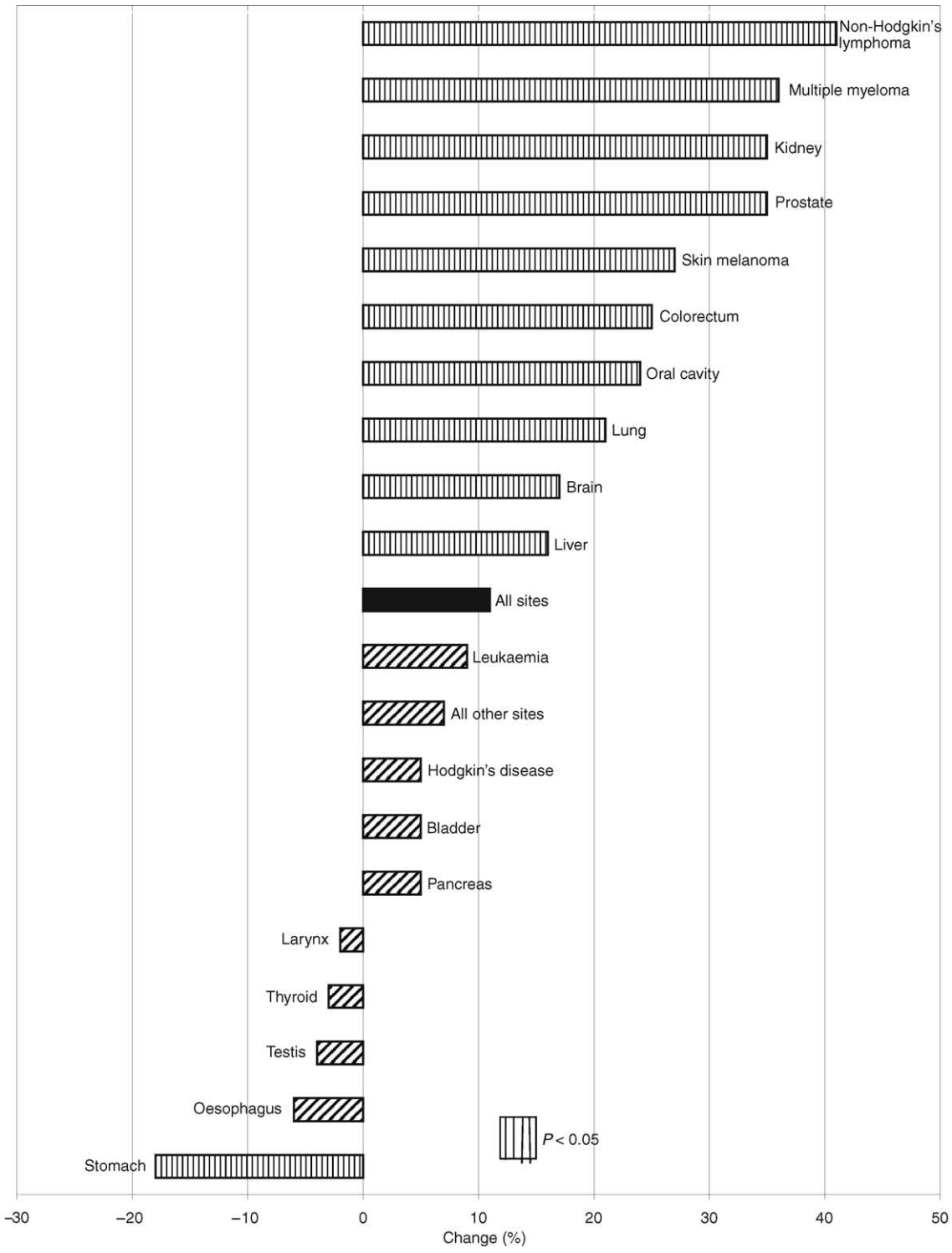

Fig. 1. Changes (in %) in mortality between 1988–1990 and 1996–1998 in Portugal in males.

cancers in Portuguese men increased by more than 20% between 1988–1990 and 1996–1998 (Figs. 1 and 4), suggesting that they may well soon equal rates seen in other European countries, at a time when many are experiencing declining trends in overall cancer mortality rates in males [1].

There were also significant changes in cancer mortality trends in women in the last decades. Within a constant overall cancer mortality for the period of 1988–1998 (Table 5), there were significant decreases in mortality for three cancer sites—stomach and oesophagus (annual change −3.0 and −4.0%, respectively), and for

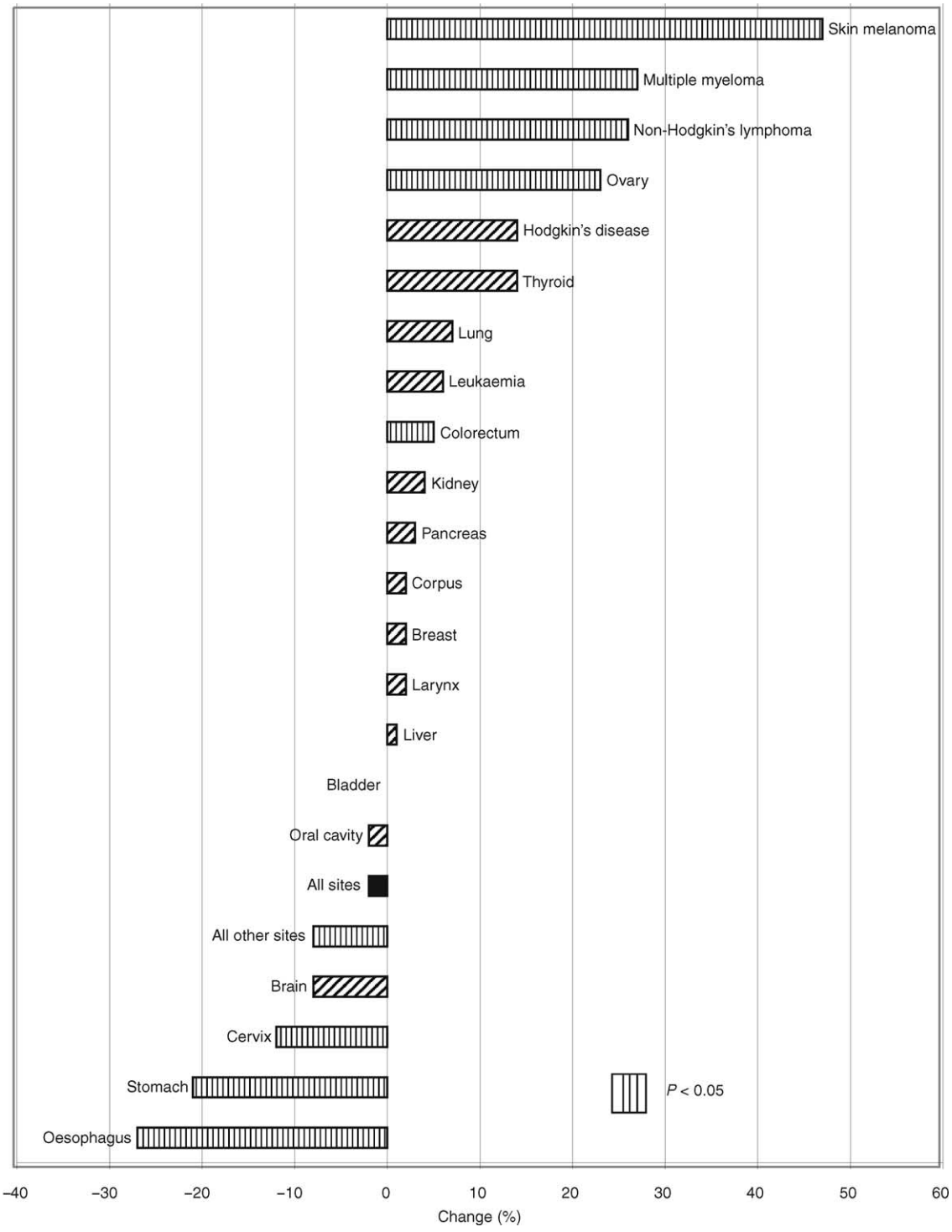

Fig. 2. Changes (in %) in mortality between 1988–1990 and 1996–1998 in Portugal in females.

cervical cancer (−1.7% of the annual change) (Table 5), and increases for malignant melanoma (5.0%), NHL (3.3%), multiple myeloma (3.6%), and ovarian cancer (3.0%).

Tobacco-related cancers, such as those of the lung and oral cavity and pharynx, contributed substantially to the increase in cancer mortality in males (21 and 24% increases, respectively). It should be noted that tobacco consumption per capita in Portugal increased in the years 1970–1994 by nearly 65%, and that by 1994, Portugal had one of the highest level of tobacco consumption in the EU [11]. Lung and bladder cancers show low rates in both genders. However, the risk of death from oral and laryngeal cancers, for which the synergistic combination of alcohol and tobacco is the major determinant of risk, is above the EU average in Portugal [6].

The increase in colorectal cancers in men (25%) and women (5%) in the period 1988–1998 means they now exceed those in other SE countries, for example Spain, Italy and Greece. This increase may reflect changes in lifestyle, especially diet, resulting from the social and economic changes in Portugal over the last 20 years. The last 20 years have seen a sharp increase in the consumption of fat and animal proteins and vegetables and a diminishing consumption of fruits, olive oil and carbohydrates [12]. In 1998, Portugal had the second highest level of supply of daily calories per capita in the world after the United States [13]. The estimated average Portuguese diet in 1992 contained 35% of calories from fat—dietary recommendations suggest that fat intake should not exceed 30% [13].

The level of prostate cancer mortality in Portugal in the middle of 1990s was similar to the EU average and approximately 35% higher than in Southern European countries (Table 6) [6]. It is noteworthy that the increase in prostate cancer mortality, in Portugal (and other Southern European countries: Italy, Spain), in the years 1978–1994 was lower than in most Northern European countries, and similar to those of Western Europe (France, Austria, Germany) in middle age men (35–64 years), as well as in the elderly men (aged 65 years and more) [14]. However, it was shown by Oliver and colleagues [15] that in some countries of Europe (Austria, France, Germany, Italy) decreasing mortality trends in the age group 50–79 years began in the 1990s. In these countries, some prostate-screening programmes, based on PSA testing, have been introduced at the end of the 1980s or beginning of the 1990s, which may result (due to an earlier diagnosis) in a gradual reduction in mortality.

One of the most important oncological problems in Portugal is gastric cancer. It was the most common cause of death from cancer in the early 1960s, and now ranks second for men and third for women. Mortality from stomach cancer in Portugal remains relatively high, the rates are the highest in the EU, in both males and females [6,16]. Moreover, the decrease in stomach cancer mortality, which is observed in all members of the EU, is the slowest in Portugal. For example, in the period between 1970 and 1990, stomach cancer mortality decreased in Portuguese men by 24.6%, while in Finland the decrease was 59.4%, in Denmark 56.6%, and in Germany 54.8% [16]. The decrease in mortality in females was also smaller in Portugal then elsewhere in the EU.

There are several possible reasons for the high rates of stomach cancer in Portugal. The first is the high prevalence of the *Helicobacter pylori* (HP) infection, an

Table 6
Age-standardised mortality rates[a] (ASR) by selected cancers in men and women in Portugal, Southern Europe[b] and European Union in 1995[c]

	Men			Women		
	Portugal	Southern Europe[b]	European Union	Portugal	Southern Europe[b]	European Union
All sites	229.1	245.4	260.4	122.7	124.0	147.3
Oral cavity	4.7	3.9	3.8	0.6	0.7	0.9
Oesophagus	7.5	6.1	8.8	1.4	0.9	2.0
Stomach	32.6	20.6	17.2	15.2	9.8	8.4
Colorectum	27.7	24.2	27.5	16.9	15.1	18.5
Liver	7.4	14.5	10.6	2.8	5.8	3.8
Pancreas	8.9	9.5	10.9	5.1	6.0	7.4
Larynx	7.3	6.8	5.1	0.4	0.3	0.4
Lung	42.7	70.7	71.5	6.7	9.2	14.8
Skin melanoma	1.2	2.0	2.3	0.9	1.4	1.6
Breast	–	–	–	24.9	25.3	30.5
Cervix	–	–	–	6.3	3.7	4.4
Corpus	–	–	–	3.4	3.3	3.0
Ovary	–	–	–	4.8	6.3	8.9
Prostate	28.3	20.7	27.0	–	–	–
Testis	0.4	0.3	0.4	–	–	–
Bladder	8.5	11.3	10.9	2.0	1.8	2.5
Kidney	3.6	5.0	6.7	1.4	2.0	3.0
Brain	5.6	5.5	5.9	3.6	3.5	3.9
Thyroid	0.5	0.5	0.5	0.7	0.7	0.7
Non-Hodgkin's lymphoma	5.0	5.2	6.4	3.3	3.6	4.2
Hodgkin's disease	0.8	0.9	0.8	0.5	0.5	0.5
Multiple myeloma	2.6	3.0	3.4	1.9	2.2	2.4
Leukaemia	6.9	7.5	7.8	4.3	4.5	4.8

[a] Standardised rates (to the European standard population).
[b] Southern Europe: Albania, Bosnia Herzegovina, Croatia, FYROM (Macedonia), Greece, Italy, Malta, Portugal, Slovenia, Spain, Yugoslavia.
[c] Estimates for 1995 [6].

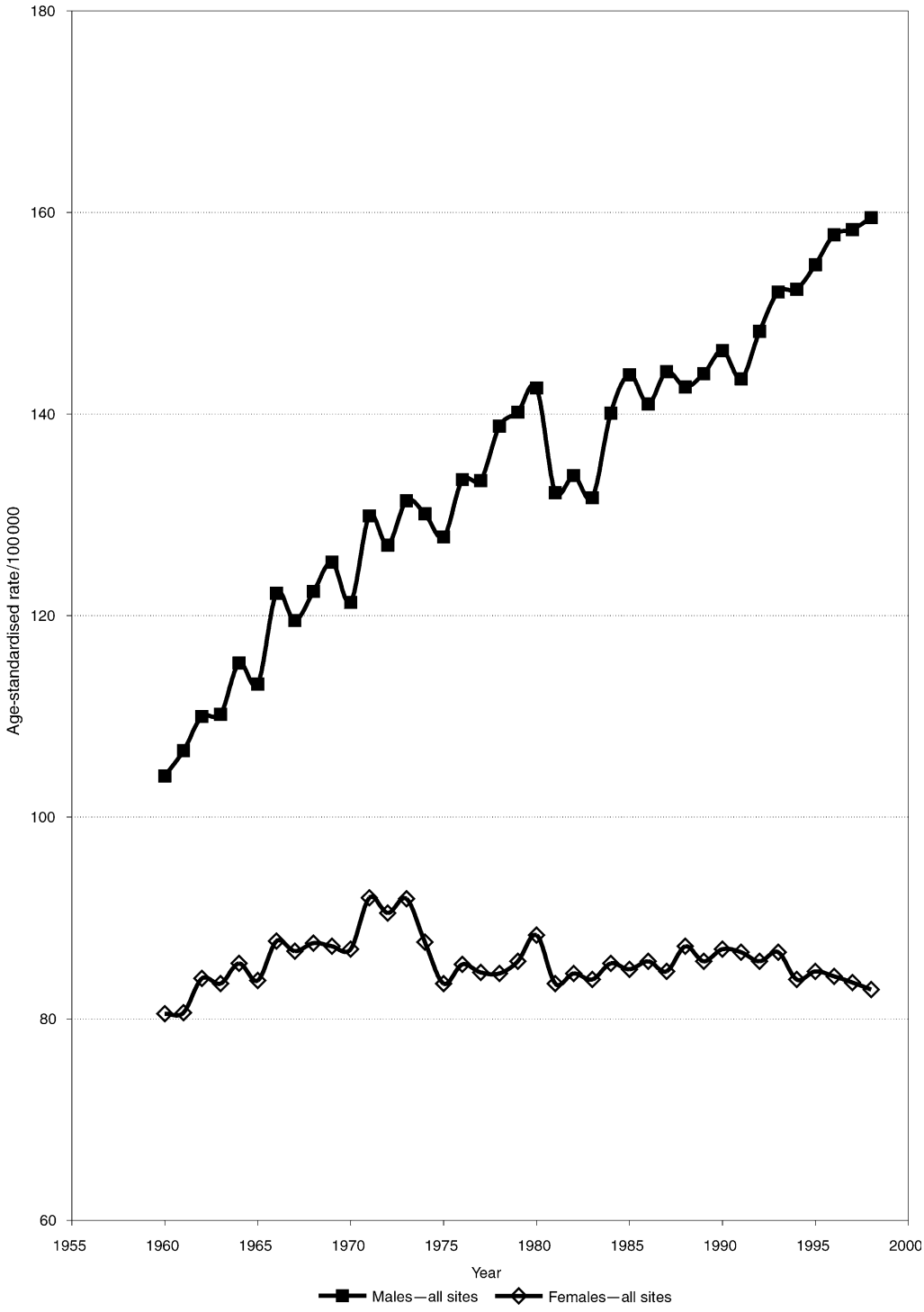

Fig. 3. Cancer mortality trends, all sites in Portugal 1960–1998.

important cause of gastric cancer [17–19]. In adult subjects (aged 15–70 years), the percentage of HP-infected individuals in Portugal was 82.8% [20]. A similar proportion (81.5%) was found by Estevens and colleagues [21]. A multicentre study observed a high proportion of HP-infected individuals in Portugal—in males 57 and 73% at 25–34 and 55–64 years, respectively, in females corresponding figures of 57 and 65% [22,23]. Among 17 centres, a higher prevalence in males aged 55–64 years was found only in Poland, Greece and two centres in Japan.

A second reason for the high risk of death from stomach cancer in Portugal may relate to dietary habits of the population. It was shown by Azevedo and colleagues [24] that the geographical distribution of several dietary items is significantly correlated with the

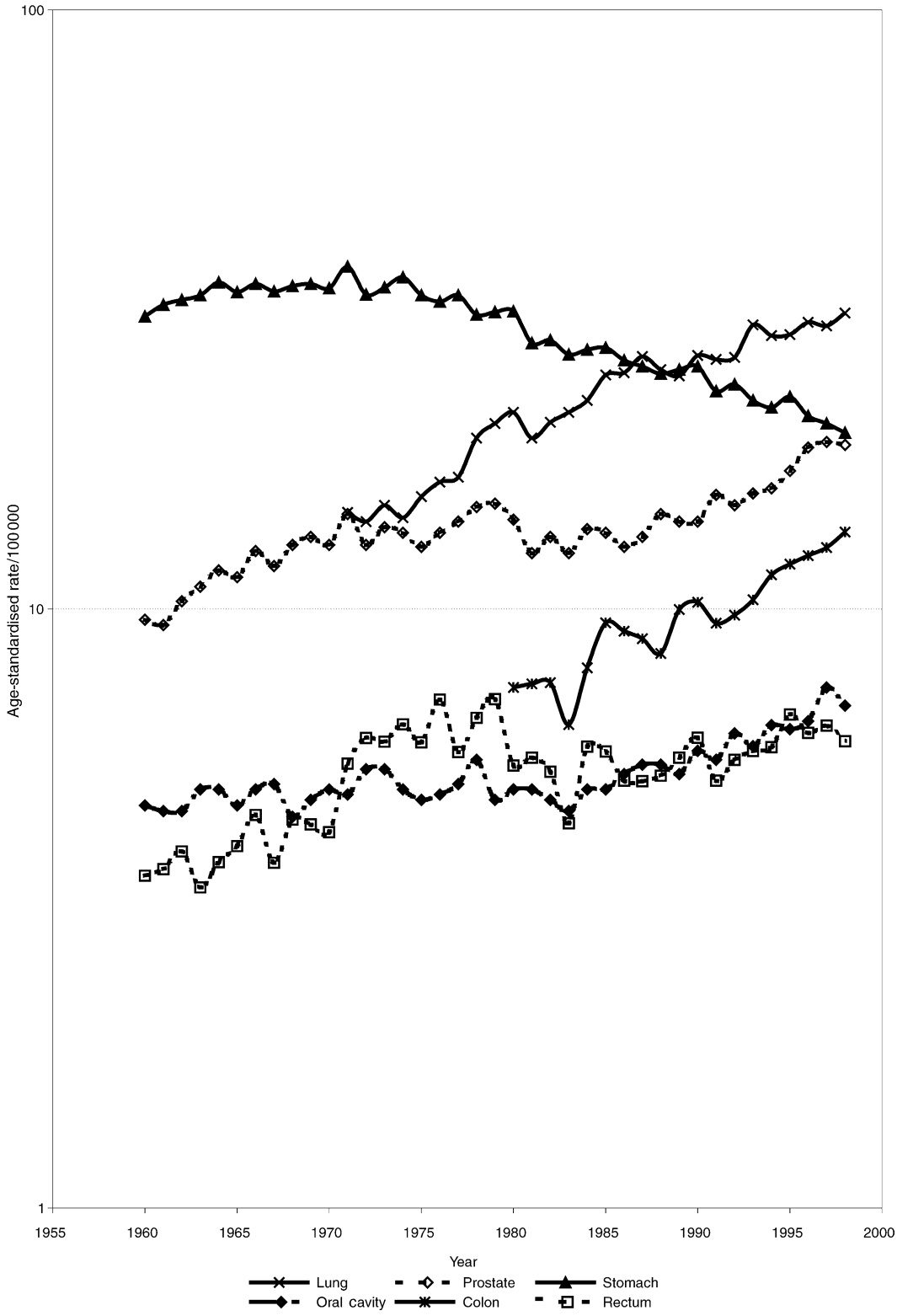

Fig. 4. Cancer mortality trends in males in Portugal from 1960 to 1998.

geographical distribution of gastric cancer in Portugal (generally a north–south gradient). A significant negative correlation was found for fruit consumption (−0.69 and −0.65 for males and females, respectively) and vegetable consumption (−0.81 and −0.74), while a significant positive correlation was found for rice consumption (0.71 and 0.64) [24].

The mortality rate of breast cancer is somewhat lower than the EU average ($24.9/10^5$ and $30.5/10^5$ in 1995 in Portugal and EU, respectively [6]. The increase in mor-

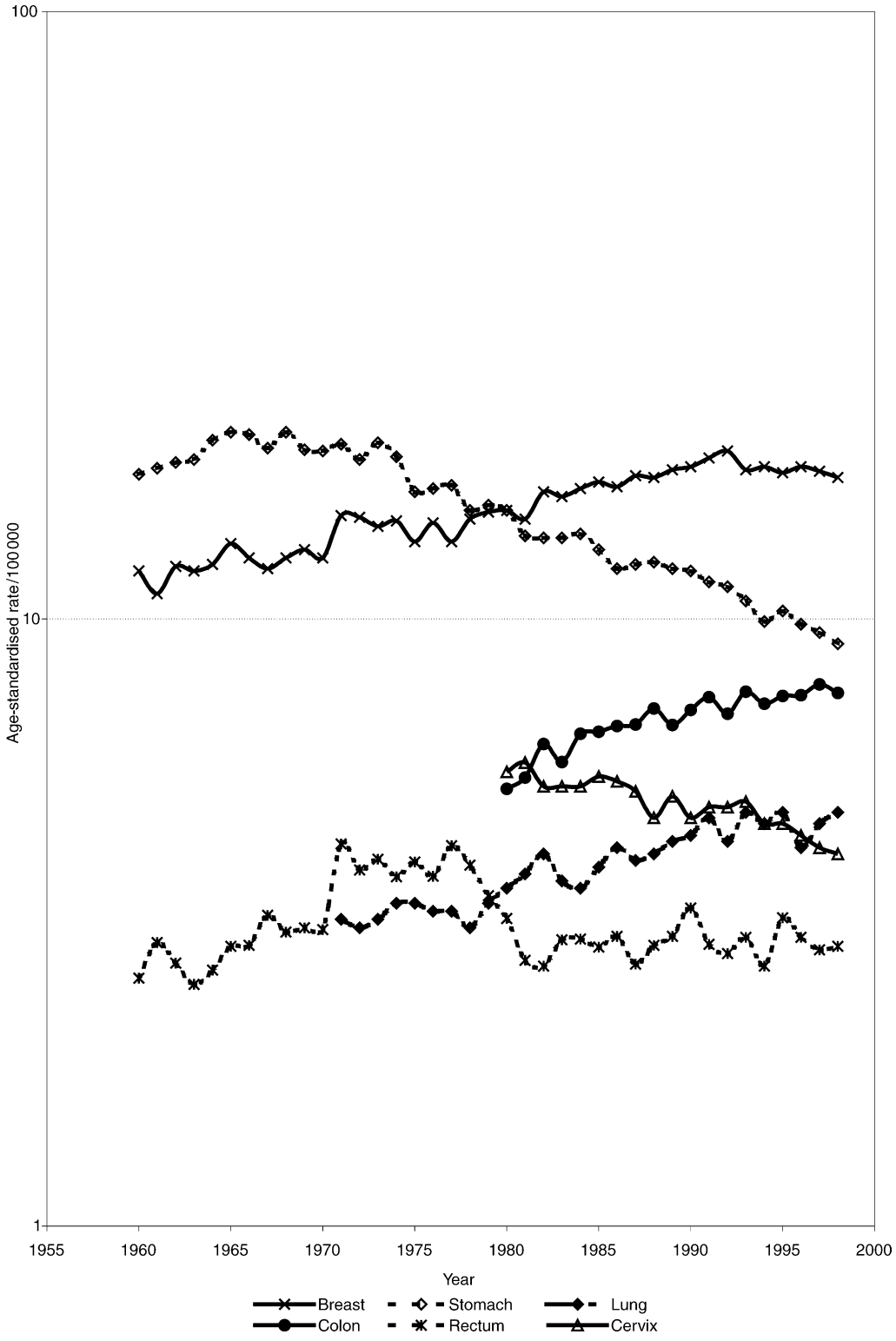

Fig. 5. Cancer mortality trends in females in Portugal from 1960 to 1998.

tality seems to have levelled off since 1992 (Fig. 5), although, since survival may well be improving, it is possible that an increase in incidence may have occurred. This would be consistent with falling rates of fertility; in Portugal the fertility rate fall from 2.8 in 1971 to 1.4 in 1995–2000 [25,26]. Falls in mortality from breast cancer have been observed elsewhere in Europe, most notably in the UK, where the relative contributions of screening and improved treatment have been debated [27]. In Portugal, only limited, pilot screening

programmes have been implemented [28] which are unlikely to have had a significant impact on national mortality.

5. Conclusions

The analysis of cancer in Portugal demonstrates the need for a comprehensive national cancer control programme. Such a programme should comprise the following core activities:

- A nationwide system for monitoring cancer incidence, mortality and survival—with special emphasis on improving the quality and comparability of the incidence data from the Portuguese cancer registries.
- Continuous surveillance of major cancer risk factors (e.g. tobacco smoking, alcohol consumption, dietary habits, occupational and environmental exposures);
- Primary prevention—education, information and promotion of healthy lifestyles as a means of avoiding the common preventable cancers such as lung, head and neck, digestive tract and prostate cancers;
- Secondary prevention—establishing effective screening programmes for cervical and breast cancers, and (possibly) cancer of the large bowel. Since cervical cancer rates in Portugal are amongst the highest in the EU [6], and the decreasing trend appeared later than in other EU countries, it seems that the implementation of the nationwide cervical cancer screening is a priority;
- Diagnosis and treatment—introduction of new, highly effective diagnostic and treatment procedures.

Since gastric cancer is common in Portugal it seems to be of particular importance to introduce measures to reduce the incidence of and mortality from that cancer. It is known that Portugal is a country where the regular consumption of traditional foods (smoked and salted meats and sausages) and relatively low consumption of fruits and vegetables takes place [29,30]. It was shown by Joossens and colleagues [31] that Portugal is a country with a relatively high consumption of salt, and that there is a significant positive correlation between the level of salt consumption and the frequency of gastric cancer. It may be possible to promote a healthier diet through populationwide educational programmes.

The increasing epidemic of lung cancer (in men), as well as other tobacco-related cancers, is a clear indication that a nationwide tobacco control programme should be continued and strengthened in the country. Based upon the recommendations of WHO and the experiences of other countries, the basic components of the programme should be:

- Continuous monitoring of population attitudes and habits with respect to tobacco smoking;
- Increasing the proportion of never-smokers in the population by implementing nationwide educational programmes, focused on children, youth and young adults, particular subgroups such as pregnant women and women of reproductive age could be targeted;
- Involving the medical community in Portugal (doctors, nurses, medical societies) in the process of the treatment of tobacco dependence in order to further increase the proportion of ex-smokers in the population. A direct result of such actions would be a vast reduction in the mortality rates (one third of cancer deaths in middle-aged Portuguese men are due to smoking) [32].

These complementary elements of the nationwide cancer control programme should be implemented simultaneously to strengthen each other in achieving the goal of a future reduction of cancer incidence and mortality.

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