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Original Paper

Cancer Incidence and Mortality in the European Union: Cancer Registry Data and Estimates of National Incidence for 1990

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Members of the European Network of Cancer Registries (ENCR) provide population-based data on cancer incidence for some countries and regions of Europe. These were supplemented by estimates in order to provide comparable information on cancer incidence and mortality in the 15 member states of the European Union (EU). The estimated numbers of new cases of cancer (excluding non-melanoma skin cancer) in 1990 were approximately 706 900 in men and 644 200 in women. Approximately 497 500 men and 398 200 women died of cancer in the same year. The main sites of incident cases in men were lung (21%), large bowel (13%), prostate (12%), bladder (7%) and stomach (7%). For women, the predominant sites were breast (28%), large bowel (15%), lung (6%), uterine corpus (5%) and stomach (5%). The overall incidence rates for males were highest in continental Western Europe (France, The Netherlands, Austria, Luxembourg, Belgium, Germany and Italy) while the rates of Greece, Portugal, Sweden, Ireland, Spain, Finland, the U.K. and Denmark were below the average value for the EC. Rates for females were highest in Northern and Western Europe, with the exception of France, which had a relatively low rate for females, in common with Greece, Spain and Portugal. The geographical variations in incidence of the major cancers are discussed in relation to risk factors. The estimates show the substantial burden of cancer in European Union populations, but there are also indications of effects of past preventive measures and there is scope for further intervention. Cancer registries are an important source of information for cancer control since they provide population-based incidence and survival statistics. These, along with mortality data, are required to obtain a full picture of the frequency of cancer and its effects at the population level. Some 44% of the EU population is covered by registries. The European Network of Cancer Registries aims to standardise the information provided by existing registries and to provide practical assistance to those in development. © **1997 Elsevier Science Ltd.**

Key words: epidemiology, incidence, mortality, cancer registries

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INTRODUCTION

ESTIMATES FOR 1985 [1] indicate that approximately 18% of the global burden of cancer mortality is experienced in European Union countries, despite having only 7% of the world's population. There were almost 900 000 deaths from cancer in European Union countries in 1990. Mortality statistics are the traditional indicators of the relative importance of cancer compared with other life-threatening diseases and the frequency of particular forms of cancer at the population level. This was acceptable when a diagnosis of cancer was almost invariably followed by death from the disease. However, improved patient survival for some forms of cancer has led to a divergence of incidence and mortality rates, and increased risk of multiple primary cancer. In these cir-

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cumstances, mortality may not be a reliable indicator of cancer incidence. Information on cancer incidence is critical for assessing the role of aetiological factors which determine risk, for establishing priorities for preventive measures, and for the management of health services, for which the numbers of cancer patients rather than deaths are of most relevance. In 1989, the European Commission adopted the Europe Against Cancer Programme, which seeks to encourage collaborative action in cancer research and national cancer control policies. Basic information on cancer incidence in the European Union, as well as survival and mortality, is fundamental to this programme.

Ideally, one would wish to have up-to-date information on cancer incidence based on complete registers of newly diagnosed cases. Population-based cancer registries fulfil this role in some parts of the European Union. In recognition of the value of information provided by cancer registries, the European Commission has supported the European Network of Cancer Registries (ENCR) [2]. The ENCR aims to extend and improve the information provided by cancer registries by co-ordinating data collection activities and providing training in data analysis and presentation. One of the activities of the ENCR is maintenance of the European Cancer Incidence and Mortality Database (EUROCIM) [3]. Eighty-four cancer registries (including some from European countries outside the European Union) have now contributed data, which are validated at the International Agency for Research on Cancer before being entered in EUROCIM. Approximately 40% of the population of the Community now reside in areas covered by cancer registries which are included in the database. Complete information is available for some countries but, for others, some form of estimation is required.

Estimates have been published for cancer incidence [4] and mortality [1] in 24 United Nations regions of the world in 1985, for incidence in the (12 nation) European Union based on data from around 1980 [5] and from the mid-1980s [6]. In addition, national level estimates of incidence are available for France in 1980 [7] and Switzerland in 1983–1987 [8]. There have also been a number of studies of specific cancer sites, including respiratory cancer [9] and breast cancer [10, 11] in Italy. Trends in cancer mortality in Europe have been surveyed by Negri and associates [12] and both incidence and mortality by Coleman and associates [13].

The motivation for this further set of estimates is the availability of more up-to-date data in EUROCIM, or published by national cancer registries. Furthermore, the European Union now encompasses 15 nations, whereas the most recent published estimates relate to the 12 nations of the European Union [6].

For consistency with previously published information, the statistical methodology and style of presentation in this paper are largely the same as in previous reports [5, 6]. Summary information is presented on incidence of and mortality from 23 major sites for the 15 European Union countries. The full results are available in the EUCan90 computer software package for use with Microsoft Windows [14].

MATERIALS AND METHODS

The sites of cancer chosen for study were lip, oral cavity and pharynx (ICD-9 140–149), oesophagus (150), stomach (151), large bowel (153, 154), liver (155), pancreas (157), larynx (161), lung (162), skin melanoma (172), breast (174), cervix (180), corpus (182), ovary (183), prostate (185), testis (186), bladder (188), kidney and other urinary tract (189), brain and other central nervous system (191, 192), thyroid (193), non-Hodgkin's lymphoma (NHL) (200, 202), Hodgkin's disease (201), multiple myeloma (203), leukaemia (204–208), and all cancer (excluding non-melanoma skin cancer) (140–172, 174–208). The age groups used were 0–14, 15–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74 and $\geq$75 years.

Population estimates and numbers of deaths by age, sex and site of cancer in 1990 were available from the World Health Organisation (WHO) database for all European Union countries except Belgium, for which the latest available year was 1989. However, the level of detail published for Belgium in 1989 (the ICD-9 'B List') does not contain data on kidney, thyroid, NHL and multiple myeloma. For these sites, the most recent complete information was from 1987. The data were originally coded to ICD-9 for all countries except Denmark, which continues to use ICD-8 for mortality statistics. This means that the mortality data for Denmark are not directly comparable for two sites. First, in ICD-9, code 155 (liver) includes 'liver not specified as primary or secondary' (155.2), whereas in ICD-8 these tumours are allocated to code 197.8 'Liver, unspecified'. Second, code 153 represents cancer of the colon in ICD-9, while in ICD-8 this code also includes 'intestinal tract, part unspecified' (which is coded to 159.0 in ICD-9).

Data on cancer incidence for 1990 (or a period centred on 1990) are available in published form from national cancer registration systems of Austria [15], Denmark [16], Finland [17], The Netherlands [18] and Sweden [19].

The U.K. has cancer registration systems covering England, Scotland and Wales (and now also Northern Ireland, for which incidence data for 1990 were not available). National registration has now been established in Portugal, although complete ascertainment of cases had not been achieved by 1990. There is a pathology register in Luxembourg, and a register of hospital patients based on a health insurance programme in Belgium: neither of these registries is population-based. Greece and Ireland now have national cancer registration systems which are still in development. In the remaining European Union countries—France, Germany, Italy, Spain—regional population-based cancer registration has been established. Therefore, for Belgium, France, Germany, Greece, Ireland, Italy, Luxembourg, Portugal, Spain and the U.K., national incidence was estimated using the techniques described below.

Age- and sex-specific incidence rates for England, Wales and Scotland in 1990 were applied to the population at risk in the U.K. as a whole (including Northern Ireland) to obtain an estimate of the total number of incident cases. The observed incidence/mortality ratios by sex, age and site for England, Wales and Scotland were applied to the mortality data of Ireland to obtain incidence estimates for that country.

For the remaining countries for which estimates were required, the method used was to apply the parameters of models fitted to the age- and sex-specific incidence/mortality ratios for selected cancer registry areas to the national mortality data. This approach exploits the empirical relationship between incidence and mortality rates in cross-

sectional data, which for most cancers tends to be quite homogeneous geographically with only small changes over time. It has been used in a number of studies [4–6], and has been shown to give reliable results [5]. The underlying assumption involved is that the ratio of incidence to mortality (I/M) is the same in the cancer registry areas used to estimate the model parameters (I_r/M_r) and the larger national populations (I_n/M_n). The national incidence can then be estimated from $I_n = M_n I_r/M_r$. If sufficiently detailed data were available, it would be preferable from a theoretical standpoint to try to estimate the survival experience of specific cohorts of cancer patients in order to obtain estimates of the incidence of a particular type of cancer x from the relation $I_x = M_x + M_y + S$, where M_x represents mortality due to cancer x, M_y is mortality from other causes and S represents survival. Estimated values for the 'net survival' ($M_y + S$) [20] can be derived from survival data from cancer registries. This approach, proposed by Capocacchia and associates [21, 22], has been used successfully in particular settings, such as to estimate breast cancer in Italy [10, 11], but would be difficult to apply to the general problem of obtaining estimates of the incidence of many different cancers in all European countries. First, survival data are available for only a small number of cancer registries. One possibility would be to assume that survival is constant across Europe, but the EUROCARE study [23] has demonstrated that this is not so. The reason may be that there are genuine differences in patient survival due to stage at diagnosis, access to care and quality of treatment, but the possibility that the differences are due to artefacts of data collection, including completeness of registration and follow-up, cannot be discounted. Second, death certificate only (DCO) cases are usually included in registry incidence data but not in published survival data, from which they are routinely excluded. Therefore, direct use of cancer registry survival data would tend to overestimate the true survival of all incident cases, leading to overestimation of national incidence.

We used two sets of cancer registry data to obtain estimates of the incidence/mortality ratios for countries in Southern (Greece, Italy, Portugal and Spain) and Western (Belgium, France, Germany and Luxembourg) European countries. The registries used are shown in Table 1. They were chosen on the basis of being representative of the regions in which they are located and being able to provide reasonably good quality incidence and mortality data for periods centred on 1990. The absence of any particular registries from the study does not imply a judgement on the quality of the information which they provide.

Estimates of the regional incidence/mortality ratios were obtained from log linear models for the numbers of incident cases in the pooled regional registries offset by the numbers of deaths in the same registries and terms for sex and age (recoded to the range −5 to 5, centred on age group 50–54 years). The statistical package GLIM4 was used [24]. The terms for sex and the polynomials of age up to the fifth degree were introduced on the basis of statistically significant changes in the goodness-of-fit of the models. Successive polynomial terms for age were included until two consecutive terms failed to provide a significantly improved fit to the data, or the maximum of five was reached. In general, this approach worked well, but practical problems were encountered when trying to fit models for cancer sites for which incident cases were associated with few deaths, notably testis, thyroid and Hodgkin's disease. In these circumstances, 'all EU' models were fitted using pooled data from the Southern and Western European regions and the addition of data from the national cancer registries of Denmark, Finland, The Netherlands, Sweden and the U.K.

The national incidence estimates for 1990 were then obtained by applying the appropriate regression parameters to the average annual numbers of deaths in 1988–1992 in France, Germany, Greece, Luxembourg, Portugal and Spain. For Italy, 1989–1991 deaths were used for this purpose and, for Belgium, only 1986–1987 deaths were available. Some further practical difficulties were encountered when this procedure was applied to Belgium and Luxembourg, for which the annual average numbers of deaths were sparse for some sites. The age-specific average numbers of deaths were smoothed by applying the age-specific proportions of deaths in France and Germany (population weighted) to the total numbers of deaths from stomach, liver, testis, bladder, thyroid, Hodgkin's disease and NHL in Belgium and for all cancer sites in Luxembourg.

Finally, in order to provide estimates for the five year age groups within the ranges 0–14 and 15–34 years, the estimated numbers of incident cases in these ranges were allocated to the age groups 0–4, 5–9, 10–14, 15–19, 20–24, 25–29 and 30–34 according to the site-specific proportions in the pooled data for the Southern and Western European registries and the registries of Denmark, Finland, The Netherlands, Sweden and the U.K.

Table 1. Registry data used in the prediction models for countries in Western and Southern Europe and all EU models

Western Europe	Southern Europe	All EU
Calvados (France)	Florence (Italy)	W. Europe data
Doubs (France)	Vicenza (Italy)	S. Europe data
Haut-Rhin (France)	Romagna (Italy)	Denmark
Herault (France)	Turin (Italy)	Finland
Isére (France)	Genoa (Italy)	Netherlands
Tarn (France)	Asurias (Spain)	Sweden
Hamburg (Germany)	Granada (Spain)	U.K.
North Netherlands	Navarra (Spain)	Austria
South Netherlands	Coimbra (Portugal)	
Tyrol (Austria)		

As in previous studies [5, 6], we made adjustments to the data for uterine cancer presented in this paper. In some countries in Europe, the numbers of deaths attributed to cervical cancer (ICD-9 180) and uterine corpus cancer (182) are understated by the allocation of large numbers of deaths to the ICD-9 category 'uterine cancer not otherwise specified' (179). We re-allocated such deaths in the registry and national mortality data to cervix and uterine corpus cancer according to the proportions specified as 180 and 182 in Southern, Western and Northern (all other) European countries. Although this is less of a problem in cancer registry data, we sought to achieve consistency in the data presented, whether previously published or estimated, by re-allocating incident cases assigned to the rubric 179 to 180 and 182 according to the proportions pertaining in the pooled registries in Southern, Western and Northern Europe. For Denmark, data for code 182.9 of the ICD-8 classification were available. This is equivalent to ICD-9 code 179 so that the same re-allocation procedure could be used.

Results are presented as numbers of incident cases and deaths, rates standardised to the World and European Standard Populations, and cumulative rates [20] (Tables 2–25). For each site of cancer, barcharts are also shown in which the 15 European Union countries are ranked according to the age standardised rate (World Standard) (Figures 2–25).

RESULTS

It is estimated that there were 706 870 new cases of cancer (excluding non-melanoma skin cancer) in men and 644 213 in women in the European Union in 1990. Approximately 497 500 men and 398 200 women died of cancer in the same year. The main sites of incident cases in men were lung (21%), large bowel (13%), prostate (12%), bladder (7%) and stomach (7%) (Figure 1). For women, the predominant sites were breast (28%), large bowel (15%), lung (6%), uterine corpus (5%) and stomach (5%).

All cancers (excluding non-melanoma skin cancer (Figure 2a, Table 2)

The all cancer age standardised incidence rates (World Standard) for men were highest in France, The Netherlands, Austria, Luxembourg and Belgium, while the lowest rates were those of Greece and Portugal. For women, the highest rates were in Denmark, Sweden, The Netherlands, Ireland, U.K. and Austria, with the lowest rates in Greece, Spain and Portugal. These countries tended also to have the highest or lowest cancer mortality rates, but notable exceptions in men were the highest mortality, which was recorded (in 1987) in Belgium, and the lowest, which was Sweden. These differences in the rankings of incidence and mortality are due to the relative importance of lung cancer, which is of poor prognosis (26% of incidence in men in Belgium and 10% in Sweden). In the European Union as a whole, risk of cancer was 42% higher in men than in women, but this male excess ranged from 5% in Denmark to 80% in France.

Lip, oral cavity, pharynx (Figure 2b, Table 3)

There were wide variations in the estimated incidence of this group of tumours in men in European Union countries: the rate for France was almost seven times greater than that for Greece. In contrast, there was much less variation among females, for whom the risk is substantially lower, even in countries where men are at high risk. Tobacco smoking and alcohol consumption are the main risk factors for oral and pharyngeal cancer [25]. Tobacco chewing is also an important risk factor, although currently this is not a common habit in European countries. The different geographical pattern of lung cancer compared with oral and pharyngeal cancer in Europe suggests that alcohol has a strong modifying effect on risk due to tobacco smoking. It

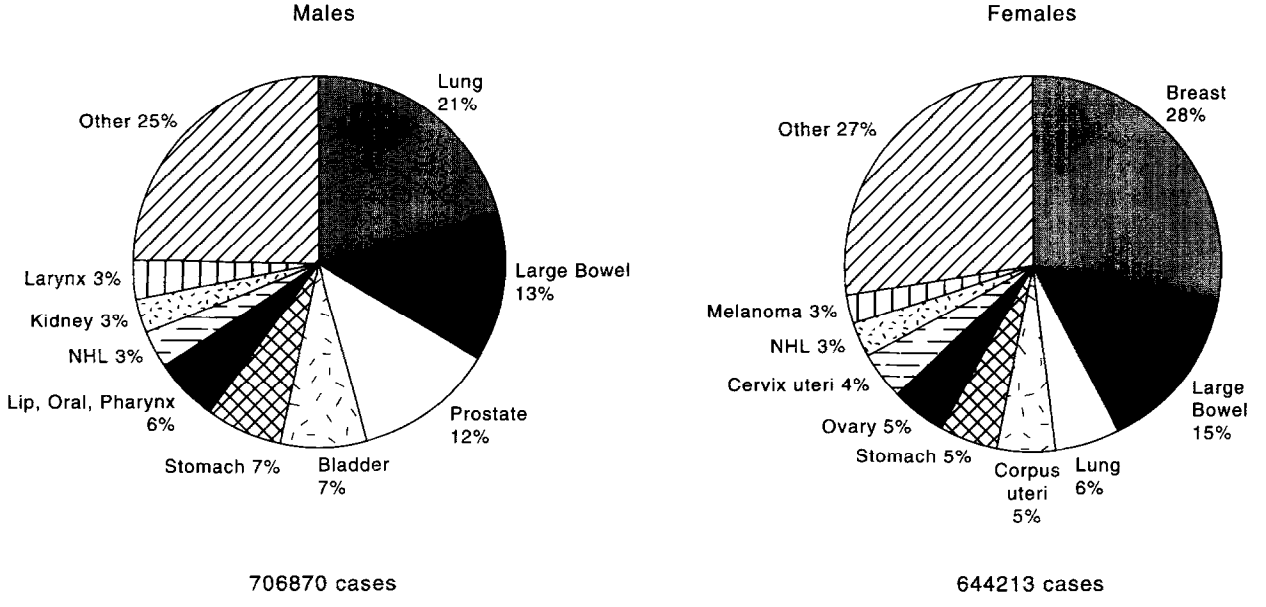

Figure 1. Estimated percentage frequencies of incident cases of major cancers in males and females in European Union countries in 1990.

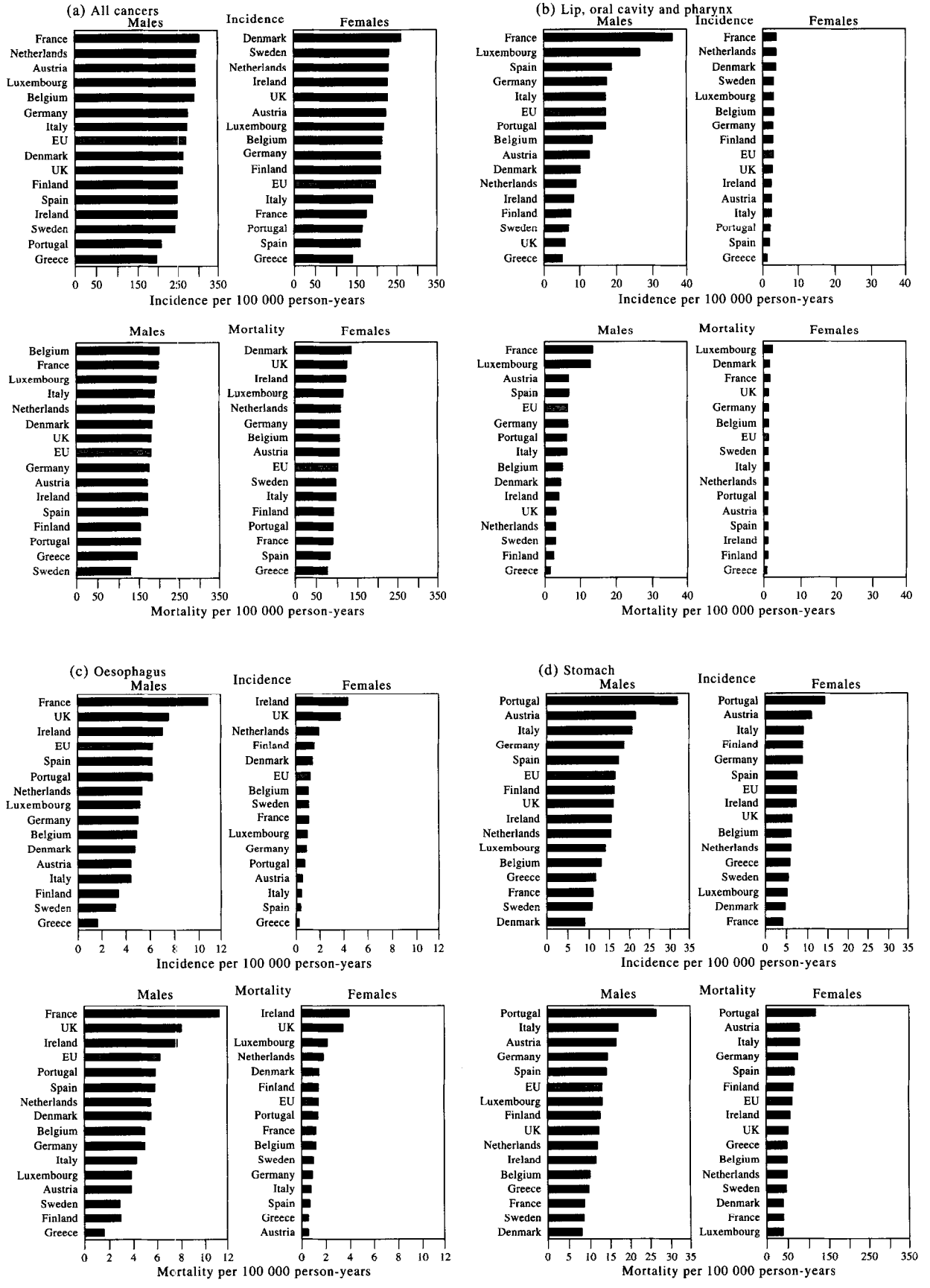

Figure 2. Estimated incidence and mortality in 1990 (a) all cancers (excluding non-melanoma skin carcinoma); (b) cancer of the lip, oral cavity and pharynx; (c) the oesophagus; and (d) the stomach.

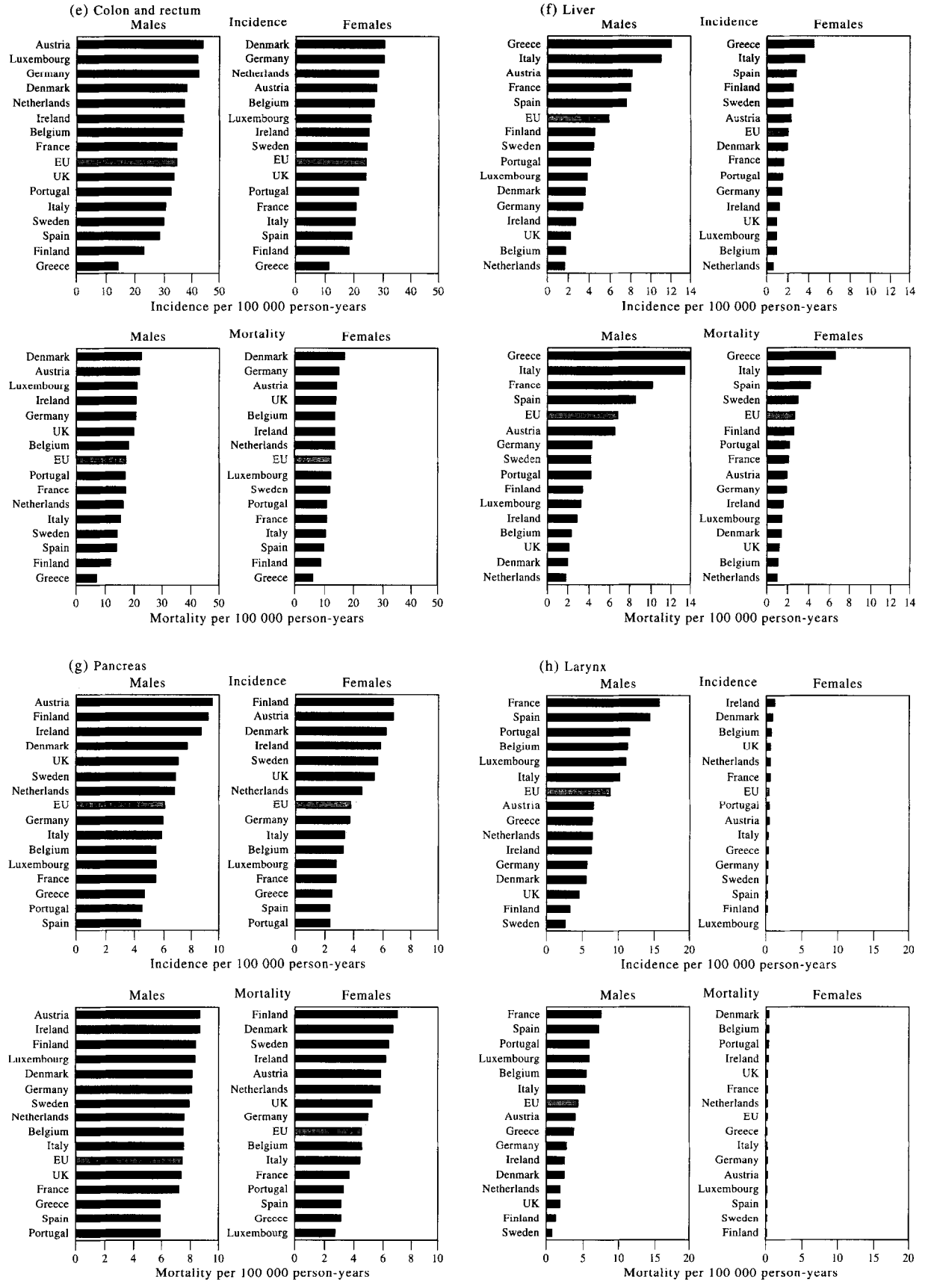

Figure 2. (continued) (e) the colon and rectum; (f) the liver; (g) the pancrease; and (h) the larynx.

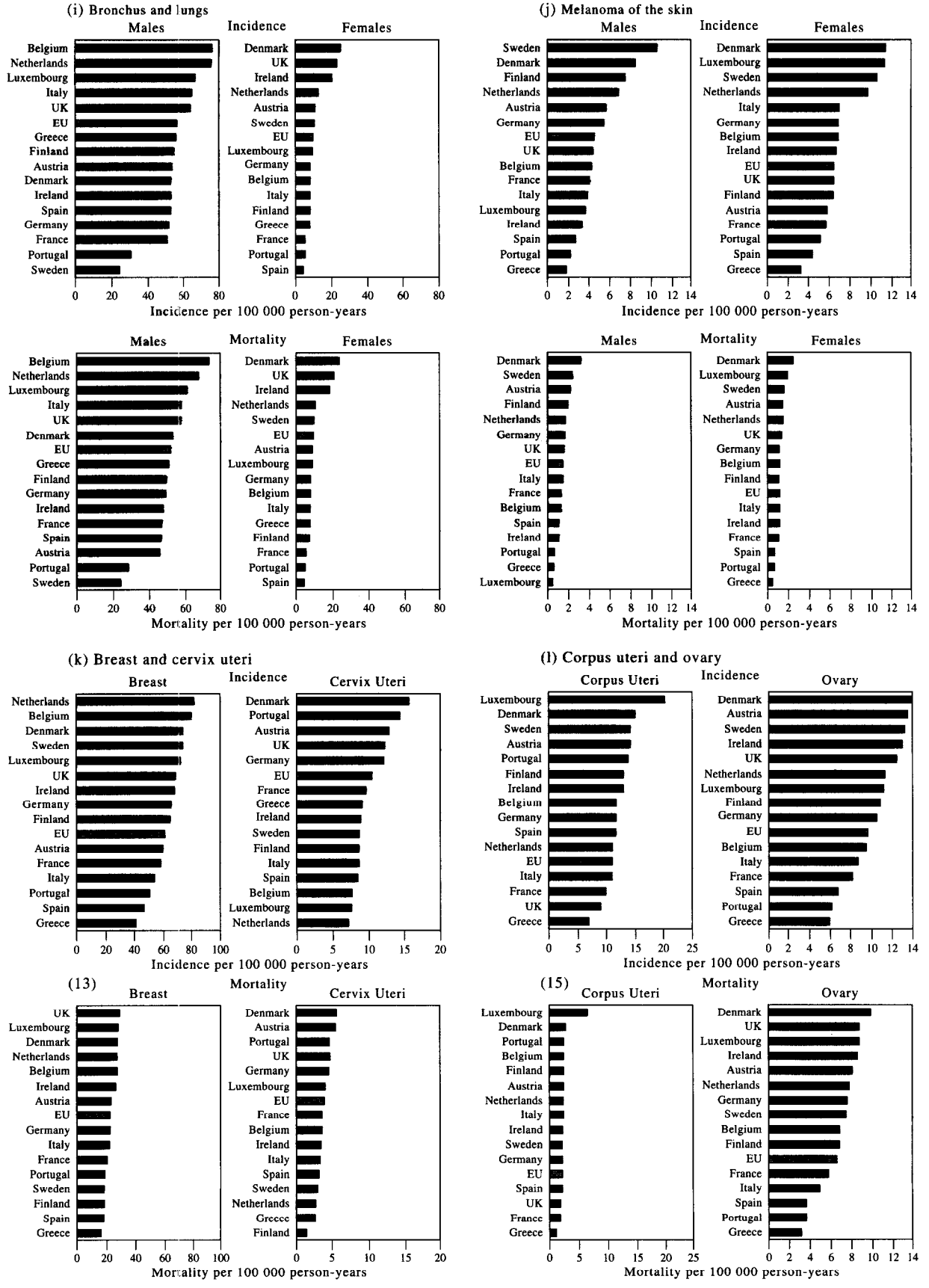

Figure 2. (continued) (i) the bronchus and lung; (j) melanoma of the skin; (k) breast and cervix uteri; and (l) corpus uteri and ovary.

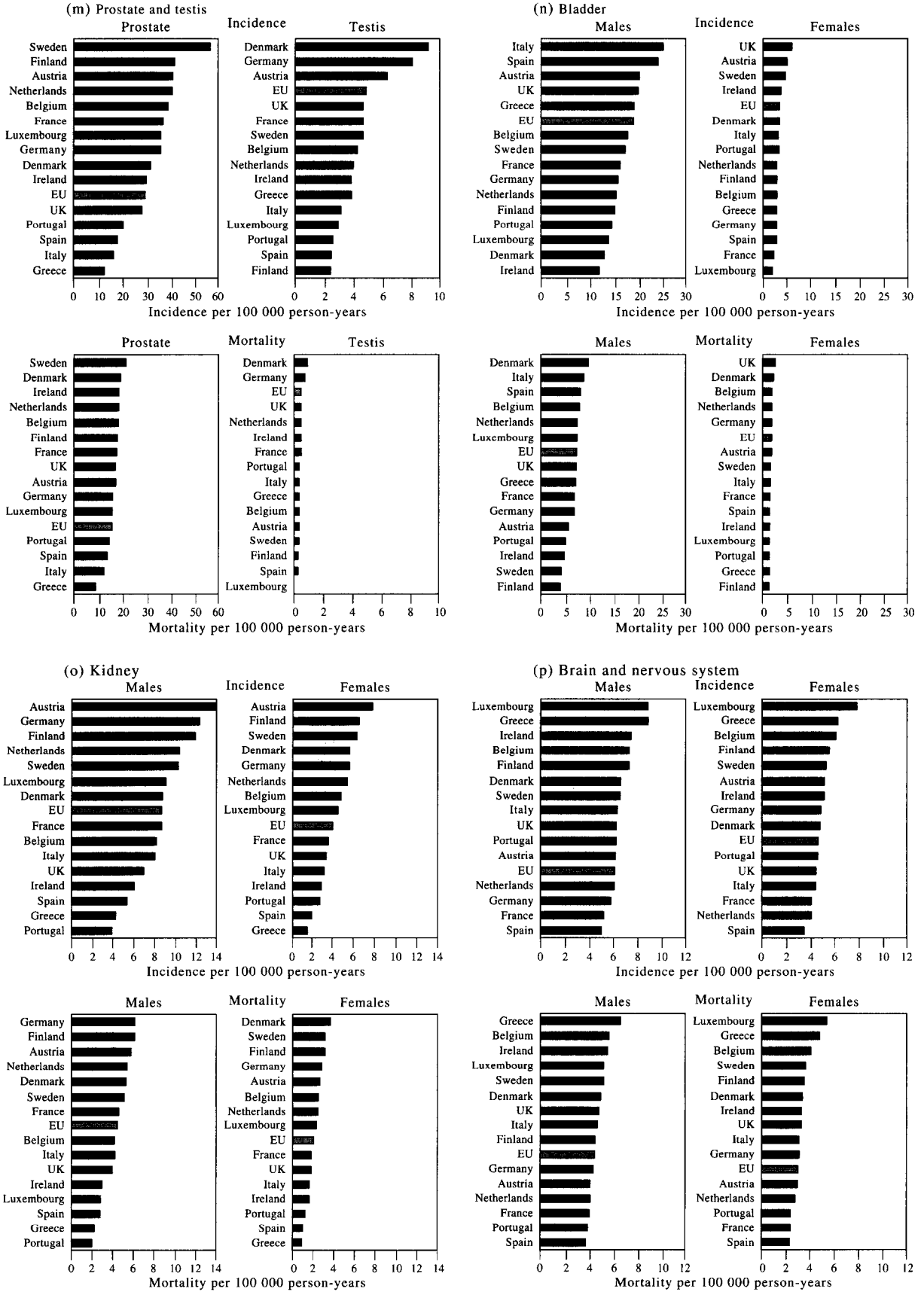

Figure 2. (continued) (m) prostate and testis; (n) bladder; (o) kidney; and (p) brain and nervous system.

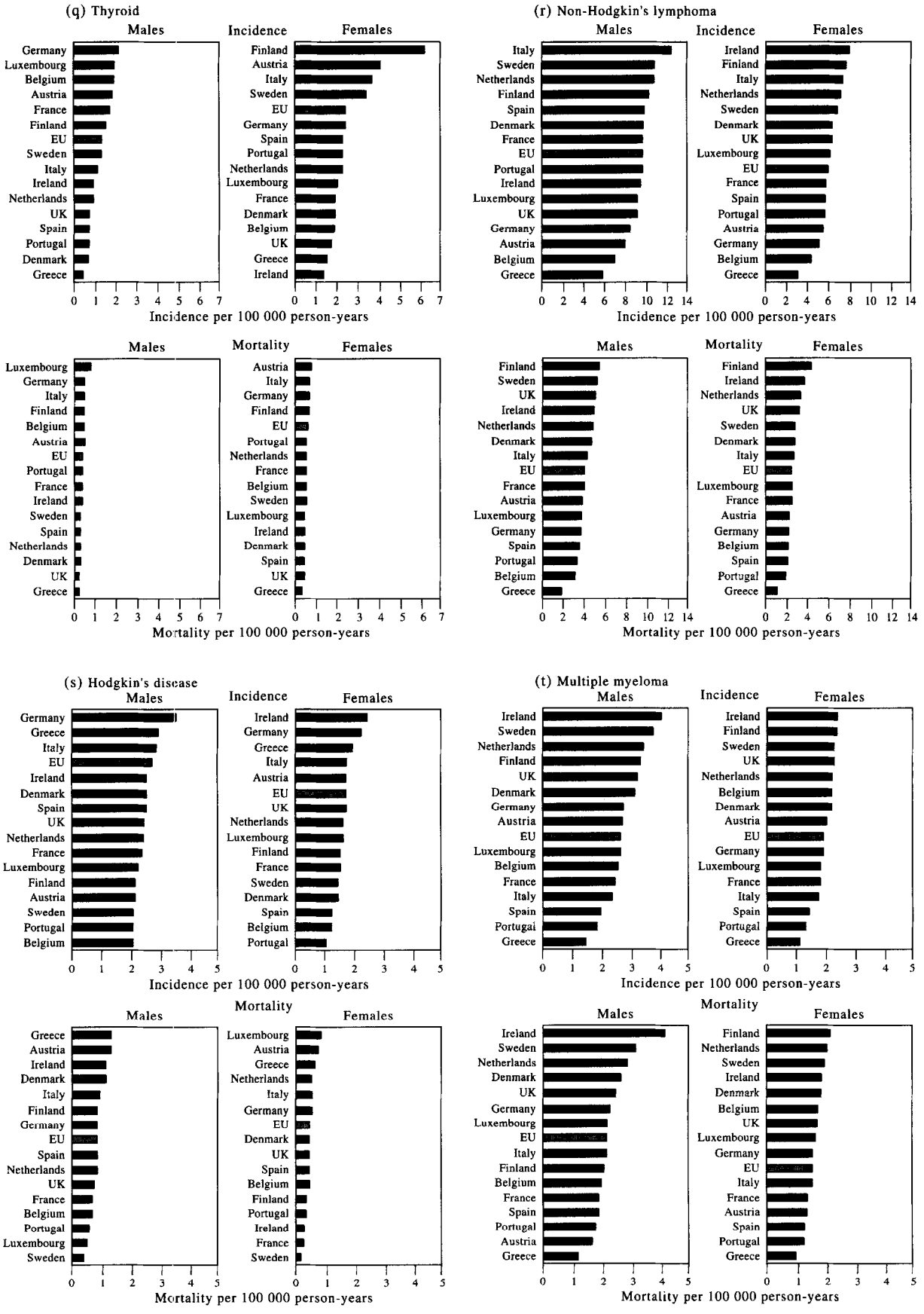

Figure 2. (continued) (q) thyroid; (r) Non-Hodgkin's lymphoma; (s) Hodgkin's disease; and (t) myeloma.

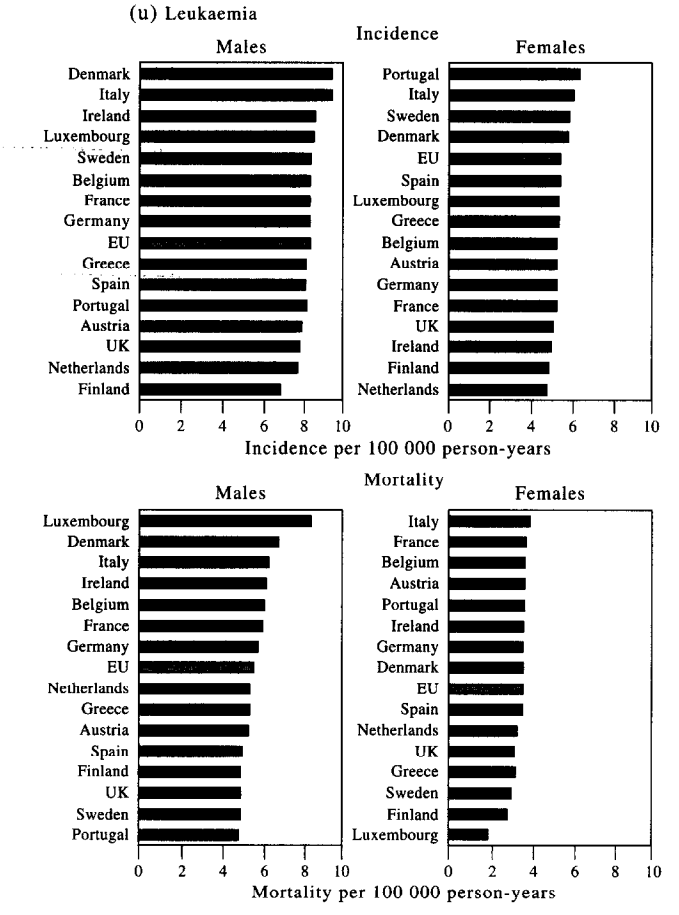

Figure 2. (continued) (u) leukaemia.

Table 2. Estimated incidence and recorded mortality from all cancers (except non-melanoma skin cancer) in European Union countries in 1990, by sex

	No./Year	ASR (W)†	ASR (E)‡	CR*	No./Year	ASR (W)†	ASR (E)‡	CR*
		Males, incidence 1990				Females, incidence 1990		
Austria	15 579	291.4	427.3	34.4	16 956	222.3	314.3	25.1
Belgium	21 333	288.8	422.8	33.9	18 954	211.2	296.7	23.6
Denmark	10 378	258.8	375.7	30.4	11 569	257.7	357.2	29.6
Finland	8046	248.4	367.9	29.0	9059	208.4	289.2	22.7
France	120 582	302.4	435.2	35.4	86 431	172.4	241.5	19.0
Germany	151 813	274.3	396.4	32.3	163 771	208.8	292.7	23.5
Greece	15 095	195.2	278.6	23.1	11 479	139.4	188.9	15.4
Ireland	5430	247.8	369.7	28.5	5380	225.7	317.2	25.0
Italy	115 114	270.9	389.1	32.4	95 363	187.4	259.0	20.7
Luxembourg	770	290.9	424.6	34.2	737	216.8	305.9	24.6
Netherlands	29 180	291.9	429.7	34.7	26 699	227.9	315.8	25.7
Portugal	13 243	207.6	294.2	24.3	12 210	163.7	220.2	17.8
Spain	65 676	248.1	354.1	28.9	47 921	156.6	214.5	17.0
Sweden	18 704	241.3	356.2	28.2	18 437	229.1	318.0	26.0
U.K.	115 927	257.1	381.8	29.8	119 247	224.9	315.7	25.4
EU	706 870	268.4	389.3	31.5	644 213	196.4	273.9	21.9
		Males, mortality 1990				Females, mortality 1990		
Austria	9607	169.8	259.1	19.0	9619	105.8	158.8	11.2
Belgium	15 658	200.3	307.6	22.4	11 585	107.0	159.9	11.5
Denmark	7721	180.0	273.6	20.8	7139	136.5	200.3	15.7
Finland	5024	150.4	231.4	17.3	4749	91.4	136.2	10.0
France	83 994	197.3	296.3	22.2	53 558	87.3	130.6	9.2
Germany	102 691	174.7	266.1	19.5	102 021	107.1	159.9	11.7
Greece	1 985	143.2	215.1	16.7	7351	75.6	110.1	8.4
Ireland	3805	168.6	259.1	19.0	3227	120.9	179.1	13.5
Italy	84 970	188.3	283.0	22.2	59 600	96.9	144.2	10.5
Luxembourg	527	192.9	292.4	22.6	441	114.1	168.6	12.6
Netherlands	19 829	188.2	292.1	21.1	15 270	109.1	162.7	11.8
Portugal	10 200	150.4	223.7	17.2	7863	88.0	127.8	9.6
Spain	46 946	166.9	250.3	19.1	29 320	79.5	117.4	8.6
Sweden	10 654	127.4	196.4	14.2	9627	97.5	144.5	10.9
U.K.	83 53	178.3	272.9	20.4	76 878	126.0	185.7	14.4
EU	497 464	178.3	270.3	20.3	398 248	101.5	150.9	11.1

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

has been estimated that dietary factors may cause up to one sixth of cases in European countries [26].

Oesophagus (Figure 2c, Table 4)

Oesophageal cancer is a disease of very poor prognosis, so one would expect incidence and mortality to be approximately equivalent. In fact, there were slightly fewer incident cases than deaths estimated for Europe. This anomaly can be seen even in data for countries with complete cancer registration, and is probably due to the misclassification of site of cancer on death certificates. Specifically, adenocarcinoma of the lower third of the oesophagus may be misclassified as carcinoma of the cardia, and vice versa. The geographical distribution of oesophageal cancer shares some characteristics with oral and pharyngeal cancer. High incidence rates in men were estimated for France, Spain and Portugal, but also for the U.K. and Ireland. The estimated rates for females in Ireland and the U.K. were exceptionally high. For men in particular, alcohol and tobacco consumption are important risk factors for European populations, but the differences between the geographical pattern for oesophageal cancer compared to others related to these exposures suggest a role for another risk factor [27]. This is most likely to be diet since nutritional deficiency has been shown to cause very high rates of oesophageal cancer in some developing countries. For women, the geographical pattern between countries in Europe, and indeed within them [28], suggests that consumption of tobacco and alcohol cannot be entirely responsible.

Stomach (Figure 2d, Table 5)

Despite the persistent declines in stomach cancer mortality in Europe during recent decades, it remains the fourth most common cause of cancer death. The estimated incidence rates were approximately twice as high in males as in females (sex ratio 2.2). The highest rates were seen in Portugal (31.9), Austria (21.6), Italy (20.7), Germany (18.6) and Spain (17.5). Incidence in Portugal for both males and females was particularly high, at approximately twice the average for the European Union. The main risk factors for stomach cancer are thought to be high salt consumption, a lack of fresh fruit and vegetables in the diet and *Helicobacter pylori* [29]; the prevalence of infection with his organism showed an approximate correlation with incidence and mortality in a multicentre European study [30]. The decline in stomach cancer in developed countries is

Table 3. Estimated incidence and recorded mortality from lip, oral cavity and pharynx cancer in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	591	12.3	16.8	1.4	5.4	160	2.3	3.2	0.3	1.3
Belgium	861	13.1	17.8	1.4	3.7	244	2.8	3.9	0.3	1.3
Denmark	360	9.7	13.8	1.2	3.7	154	3.4	4.7	0.4	1.3
Finland	232	7.2	10.6	0.9	3.2	133	2.6	3.8	0.3	1.7
France	12544	35.1	48.4	4.1	10.0	1630	3.4	4.8	0.4	2.2
Germany	9105	17.1	23.4	1.9	5.9	2103	2.7	3.8	0.3	1.2
Greece	357	4.7	6.7	0.6	2.2	118	1.1	1.7	0.1	1.0
Ireland	166	8.0	11.7	0.9	3.1	61	2.3	3.4	0.3	1.2
Italy	6813	16.7	23.5	2.0	6.0	1281	2.2	3.2	0.2	1.4
Luxembourg	66	26.4	36.6	3.1	8.1	10	2.8	4.1	0.3	2.0
Netherlands	824	8.7	12.3	1.0	3.0	389	3.4	4.7	0.4	1.6
Portugal	989	16.7	22.9	1.9	7.1	163	1.9	2.7	0.2	1.3
Spain	4561	18.5	25.6	2.1	7.1	628	1.8	2.6	0.2	1.4
Sweden	476	6.6	9.6	0.8	2.6	253	2.9	4.2	0.3	1.3
U.K.	2295	5.7	8.0	0.7	2.0	1360	2.5	3.6	0.3	1.1
EU	40240	16.7	23.1	1.9	5.6	8687	2.6	3.7	0.3	1.4
	Males, mortality 1990					Females, mortality 1990				
Austria	323	6.6	9.1	0.8	3.3	75	0.8	1.3	0.1	0.8
Belgium	330	4.9	6.8	0.5	2.1	99	1.1	1.5	0.1	0.9
Denmark	161	4.2	6.1	0.5	2.1	72	1.4	2.0	0.1	1.0
Finland	69	2.2	3.2	0.2	1.4	36	0.6	0.9	0.0	0.8
France	4865	13.3	18.6	1.6	5.8	672	1.3	1.9	0.1	1.3
Germany	3408	6.3	8.7	0.7	3.3	833	1.1	1.5	0.1	0.8
Greece	114	1.4	2.1	0.2	0.9	62	0.5	0.8	0.1	0.8
Ireland	82	3.8	5.7	0.5	2.1	23	0.7	1.1	0.1	0.7
Italy	2454	5.9	8.4	0.7	2.9	595	1.0	1.5	0.1	1.0
Luxembourg	31	12.4	17.3	1.4	5.9	7	2.1	2.9	0.2	1.6
Netherlands	264	2.8	3.9	0.3	1.3	124	1.0	1.4	0.1	0.8
Portugal	366	6.1	8.4	0.7	3.6	83	0.9	1.3	0.1	1.0
Spain	1612	6.4	9.0	0.8	3.4	288	0.8	1.2	0.1	1.0
Sweden	187	2.7	3.8	0.3	1.8	115	1.0	1.5	0.1	1.2
U.K.	1201	2.9	4.1	0.3	1.4	731	1.1	1.7	0.1	0.9
EU	15467	6.3	8.8	0.7	3.1	3815	1.0	1.5	0.1	1.0

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

thought to be due to improved methods of food preservation such as refrigeration (which both reduces the need for salting as a means of preservation and increases the general availability of fresh foods), and to a progressive decline in the prevalence of *H. pylori* in successive generations [31].

Colon and rectum (Figure 2e, Table 6)

Incidence data from cancer registries are available separately for cancers of the colon and rectum. However, deaths from these cancers are often certified as 'large bowel cancer', without further specification. Therefore, in order to retain comparability between incidence and mortality in this study, the data were combined. Colorectal cancer was the second most common cancer both in males, after lung cancer, and females, after breast cancer. There is less geographical variation in colorectal compared with stomach cancer. The highest estimated incidence rates were in Western Europe with comparatively lower rates in Southern and, excepting Denmark, Northern European countries. Risk factors for colorectal cancer are not clearly understood, but high consumption of animal fats and low consumption of dietary fibre and fresh fruit and vegetables seem to increase risk [32]. The sex ratio is close to unity, but in persons aged less than 55 years the risk for females exceeds that for males, suggesting an endocrine influence in premenopausal women [33]. In postmenopausal women, there is evidence of reduced risk for woman receiving hormone replacement therapy [34].

Liver (Figure 2f, Table 7)

The results presented for liver cancer include cancers which are unspecified as primary or secondary. Although this is rare in cancer registry (incidence) data, the proportion of deaths certified as liver cancer without specification varies between countries, so that interpretation of the geographical differences in liver cancer mortality in Europe is extremely difficult. Similarly, incidence rates estimated from mortality attributed to liver cancer are not reliable and should be treated with caution. Hepatitis B and C infection and alcohol consumption are the most important risk factors for liver cancer in European populations. Chronic infection with hepatitis B is most prevalent in Southern European countries [35], which is consistent with the high rates observed in this region.

Table 4. Estimated incidence and recorded mortality from oesophagus cancer in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)‡	CR* (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	217	4.3	6.2	0.5	1.4	46	0.5	0.7	0.1	0.2
Belgium	344	4.8	6.9	0.5	1.6	113	1.0	1.6	0.1	0.6
Denmark	186	4.7	6.9	0.6	1.9	76	1.3	2.0	0.2	0.5
Finland	108	3.3	5.0	0.4	1.6	95	1.5	2.5	0.2	0.9
France	4101	10.8	15.4	1.3	3.4	602	1.0	1.5	0.1	0.6
Germany	2698	4.9	7.0	0.6	1.8	733	0.8	1.2	0.1	0.4
Greece	120	1.5	2.2	0.2	0.7	26	0.2	0.3	0.0	0.2
Ireland	150	7.0	10.4	0.9	2.8	126	4.3	6.7	0.5	2.3
Italy	1788	4.3	6.1	0.5	1.6	244	0.4	0.6	0.0	0.2
Luxembourg	13	5.1	7.2	0.6	1.7	4	0.9	1.4	0.1	0.6
Netherlands	514	5.2	7.7	0.7	1.8	272	1.9	2.9	0.2	1.1
Portugal	373	6.1	8.5	0.7	2.7	63	0.7	1.0	0.1	0.4
Spain	1520	6.1	8.5	0.7	2.4	127	0.3	0.5	0.0	0.2
Sweden	231	3.0	4.5	0.4	1.2	107	1.0	1.5	0.1	0.5
U.K.	3380	7.5	11.3	0.9	2.9	2574	3.7	5.8	0.4	2.2
EU	15 743	6.1	8.8	0.7	2.1	5208	1.2	1.9	0.1	0.8
	Males, mortality 1990					Females, mortality 1990				
Austria	191	3.7	5.3	0.5	2.0	44	0.4	0.7	0.0	0.5
Belgium	358	4.9	7.2	0.5	2.3	124	1.1	1.7	0.1	1.1
Denmark	211	5.4	7.8	0.7	2.7	74	1.4	2.1	0.2	1.0
Finland	91	2.8	4.2	0.4	1.8	84	1.3	2.1	0.1	1.8
France	4311	11.1	16.0	1.4	5.1	705	1.1	1.7	0.1	1.3
Germany	2710	4.9	7.0	0.6	2.6	745	0.8	1.2	0.1	0.7
Greece	132	1.5	2.3	0.2	1.1	50	0.4	0.7	0.0	0.7
Ireland	162	7.5	11.3	0.8	4.2	124	3.9	6.2	0.4	3.8
Italy	1801	4.2	6.1	0.5	2.1	457	0.7	1.0	0.1	0.8
Luxembourg	10	3.7	5.5	0.4	1.9	7	2.1	3.0	0.2	1.6
Netherlands	547	5.4	8.2	0.7	2.8	286	1.8	2.8	0.2	1.9
Portugal	373	5.8	8.4	0.7	3.6	134	1.3	2.0	0.1	1.7
Spain	1494	5.7	8.2	0.7	3.2	267	0.6	1.0	0.1	0.9
Sweden	222	2.8	4.3	0.3	2.1	108	0.9	1.4	0.1	1.1
U.K.	3564	7.9	11.8	1.0	4.2	2429	3.4	5.3	0.4	3.2
EU	16 177	6.2	9.0	0.7	3.2	5638	1.3	2.0	0.1	1.4

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Pancreas (Figure 2g, Table 8)

Pancreatic cancer is associated with very poor survival, so that incidence and mortality rates are generally very similar. In common with oesophageal cancer, there were more estimated incident cases than deaths in the European Union as a whole. This is likely to be due to misclassification of cancer deaths in death certificates. Improving diagnostic techniques mean that incidence data from cancer registries provide a more accurate picture of the patterns of risk in Europe. The highest rates were in Northern and Western Europe for both males and females. Smoking is a risk factor for pancreatic cancer, accounting for approximately 20% of cases [36], but dietary factors may also play a role [37].

Larynx (Figure 2h, Table 9)

There were large-scale variations in laryngeal cancer incidence between European Union countries, ranging from 15.6 for males in France to 2.5 for males in Sweden. In general, the highest rates were in Western and Southern Europe. The incidence in females was much lower, with a sex ratio of 16.5. In contrast to males, the high risk areas for females were Ireland (1.3), Denmark (1.0), Belgium (0.9) and the U.K. (0.8). Tobacco and alcohol are the main risk factors for laryngeal cancer. These have independent carcinogenic effects, but act multiplicatively [38], which is why the geographical patterns of laryngeal and lung cancer do not coincide. Use of black rather than blonde tobacco confers a 2-fold higher risk, which may be relevant to the high rates seen in Southern European countries where the use of black tobacco is common [39]. Diet may also play a role.

Lung (Figure 2i, Table 10)

In 1990, lung cancer was the most frequent malignancy in European Union populations. There were 146 305 new cases among men (20.7% of all male cancer) and 36 093 among women (5.6%). The highest rates for males were in Belgium, The Netherlands, Luxembourg, Italy and the U.K. The rate for males in Belgium (75.2) was some three times greater than for males in Sweden (23.9). Overall, the sex ratio was 5.4, but this varied greatly, between 2.1 in Denmark to 13.0 in Spain. The countries with particularly high female rates of lung cancer were Denmark (25.2), the U.K. (23.5) and Ireland (20.2). The geographical variations in lung cancer risk are due to the patterns of

Table 5. Estimated incidence and recorded mortality from stomach cancer in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	1223	21.6	33.2	25.	8.6	1128	11.3	17.6	1.2	6.1
Belgium	1002	12.9	19.8	1.5	4.6	722	6.2	9.5	0.6	3.9
Denmark	375	8.9	13.5	1.0	3.8	264	4.6	7.0	0.5	2.5
Finland	544	6.3	25.0	1.9	7.3	491	9.0	13.8	1.0	5.4
France	4824	10.3	16.8	1.2	4.1	2914	4.0	6.4	0.4	3.4
Germany	10 920	18.6	28.4	2.1	7.5	9138	9.0	13.7	0.9	5.6
Greece	945	11.7	17.3	1.4	5.9	587	5.8	8.7	0.7	4.8
Ireland	350	15.6	23.9	1.9	6.5	222	7.4	11.5	0.8	4.3
Italy	9370	20.7	31.3	2.4	8.2	6186	9.4	14.4	1.0	6.7
Luxembourg	39	13.9	21.4	1.5	5.2	22	5.1	7.9	0.5	3.3
Netherlands	1595	15.5	23.6	1.8	5.5	925	6.1	9.4	0.7	3.5
Portugal	2086	31.9	46.4	3.8	15.0	1335	14.6	21.5	1.6	10.3
Spain	4849	17.5	26.0	2.0	7.5	3026	7.7	11.8	0.8	6.5
Sweden	894	10.6	16.5	1.2	4.6	575	5.3	8.1	0.6	2.9
U.K.	7545	16.0	24.6	1.9	6.5	4808	6.4	10.2	0.7	4.0
EU	46 561	16.7	25.4	1.9	6.2	32 343	7.5	11.6	0.8	4.7
	Males, mortality 1990					Females, mortality 1990				
Austria	973	16.5	36.0	1.8	10.1	864	8.0	12.8	0.8	8.9
Belgium	819	9.9	15.9	1.0	5.2	674	4.8	7.9	0.4	5.8
Denmark	340	7.6	11.9	0.8	4.4	240	3.9	6.0	0.4	3.4
Finland	422	12.5	19.4	1.4	8.4	372	6.5	10.0	0.7	7.8
France	3962	8.6	13.6	0.9	4.7	2836	3.6	5.8	0.3	5.3
Germany	8819	14.5	22.7	1.6	8.6	8466	7.6	12.0	0.8	8.3
Greece	816	9.8	14.7	1.1	6.8	531	4.9	7.5	0.5	7.2
Ireland	264	11.4	17.8	1.4	6.9	182	5.7	9.2	0.6	5.6
Italy	8027	17.0	26.5	1.9	9.4	5757	8.0	12.7	0.8	9.6
Luxembourg	35	13.0	19.4	1.6	6.6	13	3.6	5.2	0.5	2.9
Netherlands	1274	11.8	18.7	1.2	6.4	817	4.8	7.7	0.4	5.3
Portugal	1798	26.2	39.5	3.0	17.5	1212	12.2	18.6	1.3	15.3
Spain	4102	14.2	21.8	1.6	8.7	2786	6.6	10.3	0.7	9.4
Sweden	722	8.4	13.2	0.9	6.8	505	4.5	6.9	0.5	5.2
U.K.	5858	12.2	18.9	1.4	7.0	3950	5.1	8.2	0.5	5.1
EU	38 231	13.2	20.6	1.5	7.7	29 205	6.3	9.9	0.6	7.3

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

tobacco consumption experienced by generations of men and women in different parts of Europe. Tobacco smoking accounts for over 90% of lung cancer cases in men and approximately 50% in women [36, 40]. Very high incidence rates are observed when generations with high exposures coincide with high-risk age groups. For males, the most adverse combinations have already occurred in Denmark, Finland, Sweden and the U.K., and rates will continue to decline in the immediate future. The peaks of incidence for other populations of males, and for all female populations, are yet to be encountered. The majority of the European Union is composed of populations in this latter category: therefore, the estimated incidence of 182 400 new cases in 1990 will be surpassed during the 1990s.

Skin melanoma (Figure 2j, Table 11)

There was a clear geographical pattern in malignant melanoma incidence, with a gradient from low risk in Southern Europe to high risk in the North, particularly in the Nordic countries. This was seen for both males and females. Malignant melanoma of the skin is more common in females than males (sex ratio 0.7). This tumour has a good prognosis with early diagnosis, but comparison of the mortality/incidence ratios for males (0.33) and females (0.17) reveals a difference in survival between the sexes. The hazard ratio may be as large as 2.0. The poorer survival of men might be due to a different anatomical distribution of tumours or a reluctance to seek early medical advice when a skin lesion is noted. It has been shown that exposure to solar ultraviolet light is a major risk factor for malignant melanoma, and at first sight, this seems at odds with the high risks in northern countries and low risk in the south [41]. However, intermittent intense exposure of pale complexioned skin, especially associated with sunburn and the presence of precursor naevi, are more important than sustained moderate level exposures. The geographical pattern probably, therefore, reflects recreational exposure during holiday periods, especially in childhood.

Breast (Figure 2k, Table 12)

Without exception in the 15 countries of the European Union, the breast was the most frequent site of cancer in females. The estimated 178 904 new cases in 1990 represent 28% of all female cancer. Breast cancer was also the most frequent cause of cancer death. There were 73 557 breast cancer deaths (15% of the total due to cancer) in

Table 6. Estimated incidence and recorded mortality from colon and rectum cancer in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	2345	43.1	64.7	5.3	18.1	2507	27.4	41.4	3.2	16.5
Belgium	2770	35.8	54.4	4.2	12.8	2989	26.8	40.5	3.0	16.0
Denmark	1592	37.4	56.9	4.5	15.3	1685	30.2	45.4	3.5	14.8
Finland	752	22.7	34.5	2.7	9.9	945	17.9	26.9	2.0	10.7
France	14 706	34.0	51.5	4.1	12.4	12 996	20.5	31.2	2.3	15.1
Germany	24 024	41.7	62.8	5.0	16.5	29 201	30.1	45.4	3.5	17.8
Greece	1132	13.8	20.6	1.6	7.0	1108	11.3	16.6	1.3	9.1
Ireland	814	36.8	56.3	4.2	15.2	691	24.8	37.8	2.7	13.3
Italy	13 430	30.4	45.1	3.6	11.7	12 073	20.3	30.0	2.3	13.1
Luxembourg	114	41.8	63.0	5.0	14.8	106	25.9	39.2	3.0	15.1
Netherlands	3773	36.9	55.7	4.3	12.7	3908	28.1	41.9	3.3	14.5
Portugal	2117	32.0	46.8	3.9	15.2	1876	21.1	30.8	2.4	14.5
Spain	7770	28.0	41.5	3.3	12.1	6862	19.2	28.2	2.2	14.7
Sweden	2413	29.6	45.2	3.5	12.8	2436	24.1	36.1	2.8	12.6
U.K.	15 383	33.2	50.6	3.9	13.3	15 703	23.6	36.0	2.7	13.2
EU	93 135	33.8	50.9	4.0	12.3	95 086	23.7	35.7	2.7	13.8
	Males, mortality 1990					Females, mortality 1990				
Austria	1285	22.0	34.4	2.4	13.3	1465	14.1	22.3	1.4	15.2
Belgium	1493	18.3	29.1	2.0	9.5	1719	13.6	21.5	1.4	14.8
Denmark	1019	22.6	35.4	2.5	13.2	1055	16.7	26.2	1.8	14.7
Finland	402	11.7	18.5	1.2	8.0	515	8.3	13.3	0.8	10.8
France	7886	16.9	26.8	1.8	9.4	7599	10.4	16.6	1.0	14.1
Germany	12 558	20.5	32.4	2.2	12.2	16 624	14.9	23.6	1.5	16.3
Greece	624	7.0	11.0	0.8	5.2	619	5.5	8.6	0.6	8.4
Ireland	471	20.7	32.4	2.2	12.2	398	13.5	21.0	1.3	12.2
Italy	7255	15.3	23.9	1.7	8.5	6902	10.0	15.6	1.0	11.5
Luxembourg	59	21.2	32.4	2.4	11.2	51	11.9	18.7	1.3	11.5
Netherlands	1772	16.4	26.0	1.8	8.9	2135	13.2	21.0	1.4	13.9
Portugal	1204	17.0	26.2	1.9	11.7	1080	10.6	16.4	1.1	13.6
Spain	4204	14.3	22.2	1.6	8.9	3760	9.2	14.2	1.0	12.7
Sweden	1233	14.3	22.5	1.6	11.5	1299	11.3	17.7	1.2	13.5
U.K.	9573	20.0	31.0	2.3	11.4	9836	13.8	21.4	1.5	12.8
EU	51 038	17.5	27.4	1.9	10.2	55 057	12.1	19.0	1.2	13.8

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

1990. There was a 2-fold variation in national incidence rates, the highest and lowest of which were found in The Netherlands (81.0) and Greece (40.6), respectively. In general, the highest rates were found in Northern and Western regions of Europe and the Nordic countries, with consistently low rates in the Southern European countries of Greece, Italy, Portugal and Spain. This North to South gradient is partly explained by differences between the populations in the prevalence of risk factors for breast cancer: early menarche, late age at first birth, nulliparity, late menopause, height and weight [42, 43], and oral contraceptive use (for early breast cancer) [44]. An association with consumption of fat—particularly animal fat—and other dietary factors is based on correlations between incidence and mortality rates and national food consumption statistics [45], and observations of changes in risk following migration [46]. This association is being evaluated in the EPIC Study [47]. Risk is also associated with hereditary factors and exposure to ionising radiation [42], but these are less likely to have influenced the geographical pattern of incidence in Europe. By 1990, breast screening activity, whether organised or otherwise, would have been established in all 15 countries. Some of the variation in incidence might be due to the early effects of screening in some countries, specifically a temporary increase in incidence (as unsuspected cancers are found) which should eventually level out. It is too early to observe the expected effects of screening on mortality at the population level. There have been recent declines in mortality for young women in some countries, and these have been ascribed to improvements in treatment, specifically the introduction of adjuvant anti-oestrogen therapy [48].

Cervix uteri (Figure 2k, Table 12)

The estimated total incidence of cervix cancer was 26 585. After adjustment for deaths attributed to uterus cancer NOS, the total mortality was estimated as 12 817. The highest incidence rate was in Denmark (15.3), which was some 2-fold greater than in The Netherlands (7.1). The main cause of cervical cancer is thought to be sexually transmitted infection with certain types of human papillomavirus (HPV) [49]. There is no systematic information on the prevalence of such infections in Europe, but the variations in incidence are likely to be due to historical patterns of sexual behaviour, including contraceptive use, and the influence of screening activities [50]. Cervical cancer screen-

Table 7. Estimated incidence and recorded mortality from liver cancer in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	424	8.0	11.8	1.0	2.0	224	2.3	3.6	0.3	0.9
Belgium	124	1.7	2.5	0.2	0.6	90	0.8	1.2	0.1	0.5
Denmark	147	3.5	5.3	0.4	1.5	105	1.8	2.7	0.2	0.9
Finland	148	4.4	6.9	0.5	1.6	143	2.5	3.9	0.3	1.1
France	3162	7.9	11.5	1.0	2.7	943	1.6	2.3	0.2	1.1
Germany	1838	3.3	4.8	0.4	1.3	1342	1.4	2.1	0.2	0.8
Greece	961	11.9	17.5	1.5	6.0	449	4.5	6.6	0.5	3.7
Ireland	57	2.6	4.0	0.3	1.1	34	1.2	1.9	0.1	0.6
Italy	4687	10.9	15.7	1.4	4.1	2215	3.6	5.3	0.4	2.4
Luxembourg	10	3.7	5.5	0.4	1.2	4	0.9	1.4	0.1	0.6
Netherlands	145	1.5	2.1	0.2	0.5	78	0.6	0.8	0.1	0.3
Portugal	251	4.0	5.6	0.5	1.8	124	1.5	2.1	0.2	0.9
Spain	2021	7.5	10.7	1.0	3.1	1055	2.8	4.1	0.3	2.3
Sweden	354	4.3	6.6	0.5	2.0	264	2.5	3.7	0.3	1.5
U.K.	880	2.0	3.0	0.2	0.8	566	0.9	1.4	0.1	0.5
EU	15 209	5.8	8.4	0.7	2.0	7636	2.0	2.9	0.2	1.1
	Males, mortality 1990					Females, mortality 1990				
Austria	357	6.5	9.7	0.8	3.7	196	1.9	3.0	0.2	2.0
Belgium	164	2.2	3.2	0.3	1.0	126	1.0	1.6	0.1	1.1
Denmark	85	1.9	3.0	0.2	1.1	63	1.3	1.8	0.1	0.9
Finland	111	3.3	5.1	0.4	2.2	130	2.5	3.7	0.3	2.7
France	4143	10.1	14.8	1.3	4.9	1267	2.0	3.0	0.2	2.4
Germany	2431	4.3	6.4	0.5	2.4	1791	1.8	2.7	0.8	1.8
Greece	1198	13.8	21.3	1.6	10.0	734	6.6	10.2	0.2	9.9
Ireland	64	2.8	4.3	0.3	1.7	48	1.6	2.5	0.6	1.5
Italy	5893	13.2	19.7	1.7	6.9	3464	5.1	7.9	0.1	5.8
Luxembourg	9	3.2	4.9	0.4	1.7	6	1.4	2.1	0.1	1.4
Netherlands	169	1.7	2.5	0.2	0.9	130	0.9	1.3	0.2	0.8
Portugal	265	4.1	5.9	0.5	2.6	188	2.1	3.0	0.	2.4
Spain	2409	8.5	12.8	1.1	5.1	1706	4.2	6.4	0.5	5.8
Sweden	343	4.1	6.3	0.5	3.2	313	3.0	4.5	0.3	3.2
U.K.	952	2.1	3.1	0.3	1.1	672	1.1	1.7	0.1	0.9
EU	18 593	6.8	10.2	0.9	3.7	10 834	2.6	3.9	0.3	2.7

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

ing is widespread in all EU countries. It has probably prevented quite large rises in incidence in some countries, and resulted in marked decreases in others—particularly in the age range 35–54 years [51–53]. The denominator for uterine cervical cancer should exclude women who have had a hysterectomy, but appropriate data are not available for all European countries. It is unlikely that this would have a large effect on rates for cancer at this site.

Corpus uteri (Figure 2l, Table 13)

As for cervical cancer, the incidence estimates for corpus uteri cancer were based on adjusted mortality data. The estimated numbers of new cases and deaths were, respectively, 33 043 and 8810. The highest estimated incidence was in Luxembourg, but this figure should be interpreted with caution since it is based on only 26 deaths. Elsewhere, the range of estimated incidence rates was from 6.7 in Greece to 14.8 in Denmark. The main risk factors for corpus uteri cancer are obesity [54] and unopposed hormone replacement therapy with oestrogens [55]. Use of oral contraceptives has a protective effect [56]. As with cervical cancer, rates for population denominators for rates of corpus uteri cancer should exclude women who have had a hysterectomy. This is more of a problem for corpus uteri cancer, which has an older age distribution, and may have led to an underestimate of up to approximately 10% for some European countries.

Ovary (Figure 2l, Table 13)

There were approximately 29 353 new cases of ovarian cancer in the European Union in 1990, and 22 166 deaths. Ovarian cancer was the fifth most common cause of cancer death. The highest incidence rate was in Denmark (13.8). This was some 2-fold higher than the lowest rate, which was in Greece (5.9). In general, incidence was lower in the Southern European countries and France than in the remainder of the European Union. The causes of ovarian cancer are still poorly understood, but high parity (large family size) confers a protective effect [57]. Oral contraceptive use has also been reported to be protective [58]. These factors have been studied in relation to temporal trends in ovarian cancer in some countries [59, 60] and may account for some of the geographical variations in Europe.

Table 8. Estimated incidence and recorded mortality from pancreatic cancer in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	518	9.5	14.3	1.2	2.6	652	6.8	10.5	0.8	2.8
Belgium	421	5.5	8.4	0.6	1.9	405	3.3	5.2	0.4	2.2
Denmark	320	7.7	11.5	0.9	3.1	360	6.3	9.5	0.8	3.2
Finland	304	9.2	14.0	1.1	3.6	389	6.8	10.6	0.8	4.5
France	2305	5.5	8.2	0.7	1.9	1927	2.8	4.4	0.3	2.2
Germany	3436	6.0	9.0	0.7	2.4	3925	3.8	5.9	0.4	2.4
Greece	377	4.7	6.9	0.6	2.4	262	2.5	3.8	0.3	2.1
Ireland	194	8.7	13.3	1.0	3.6	172	5.9	9.1	0.7	3.3
Italy	2566	5.9	8.7	0.7	2.2	2225	3.4	5.2	0.4	2.4
Luxembourg	15	5.5	8.3	0.6	2.0	13	2.8	4.5	0.3	2.0
Netherlands	686	6.8	10.2	0.8	2.3	657	4.6	7.0	0.5	2.4
Portugal	299	4.5	6.7	0.5	2.2	238	2.4	3.7	0.3	1.8
Spain	1194	4.4	6.5	0.5	1.9	954	2.4	3.7	0.3	2.0
Sweden	548	6.9	10.4	0.9	2.9	605	5.7	8.7	0.7	3.2
U.K.	3330	7.1	10.9	0.8	2.9	3678	5.5	8.4	0.6	3.1
EU	16513	6.1	9.1	0.7	2.2	16462	3.9	6.0	0.4	2.4
	Males, mortality 1990					Females, mortality 1990				
Austria	485	8.7	13.2	1.0	5.0	602	5.9	9.2	0.6	6.2
Belgium	581	7.5	11.5	0.9	3.7	570	4.6	7.2	0.5	4.9
Denmark	349	8.2	12.5	1.0	4.5	396	6.8	10.4	0.8	5.5
Finland	278	8.4	12.8	1.0	5.5	409	7.1	11.1	0.8	8.6
France	3090	7.2	10.9	0.8	3.7	2647	3.7	5.9	0.4	4.9
Germany	4651	8.1	12.2	1.0	4.5	5330	5.0	7.8	0.6	5.2
Greece	493	5.8	8.9	0.7	4.1	343	3.1	4.8	0.4	4.6
Ireland	188	8.7	13.0	1.0	4.9	183	6.3	9.6	0.7	5.6
Italy	3368	7.5	11.3	0.9	4.0	3041	4.4	6.9	0.5	5.1
Luxembourg	22	8.4	12.2	1.0	4.2	15	2.7	4.5	0.2	3.4
Netherlands	795	7.6	11.7	0.9	4.0	890	5.9	9.1	0.6	5.8
Portugal	395	5.8	8.7	0.7	3.9	328	3.2	5.0	0.4	4.1
Spain	1622	5.8	8.7	0.7	3.4	1326	3.1	4.9	0.3	4.5
Sweden	646	7.9	12.1	1.0	6.0	736	6.5	10.1	0.7	7.6
U.K.	3375	7.3	11.1	0.9	4.0	3579	5.3	8.1	0.6	4.6
EU	20338	7.4	11.1	0.9	4.1	20395	4.6	7.2	0.5	5.1

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Prostate (Figure 2m, Table 14)

The highest rates of prostate cancer incidence in the European Union were those for Sweden (55.3), which were approximately twice as high as in the U.K. and five times higher than in Greece. There were 86925 new cases in the European Union as a whole in 1990. Greater variation in incidence rates than in mortality rates is apparent, reflecting different practices towards the investigation and treatment of prostatic disease in European countries. The recorded incidence of prostate cancer is likely to be increased by the use of transurethral prostatectomy for benign prostatic hyperplasia, and prostate-specific antigen testing followed by ultrasonographically guided needle biopsy [61]. These are capable of revealing asymptomatic tumours which otherwise may not have become manifest during life. Therefore, the differences in incidence rates between European countries may be more the result of different use of these medical procedures rather than variations in exposure to risk factors or genetic predisposition (which is clearly important in determining differences in risks between ethnic groups). The aetiology of prostate cancer is unclear [61], but the possible role of dietary fat consumption is consistent with the South to North gradient in both incidence and mortality in Europe. Physical exercise, which appears to have a protective effect [62], may have been greater in more agricultural Southern European countries for the generations of men now in high-risk age groups.

Testis (Figure 2m, Table 14)

There was greater than 4-fold variation in testicular cancer incidence in Europe, from 9.0 in Denmark to 2.3 in Finland. With the exception of this low value for Finland, the rates were generally higher in Nordic and Western European countries than in Southern Europe. The 9807 new cases in Europe in 1990 can be compared with the 979 deaths, indicating that approximately 9 in 10 testicular cancer patients now survive the disease. The causes of testicular cancer are not known, however, there is an association with cryptorchidism [63], which seems to be increasing in Europe [64]. The association with cryptorchidism and the occurrence of a peak in the age incidence curve in young

Table 9. Estimated incidence and recorded mortality from larynx cancer in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	317	6.4	8.9	0.8	2.7	34	0.5	0.7	0.1	0.2
Belgium	755	11.2	15.6	1.5	3.5	74	0.9	1.2	0.1	0.4
Denmark	201	5.4	7.7	0.7	2.1	44	1.0	1.5	0.1	0.4
Finland	101	3.2	4.6	0.4	1.4	9	0.2	0.3	0.0	0.1
France	5602	15.6	21.5	2.1	4.7	297	0.7	0.9	0.1	0.3
Germany	2896	5.5	7.7	0.7	2.0	283	0.4	0.5	0.1	0.2
Greece	496	6.3	9.2	0.8	3.1	39	0.4	0.6	0.0	0.3
Ireland	122	6.2	8.8	0.8	2.3	31	1.3	1.9	0.2	0.6
Italy	4204	10.1	14.4	1.3	3.7	238	0.4	0.6	0.1	0.2
Luxembourg	27	10.9	15.0	1.4	3.6	0	0.0	0.0	0.0	0.2
Netherlands	602	6.3	9.1	0.8	2.1	78	0.8	1.1	0.1	0.3
Portugal	695	11.6	16.1	1.4	5.0	43	0.5	0.7	0.1	0.3
Spain	3569	14.3	19.9	1.7	5.5	81	0.2	0.3	0.0	0.2
Sweden	179	2.5	3.6	0.3	0.9	23	0.3	0.5	0.0	0.1
U.K.	1847	4.4	6.4	0.6	1.6	432	0.8	1.2	0.1	0.4
EU	21 613	8.8	12.3	1.1	3.9	1706	0.5	0.8	0.1	0.2
	Males, mortality 1990					Females, mortality 1990				
Austria	209	4.0	5.9	0.5	2.2	15	0.2	0.2	0.0	0.2
Belgium	399	5.5	8.1	0.7	2.5	47	0.4	0.7	0.0	0.4
Denmark	96	2.4	3.6	0.3	1.2	25	0.5	0.8	0.1	0.3
Finland	40	1.2	1.9	0.2	0.8	5	0.1	0.1	0.0	0.1
France	2880	7.5	10.8	0.9	3.4	155	0.3	0.5	0.0	0.3
Germany	1527	2.7	3.9	0.3	1.5	158	0.2	0.3	0.0	0.2
Greece	323	3.8	5.8	0.5	2.7	28	0.2	0.4	0.0	0.4
Ireland	51	2.4	3.6	0.3	1.3	9	0.4	0.5	0.0	0.3
Italy	2374	5.4	8.0	0.7	2.8	128	0.2	0.3	0.0	0.2
Luxembourg	15	6.0	8.2	0.7	2.8	1	0.1	0.3	0.0	0.2
Netherlands	179	1.8	2.7	0.2	0.9	29	0.3	0.4	0.0	0.2
Portugal	376	6.0	8.6	0.7	3.7	38	0.4	0.6	0.0	0.5
Spain	1919	7.3	10.5	0.9	4.1	57	0.1	0.2	0.0	0.2
Sweden	57	0.7	1.1	0.1	0.5	6	0.1	0.1	0.0	0.1
U.K.	739	1.7	2.5	0.2	0.9	191	0.3	0.5	0.0	0.2
EU	11 184	4.3	6.3	0.5	2.2	892	0.2	0.4	0.0	0.2

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

men suggest that risk may be determined in early life, perhaps *in utero* [65].

Bladder (Figure 2n, Table 15)

Male bladder cancer rates varied from 24.9 in Italy to 11.7 in Ireland, while rates for females were highest in the U.K. (6.0) and lowest in Luxembourg (2.0). This variation is likely to be due in part to differences in registry practice towards the recording of non-invasive cancers and papillomas of uncertain behaviour. Some of these tumours, if not treated, will proceed to malignancy and in some cancer registries all papillomas are included in published statistics. The apparent anomaly of high mortality but low incidence of bladder cancer in Denmark, for example, is due to the strict exclusion of such tumours from the 'invasive' behaviour category in incidence data, while any bladder tumour at death may be noted as an underlying cause. It is worth noting that in the last volume of *Cancer Incidence in Five Continents*, Denmark had one of the highest incidence rates, because non-invasive tumours were included in the tables for this site [66]. The main known risk factors for bladder cancer are tobacco smoking, especially of black tobacco [67], which may explain the high rates in some Southern European countries, and certain occupational exposures [68]. Smoking accounts for approximately one-third of all cases in Europe [36], but the fraction attributable to occupational exposures is much smaller [69].

Kidney (Figure 2o, Table 16)

In both males and females, the highest incidence of kidney cancer was observed in Austria. High incidence was also seen in Germany and the Nordic countries, where the incidence was approximately three times higher than in the Southern European countries of Greece, Portugal and Spain. This may be partly due to variations in the autopsy rates in these countries. A sex ratio of approximately 2 was fairly consistent throughout the 15 countries of the EC. Little is known about the causes of kidney cancer, but tobacco smoking accounts for approximately 45% of cases in men in Europe [36].

Brain and other central nervous system cancers (Figure 2p, Table 17)

Mortality data for brain and other CNS cancers are very difficult to interpret because of the difficulty of obtaining a confirmed diagnosis of a primary intracranial tumour. The

Table 10. Estimated incidence and recorded mortality from lung cancer in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	2779	52.8	77.4	6.7	18.3	918	11.3	16.5	1.4	5.0
Belgium	5564	75.2	110.5	9.7	25.7	750	8.2	11.7	1.0	4.0
Denmark	2085	52.1	76.6	6.9	19.9	1102	25.2	35.5	3.3	9.7
Finland	1739	54.0	80.2	7.1	20.8	383	8.0	11.6	1.0	4.2
France	19 419	50.1	71.5	6.4	16.3	2845	5.5	7.9	0.7	3.3
Germany	27 943	50.9	74.0	6.7	19.2	6764	8.5	12.1	1.1	4.1
Greece	4283	55.4	79.8	7.1	26.7	714	7.8	11.1	0.9	5.8
Ireland	1135	52.0	78.1	6.5	21.1	530	20.2	29.9	2.6	10.2
Italy	27 112	63.7	91.8	8.3	23.7	4555	8.1	11.8	1.0	5.0
Luxembourg	173	66.0	96.2	8.6	22.5	33	9.5	13.6	1.2	4.5
Netherlands	7441	74.4	111.0	9.7	25.7	1424	13.0	18.1	1.6	5.2
Portugal	1921	30.3	43.1	3.8	13.8	425	5.0	7.2	0.6	3.3
Spain	13 728	51.7	74.3	6.5	21.3	1362	4.0	5.7	0.5	2.9
Sweden	1791	23.9	35.2	3.1	9.7	863	10.8	15.2	1.4	4.3
U.K.	29 187	63.2	95.6	7.9	25.2	13 425	23.5	34.1	3.1	11.3
EU	146 305	55.6	81.2	7.2	19.3	36 093	10.3	14.9	1.3	5.2
	Males, mortality 1990					Females, mortality 1990				
Austria	2427	45.0	66.9	5.5	25.1	752	8.7	12.8	1.0	7.8
Belgium	5546	72.8	109.6	9.0	35.3	750	7.7	11.2	0.9	6.5
Denmark	2180	52.6	78.7	6.9	28.1	1118	23.8	34.1	3.1	15.6
Finland	1599	48.8	73.7	6.3	31.7	346	6.8	10.1	0.8	7.3
France	18 805	46.5	68.0	5.7	22.3	2812	5.1	7.4	0.6	5.2
Germany	27 423	48.5	72.0	6.0	26.6	6795	7.9	11.5	1.0	6.6
Greece	4034	50.1	73.8	6.3	33.5	714	7.2	10.6	0.8	9.6
Ireland	1044	47.1	71.8	5.7	27.1	485	18.5	27.4	2.4	14.9
Italy	25 168	57.5	84.5	7.4	29.5	4431	7.3	10.9	0.9	7.4
Luxembourg	162	60.8	91.3	8.0	30.7	31	8.5	12.2	1.1	7.0
Netherlands	7011	67.5	103.9	8.2	35.3	1230	10.3	14.7	1.3	8.0
Portugal	1825	27.9	40.4	3.6	17.8	416	4.5	6.6	0.5	5.3
Spain	12 662	46.2	67.9	5.8	26.8	1320	3.5	5.2	0.4	4.5
Sweden	851	23.7	35.7	3.0	17.3	836	9.7	14.0	1.2	8.7
U.K.	26 924	57.4	87.7	7.1	32.0	12 345	21.0	30.7	2.8	16.0
EU	138 661	51.2	76.3	6.4	27.8	34 381	9.3	13.6	1.2	8.6

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

brain is a common site of metastasis, which is often incorrectly certified as primary brain cancer. This is probably the reason for the apparently high mortality in Greece and Belgium. The validity of the data from cancer registries will also be influenced by the presence of diagnostic facilities and autopsy rates, but they are certainly superior to the mortality-based figures. In any case, there appears to be relatively little variation in incidence between countries with complete cancer registration systems (Austria, Denmark, Finland, The Netherlands, Sweden, U.K.). Little is known about the causes of brain and CNS cancer. Reports of increasing risk in industrialised countries have generated concern, but the trends may be due to improved scanning and imaging technology, and more aggressive investigation of disease in the elderly [70].

Thyroid (Figure 2q, Table 18)

Thyroid cancer is a disease of relatively good prognosis. It is approximately twice as frequent in females as in males. In 1990, there were 10 135 new cases and 3385 deaths in the European Union. In both sexes, the highest incidence and mortality rates tended to be in Finland, Sweden, Austria, Germany and Italy. The approximately 5-fold variation between high- and low-incidence countries was similar in males and females, although the reported incidence for females in Finland was exceptional (6.1) in comparison with the European Union average (2.4). Like prostate cancer, thyroid cancer incidence can be influenced by screening of populations and histological examination of biopsied nodules which were otherwise asymptomatic. Radiation exposure is a well-established risk factor, but clearly can account for only very little of the international variation [71]. Dietary deficiency of iodine appears to influence risk of some histological types of thyroid tumour, and this is likely to be a more important geographical factor [72]. A small proportion of cases are related to genetically determined syndromes.

Non-Hodgkin's lymphoma (Figure 2r, Table 19)

It is estimated that there were 42 673 new cases of non-Hodgkin's lymphoma in the European Union in 1990, representing some 3% of all cancer. In general, incidence and mortality were higher in the Nordic countries, The Netherlands, the U.K. and Ireland than in other Western and Southern European countries. The exception was Italy, which had high incidence and above average mortality.

Table 11. Estimated incidence and recorded mortality from melanoma of the skin in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	277	5.7	7.7	0.7	2.8	353	5.8	7.5	0.6	3.5
Belgium	267	4.2	5.5	0.5	1.2	503	6.9	8.8	0.7	2.7
Denmark	302	8.6	11.4	0.9	3.4	422	11.5	14.5	1.2	4.2
Finland	235	7.5	10.3	0.8	2.9	246	6.4	8.4	0.6	2.5
France	1439	4.1	5.3	0.4	1.2	2297	5.7	7.2	0.6	2.7
Germany	2820	5.5	7.2	0.6	1.9	4433	7.0	9.0	0.7	2.7
Greece	108	1.7	2.1	0.2	0.7	213	3.2	3.8	0.3	1.6
Ireland	61	3.2	4.1	0.3	1.1	141	6.7	8.4	0.7	2.7
Italy	1413	3.8	4.9	0.4	1.2	2962	7.1	8.7	0.7	3.2
Luxembourg	9	3.6	4.9	0.4	0.9	34	11.4	15.1	1.2	4.7
Netherlands	636	6.9	8.9	0.7	3.0	959	9.8	12.2	1.0	3.5
Portugal	118	2.1	2.6	0.2	0.8	298	5.0	5.6	0.4	2.0
Spain	626	2.7	3.3	0.3	1.0	1169	4.4	5.4	0.4	2.5
Sweden	674	10.7	14.3	0.2	4.0	690	10.7	13.6	1.1	4.3
U.K.	1597	4.3	5.7	0.5	1.4	2659	6.5	8.2	0.7	2.2
EU	10 582	4.6	5.9	0.5	1.4	17 379	6.5	8.2	0.7	2.8
	Males, mortality 1990					Females, mortality 1990				
Austria	120	2.3	3.3	0.3	6.1	118	1.6	2.2	0.2	1.2
Belgium	90	1.3	1.8	0.1	4.9	105	1.2	1.7	0.1	0.9
Denmark	119	3.3	4.6	0.4	6.0	106	2.6	3.4	0.3	1.5
Finland	64	2.0	2.9	0.2	5.8	53	1.1	1.7	0.1	1.1
France	502	1.3	1.8	0.1	5.3	501	1.0	1.4	0.1	0.9
Germany	958	1.8	2.5	0.2	5.1	962	1.2	1.7	0.1	0.9
Greece	34	0.5	0.7	0.1	4.6	32	0.4	0.5	0.0	0.4
Ireland	20	1.0	1.4	0.1	5.1	26	1.1	1.5	0.1	0.8
Italy	615	1.5	2.1	0.2	6.0	552	1.1	1.5	0.1	0.9
Luxembourg	1	0.4	0.6	0.0	10.2	7	2.0	2.7	0.2	1.6
Netherlands	171	1.8	2.5	0.2	4.7	177	1.6	2.1	0.2	1.2
Portugal	43	0.6	1.0	0.1	7.8	44	0.6	0.8	0.0	0.6
Spain	265	1.0	1.4	0.1	7.5	203	0.6	0.8	0.1	0.7
Sweden	178	2.5	3.6	0.3	5.5	132	1.7	2.3	0.2	1.4
U.K.	622	1.6	2.2	0.2	3.7	665	1.4	1.8	0.1	0.9
EU	3802	1.5	2.1	0.2	4.9	3683	1.1	1.6	0.1	0.9

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Incidence was moderately greater in males than in females (sex ratio 1.6). Risk of non-Hodgkin's lymphoma is increased in immunosuppressed persons, such as patients with autoimmune disorders [73], and those infected with human immunodeficiency virus (HIV) [74].

Hodgkin's disease (Figure 2s, Table 20)

The estimated incidence of Hodgkin's disease ranged from 3.5 in males in Germany to 1.0 in females in Portugal. It is a cancer of relatively good prognosis, with 9096 new cases compared with 3179 deaths in the European Union in 1990. The sex ratio was 1.6. The geographical epidemiology of Hodgkin's disease in children and young adults is related to levels of affluence and family size, which suggests an infectious aetiology [75]. The presence of the Epstein–Barr virus is found in a proportion of tumours and is widely believed to have a causal role in Hodgkin's disease [76].

Multiple myeloma (Figure 2t, Table 21)

The highest estimated incidence rates for both males and females were in Ireland: 4.0 and 2.4, respectively. The general pattern was of high incidence also in the rest of the British Isles, The Netherlands and the Nordic countries, and consistently lower incidence in Southern European countries. The sex ratio for the European Union was 1.4. However, there was noticeably more geographical variation in rates for males than for females. The aetiology of this relatively important tumour of the elderly remains obscure. Radiation exposure and employment in agriculture have been suggested as risk factors, but these can account for only few cases [77].

Leukaemia (Figure 2u, Table 22)

There were estimated to be 36 156 new cases of leukaemia in the European Union in 1990, representing 3% of all cancers. The rates varied from 9.4 in Denmark to 6.8 in Finland for males, and from 6.4 in Portugal to 4.8 in The Netherlands for females. The overall sex ratio was 1.5. The leukaemias are a heterogeneous group of conditions, with varying aetiology. Radiation exposure is known to increase risk of most types of leukaemia (although not the common chronic lymphatic leukaemias of the elderly), as are some industrial chemicals [78]. There is much interest in the possible role of late exposure to some common infectious

Table 12. Estimated incidence and recorded mortality from breast and cervix uteri cancer in European Union countries in 1990

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Females, breast incidence 1990					Females, cervix uteri incidence 1990				
Austria	4013	5.9	81.8	6.8	28.4	744	12.6	16.2	1.3	5.0
Belgium	6341	79.2	108.3	8.8	34.0	569	7.6	10.1	0.8	2.1
Denmark	3002	73.2	99.9	8.2	25.8	557	15.3	19.4	1.6	4.8
Finland	2513	64.7	88.6	7.1	28.2	286	8.6	10.0	0.8	1.5
France	26 201	58.2	80.1	6.5	30.5	3720	9.5	12.3	1.0	4.3
Germany	45 882	65.6	89 9	7.3	27.9	7053	12.0	15.2	1.2	4.3
Greece	3077	40.6	54.4	4.5	25.5	606	8.9	11.1	0.9	4.9
Ireland	1401	67.2	91.2	7.5	27.0	172	8.8	11.2	0.9	3.3
Italy	24 762	53.7	73.0	6.0	27.7	3687	8.5	11.1	0.9	4.0
Luxembourg	222	72.0	98.9	8.0	31.5	21	7.5	9.7	0.8	2.9
Netherlands	8810	81.0	110.5	9.1	32.9	729	7.1	9.1	0.7	2.9
Portugal	3430	49.9	66.7	5.5	26.9	904	14.1	17.8	1.4	6.9
Spain	12 598	46.2	61.9	5.0	27.6	2172	8.4	10.7	0.9	4.6
Sweden	5288	72.8	99.9	8.4	28.3	538	8.6	10.9	0.9	2.7
U.K.	31 364	68.1	93.0	7.6	26.3	4827	12.1	15.3	1.2	4.0
EU	178 904	60.9	83.2	6.8	26.2	26 585	10.2	13.1	1.1	3.8
	Females, breast mortality 1990					Females, cervix uteri mortality 1990				
Austria	1736	22.2	32.0	2.5	3.7	401	5.4	7.6	0.6	1.9
Belgium	2421	26.7	37.9	3.0	4.2	341	3.6	5.2	0.4	2.0
Denmark	1285	26.9	38.6	3.0	5.8	262	5.5	7.8	0.7	1.9
Finland	747	17.2	24.3	1.9	2.8	81	1.4	2.2	0.1	1.4
France	10 173	19.7	28.3	2.2	3.8	1880	3.6	5.2	0.4	2.1
Germany	17 544	21.8	31.2	2.5	4.1	3500	4.5	6.3	0.5	2.0
Greece	1272	15.0	20.9	1.7	5.5	234	2.7	3.8	0.3	1.8
Ireland	603	25.5	36.4	3.8	3.0	77	3.4	4.8	0.4	1.2
Italy	10 924	20.6	29.3	2.3	5.0	1804	3.3	4.7	0.4	1.9
Luxembourg	95	27.3	39.6	3.2	4.0	12	4.0	5.2	0.5	1.6
Netherlands	3293	26.8	38.4	3.0	4.2	332	2.7	3.8	0.3	2.0
Portugal	1410	18.2	25.5	2.0	3.6	362	4.7	6.5	0.5	1.7
Spain	5398	17.2	24.2	1.9	5.3	975	2.9	4.1	0.3	1.9
Sweden	1477	17.8	25.4	2.0	3.7	247	2.9	4.1	0.3	1.9
U.K.	15 179	28.2	40.4	3.2	4.4	2309	4.7	6.4	0.5	2.4
EU	73 557	21.8	31.2	3.4	4.4	12 817	3.9	5.4	0.4	2.0

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

agent in promoting acute lymphoblastic leukaemia in children [79].

DISCUSSION

For some European Union countries, the information on incidence presented in this report was estimated from incidence/mortality ratios. For others, published incidence data were used. Therefore some consideration should be given to the accuracy of the original incidence and mortality data.

The data collection practices used in European Cancer Registries are not uniform, but the information they provide is comparable at least at the level of the third digit of the ICD-9 classification [80]. The main areas of concern are access to death certificates, which cancer registries use to complete the ascertainment of cases not registered by other means (particularly among the elderly), and the inclusion of non-malignant entities in cancer registers of some countries. Lack of access to death certificates in French cancer registries might have led to an underestimate of the incidence/mortality ratios for the oldest age group in Western European countries. However, the smoothing effect of the regression models used for the age-specific incidence mortality ratios would tend to reduce this problem. Inspection of estimated age-incidence curves for these countries (using the EUCan90 package) indicates that this is not a serious problem. Of more concern are variations in the definition of malignancy for three sites of cancer in particular: prostate, bladder, brain and other CNS. For all three, there are variations in the incidence/mortality ratios in European Union countries which cannot be explained by differences in survival. The large ratios for these cancer sites in Finland and Sweden in comparison with other countries are probably due to the inclusion of benign tumours (in the case of brain and other CNS cancer) and tumours of uncertain behaviour or borderline malignancy in the published incidence statistics reproduced here. Therefore, comparisons of data for these sites should be interpreted with caution. Efforts are being made to standardise further the data collection methods of registries in Europe [3]. There are also variations in the accuracy of mortality statistics [81]. This may have led to an underestimate of the true mortality of cancer at specific sites (but not the overall total) in the statistics reported here.

In order to achieve consistency with previous publications, we used a standard approach to the estimation of

Table 13. Estimated incidence and recorded mortality from cancer of the corpus uteri and ovary in European Union countries in 1990

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Females, corpus uteri incidence 1990					Females, ovary incidence 1990				
Austria	997	13.9	19.8	1.8	5.6	942	13.3	18.6	1.5	5.0
Belgium	847	11.5	15.8	1.4	4.4	787	9.4	12.9	1.1	4.2
Denmark	642	14.8	20.8	2.0	5.0	570	13.8	18.8	1.6	4.7
Finland	549	12.8	18.2	1.6	5.6	438	10.7	14.7	1.2	5.7
France	4524	9.7	13.9	1.2	4.8	3769	8.1	11.1	0.9	4.4
Germany	8242	11.3	16.0	1.4	4.7	7613	10.4	14.4	1.2	4.6
Greece	547	6.7	9.2	0.8	4.2	454	5.9	7.8	0.7	3.8
Ireland	268	12.6	16.9	1.4	5.0	278	12.8	17.6	1.5	5.4
Italy	5280	10.7	15.0	1.4	5.4	4143	8.6	11.8	1.0	4.7
Luxembourg	66	19.9	28.4	2.5	9.4	36	11.1	15.5	1.3	5.1
Netherlands	1279	10.8	15.5	1.4	4.5	1246	11.2	15.4	1.3	4.5
Portugal	987	13.5	18.5	1.6	7.1	433	6.1	8.1	0.7	3.5
Spain	3344	11.3	15.7	1.4	6.8	1914	6.7	9.1	0.8	4.3
Sweden	1084	13.9	19.8	1.8	5.3	945	13.1	17.9	1.5	4.8
U.K.	4387	8.8	12.5	1.1	3.7	5785	12.3	16.8	1.4	4.9
EU	33 043	10.7	15.1	1.3	4.9	29 353	9.6	13.2	1.1	4.3
	Females, corpus uteri mortality 1990					Females, ovary mortality 1990				
Austria	236	2.3	3.6	0.2	2.3	655	8.0	11.7	0.9	6.8
Belgium	255	2.4	3.6	0.3	2.2	655	6.8	9.9	0.8	5.6
Denmark	156	2.7	4.1	0.4	2.2	449	9.9	14.0	1.2	6.3
Finland	135	2.3	3.7	0.3	2.8	313	6.8	9.8	0.8	6.6
France	1247	1.9	2.9	0.2	2.3	3129	5.7	8.3	0.7	5.8
Germany	2219	2.1	3.3	0.3	2.1	6326	7.5	10.9	0.9	6.2
Greece	119	1.1	1.7	0.1	0.9	260	3.1	4.3	0.4	3.5
Ireland	61	2.2	3.3	0.3	2.0	196	8.5	12.1	1.0	6.0
Italy	1452	2.2	3.4	0.3	2.5	2611	4.9	6.9	0.6	4.4
Luxembourg	26	6.5	9.8	0.7	5.9	33	8.7	12.8	1.1	7.5
Netherlands	345	2.2	3.5	0.3	2.3	987	7.7	11.3	0.9	6.4
Portugal	227	2.4	3.6	0.3	2.6	271	3.5	4.9	0.4	3.4
Spain	825	2.1	3.2	0.3	2.9	1148	3.7	5.1	0.4	3.9
Sweden	227	2.1	3.3	0.3	2.4	620	7.4	10.6	0.9	6.4
U.K.	1280	1.9	2.9	0.2	1.7	4513	8.7	12.4	1.1	5.9
EU	8810	2.1	3.2	0.2	2.2	22 166	6.4	9.2	0.8	5.5

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

incidence from mortality, with some minor modifications. First, whereas Møller Jensen and associates [5] and Estève and associates [6] fitted separate models for males and females, we found that a single parameter for sex in a combined model was sufficient to describe sex differences in the age-specific incidence/mortality ratios for some sites. For other sites, the sex differences were not significant, and a term for sex was not included. Use of a combined model for males and females improved the precision of the parameter estimates for age. Second, in estimating the incidence/mortality ratios for Southern and Western European countries, we used data from cancer registries in the same regions rather than the data for Denmark, Scotland and some French registries used in previous studies. This was thought to reflect more accurately the differences between incidence/mortality ratios between European Union countries which are due to a combination of variations in survival and variations in death certification and cancer registration practice. Although there is less within-region variation in incidence/mortality ratios, one would wish to use country-specific ratios from which to derive incidence estimates. This was not possible due to the sparsity or absence of cancer registry data for some countries. Third, cancer incidence data are now available for The Netherlands, obviating the need for estimates for that country. Austria, Finland and Sweden, the three countries which joined the EC in 1995, all have complete cancer registration systems providing national incidence data.

Despite the provisos about data quality for some sites, we believe that the incidence data presented are reliable for the purpose of assessing general patterns of cancer in the European Union. The increased availability of regional and national cancer registry information means that these data are probably more accurate than has previously been possible. The estimates of Møller Jensen and associates [5] were based on data from Denmark, Finland, Norway, Sweden, Scotland and four regional registries of France in 1978–1982. With the exception of Scotland, the cancer registries of these areas report relatively high survival for most cancers [23]. This means that the incidence/mortality ratios used tended to overestimate incidence in some countries. It would not be appropriate, therefore, to use these estimates for different periods to study time trends in cancer inci-

Table 14. Estimated incidence and recorded mortality from prostate and testicular cancer in European Union countries in 1990

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, prostate incidence 1990					Males, testes incidence 1990				
Austria	2418	39.8	64.4	4.6	15.9	270	6.2	6.6	0.5	2.0
Belgium	3189	38.2	61.4	4.3	14.7	232	4.2	4.4	0.3	1.1
Denmark	1475	30.8	49.9	3.6	14.4	262	9.0	9.6	0.7	2.7
Finland	1425	40.7	66.6	4.6	17.0	61	2.3	2.4	0.2	0.9
France	17 263	35.8	57.9	4.0	14.5	1458	4.6	5.0	0.4	1.2
Germany	21 075	34.7	55.4	4.0	14.5	3597	7.9	8.4	0.6	2.5
Greece	1064	11.4	18.4	1.3	6.6	207	3.8	4.0	0.3	0.9
Ireland	728	29.0	47.9	3.1	13.6	71	3.8	4.5	0.3	1.3
Italy	7591	15.3	24.8	1.7	6.6	995	3.1	3.4	0.3	0.5
Luxembourg	102	35.1	56.4	4.0	13.6	7	2.9	3.1	0.2	4.4
Netherlands	4412	39.7	64.6	4.5	14.7	341	3.9	4.1	0.3	1.2
Portugal	1478	19.5	31.5	2.2	10.6	133	2.5	2.7	0.2	0.7
Spain	5394	17.2	28.1	1.9	8.3	517	2.4	2.6	0.2	0.6
Sweden	5048	55.3	88.6	6.6	25.6	209	4.6	4.8	0.4	1.2
U.K.	14 263	27.1	44.5	2.9	12.3	1447	4.6	5.0	0.4	1.2
EU	86 925	28.5	46.1	3.2	11.4	9807	4.8	5.2	0.4	1.3
	Males, prostate mortality 1990					Males, testes mortality 1990				
Austria	1110	16.1	28.1	1.3	11.5	15	0.3	0.4	0.0	0.2
Belgium	1620	17.7	30.7	1.5	10.3	22	0.3	0.4	0.0	0.1
Denmark	951	18.6	31.4	1.7	12.3	30	0.9	1.1	0.1	0.4
Finland	635	17.4	29.7	1.6	12.6	8	0.2	0.4	0.0	0.2
France	9211	16.9	29.5	1.4	10.9	141	0.4	0.5	0.0	0.2
Germany	10 496	15.4	26.6	1.4	10.2	356	0.7	0.8	0.1	0.3
Greece	831	8.0	13.8	0.7	6.9	22	0.3	0.4	0.0	0.2
Ireland	465	18.0	30.7	1.7	12.1	8	0.4	0.5	0.0	0.2
Italy	6152	11.4	19.7	1.0	7.2	119	0.3	0.4	0.0	0.1
Luxembourg	48	15.1	26.4	1.5	9.1	0	0.0	0.0	0.0	0.0
Netherlands	2135	17.9	31.0	1.5	10.7	38	0.4	0.5	0.0	0.2
Portugal	1123	13.9	23.7	1.3	11.0	19	0.3	0.4	0.0	0.2
Spain	3414	12.9	22.3	1.1	9.1	41	0.2	0.2	0.0	0.1
Sweden	2093	20.5	35.0	1.9	19.6	15	0.3	0.3	0.0	0.1
U.K.	8938	16.2	27.5	1.5	10.6	145	0.4	0.5	0.0	0.2
EU	50 122	15.0	25.9	1.3	10.0	979	0.4	0.5	0.0	0.2

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

dence. However, it is instructive to consider the relative frequency of the major cancers in European Union countries in 1990 compared with those from approximately 10 years before [5]. For example, the incidence of lung cancer in males in 1990 was greatest in Belgium, The Netherlands and Luxembourg as previously, but the U.K. has been displaced from fourth rank by Italy. Incidence in Greece was, by 1990, only marginally below the European Union average. Thus, while lung cancer represented 21% of all cancer in men in 1980 and in 1990, the epicentre of the pattern of incidence of tobacco related cancers in Europe is moving from north to south. Lung cancer in women accounted for 6% of all cancer in 1990 compared with 4% 10 years before. The relative importance of breast cancer for women in the European Union has also increased, from 24% to 28% of all cancer. Surprisingly, the relative frequency of prostate cancer fell from 13% to 12%. There is little doubt that the incidence of this tumour is increasing throughout Europe [12], so this finding is anomalous. It is likely to be due to an overestimate of incidence in the earlier study [5], in which incidence/mortality ratios for mainly Northern European cancer registries were applied to all European countries. Data from the present study show that the ratios of incidence to mortality are much lower in Southern than in Northern Europe. This reflects different medical practice, but it is interesting to note that there was relatively little variation in prostate cancer mortality between European Union countries.

The main value of the current set of estimates is that they provide a basis on which to assess the burden of cancer morbidity in the European Union, and the potential for prevention. For example, head and neck cancer (lip, oral cavity, pharynx, larynx and oesophagus) is due mainly to alcohol and tobacco use. The historical levels of exposure of the Swedish population to these factors, and other factors such as diet, have led to an incidence rate which is some four times lower than in France. If the Swedish experience applied in the rest of the European Union approximately 40 000 new cases of head and neck cancer in men could be avoided, 16 000 of which would be in France alone. It is not unreasonable to make this kind of comparison within Europe. Both Sweden and France, for example, are modern industrial societies with the material and intellectual resources necessary to control cancer. The value of rational cancer control programmes is clearly demonstrated in the low incidence and mortality of several preventable cancers

Table 15. *Estimated incidence and recorded mortality from bladder cancer in European Union countries in 1990, by sex*

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	1095	19.8	30.0	2.4	5.4	468	4.9	7.4	0.6	1.7
Belgium	1385	17.5	27.1	2.1	6.4	345	2.9	4.5	0.3	1.8
Denmark	555	12.9	19.7	1.6	5.4	199	3.4	5.2	0.4	1.7
Finland	497	14.9	22.9	1.8	6.5	162	2.9	4.5	0.3	2.0
France	6848	16.1	24.3	2.0	5.8	1477	2.1	3.3	0.2	1.7
Germany	9126	15.5	24.0	1.9	6.3	2978	2.8	4.4	0.3	1.8
Greece	1568	19.0	28.4	2.4	11.5	296	2.9	4.3	0.3	2.7
Ireland	268	11.7	18.3	1.3	5.0	104	3.7	5.7	0.4	2.0
Italy	11 110	24.9	37.2	3.2	11.5	2092	3.2	4.9	0.4	2.5
Luxembourg	38	13.6	21.0	1.6	5.3	9	2.0	3.1	0.2	1.2
Netherlands	1574	15.2	23.3	1.8	5.5	440	3.0	4.6	0.3	1.6
Portugal	964	14.2	21.1	1.7	8.2	307	3.2	4.8	0.4	2.6
Spain	6685	23.9	35.6	3.0	12.3	1134	2.8	4.3	0.3	2.7
Sweden	1390	17.3	26.3	2.1	7.4	460	4.6	6.9	0.5	2.4
U.K.	9110	19.7	29.9	2.4	7.9	3834	6.0	9.0	0.7	3.2
EU	52 213	18.8	28.5	2.3	7.4	14 305	3.4	5.2	0.4	2.1
	Males, mortality 1990					Females, mortality 1990				
Austria	358	5.6	9.2	0.5	3.7	186	1.6	2.6	0.1	1.9
Belgium	655	7.8	12.7	0.8	4.2	237	1.7	2.8	0.2	2.0
Denmark	447	9.5	15.3	1.1	5.8	137	2.1	3.4	0.2	1.9
Finland	140	3.8	6.5	0.3	2.8	68	1.0	1.6	0.1	1.4
France	3170	6.7	10.8	0.7	3.8	1105	1.3	2.2	0.1	2.1
Germany	4251	6.6	10.9	0.6	4.1	2042	1.6	2.7	0.2	2.0
Greece	659	7.0	11.4	0.8	5.5	136	1.1	1.8	0.1	1.8
Ireland	115	4.7	7.7	0.5	3.0	40	1.3	2.1	0.1	1.2
Italy	4285	8.7	14.0	1.0	5.0	1114	1.4	2.3	0.1	1.9
Luxembourg	21	7.2	11.6	0.8	4.0	7	1.2	2.2	0.0	1.6
Netherlands	827	7.2	12.1	0.7	4.2	302	1.6	2.7	0.1	2.0
Portugal	372	4.8	7.9	0.5	3.6	134	1.2	1.9	0.1	1.7
Spain	2492	8.1	13.0	0.9	5.3	611	1.3	2.1	0.1	2.1
Sweden	390	4.0	6.7	0.4	3.7	183	1.4	2.3	0.1	1.9
U.K.	3668	7.1	11.6	0.7	4.4	1816	2.3	3.7	0.2	2.4
EU	21 850	7.1	11.6	0.7	4.4	8118	1.6	2.6	0.1	2.0

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Table 16. Estimated incidence and recorded mortality from cancer of the kidney in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
		Males, incidence 1990					Females, incidence 1990			
Austria	716	13.9	20.0	1.7	4.4	608	7.7	11.2	0.9	2.9
Belgium	572	8.1	11.8	1.1	2.6	445	4.7	6.8	0.6	2.4
Denmark	347	8.7	12.8	1.1	3.3	276	5.5	7.9	0.7	2.3
Finland	368	11.8	16.8	1.5	4.4	293	6.4	9.0	0.8	2.8
France	3364	8.6	12.3	1.1	2.8	1800	3.5	4.9	0.4	2.1
Germany	6499	12.2	17.3	1.6	4.5	4341	5.5	7.7	0.7	2.6
Greece	320	4.2	6.0	0.5	2.9	143	1.5	2.2	0.2	1.6
Ireland	121	5.9	8.5	0.7	2.3	64	2.8	3.8	0.3	1.2
Italy	3371	8.0	11.5	1.0	4.0	1655	3.2	4.4	0.4	2.1
Luxembourg	23	9.0	12.9	1.2	3.2	15	4.4	6.3	0.6	2.2
Netherlands	981	10.3	14.7	1.3	3.3	636	5.3	7.4	0.6	2.4
Portugal	246	3.9	5.5	0.5	2.4	184	2.7	3.3	0.3	1.4
Spain	1355	5.3	7.3	0.6	2.9	645	1.9	2.6	0.2	1.7
Sweden	743	10.2	14.8	1.3	4.1	544	6.2	8.8	0.8	2.8
U.K.	2892	6.9	9.9	0.8	2.5	1697	3.3	4.5	0.4	1.4
EU	21 918	8.6	12.3	1.1	3.4	13 346	3.9	5.5	0.5	2.1
		Males, mortality 1990					Females, mortality 19906			
Austria	312	5.7	8.5	0.7	3.2	254	2.6	4.0	0.3	2.6
Belgium	321	4.2	6.5	0.5	2.0	275	2.5	3.8	0.3	2.4
Denmark	212	5.2	7.7	0.6	2.7	188	3.6	5.3	0.4	2.6
Finland	197	6.1	9.0	0.8	3.9	154	3.1	4.5	0.4	3.2
France	1987	4.6	7.0	0.5	2.4	1142	1.8	2.7	0.2	2.1
Germany	3500	6.1	9.1	0.7	3.4	2600	2.8	4.1	0.3	2.5
Greece	181	2.2	3.3	0.3	1.5	87	0.9	1.3	0.1	1.2
Ireland	62	2.9	4.2	0.4	1.6	38	1.6	2.1	0.2	1.2
Italy	1876	4.2	6.3	0.5	2.2	986	1.6	2.4	0.2	1.6
Luxembourg	8	2.8	4.2	0.3	1.5	9	2.3	3.4	0.2	2.0
Netherlands	546	5.4	8.1	0.6	2.7	348	2.4	3.6	0.3	2.3
Portugal	137	2.0	3.0	0.2	1.3	101	1.2	1.7	0.1	1.3
Spain	751	2.7	4.0	0.3	1.6	398	1.0	1.5	0.1	1.3
Sweden	395	5.1	7.6	0.6	3.7	313	3.1	4.7	0.4	3.2
U.K.	1719	4.0	5.8	0.5	2.0	1074	1.8	2.6	0.2	1.4
EU	12 204	4.5	6.7	0.5	2.4	7967	2.0	3.0	0.2	2.0

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Table 17. *Estimated incidence and recorded mortality from cancer of the brain and other CNS in European Union countries in 1990, by sex*

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
		Males, incidence 1990					Females, incidence 1990			
Austria	272	6.1	7.7	0.7	1.8	283	5.1	6.3	0.5	1.6
Belgium	466	7.3	9.4	0.8	2.2	478	6.0	7.8	0.6	2.6
Denmark	199	6.5	7.8	0.7	2.2	156	4.7	5.5	0.5	1.5
Finland	191	7.3	8.2	0.7	3.8	174	5.5	6.3	0.5	3.9
France	1743	5.2	6.5	0.5	1.5	1535	4.0	4.9	0.4	1.8
Germany	2675	5.7	7.0	0.6	1.8	2765	4.8	5.9	0.5	1.7
Greece	537	8.8	10.5	0.9	3.1	393	6.2	7.0	0.6	3.1
Ireland	140	7.4	9.3	0.8	2.6	103	5.1	6.2	0.5	2.0
Italy	2069	6.3	7.4	0.6	1.7	1617	4.3	5.0	0.4	1.7
Luxembourg	21	8.8	11.3	0.9	2.7	21	7.7	9.7	0.8	2.8
Netherlands	496	6.0	7.2	0.6	1.7	359	4.0	4.7	0.4	1.4
Portugal	310	5.0	6.9	0.6	2.1	252	4.5	4.9	0.4	2.0
Spain	1080	6.5	5.9	0.5	1.7	789	3.4	3.8	0.3	1.7
Sweden	340	6.2	7.7	0.7	3.2	281	5.3	6.0	0.5	3.4
U.K.	2114	6.0	7.6	0.7	1.8	1650	4.4	5.2	0.4	1.4
EU	12 653	6.0	7.2	0.6	1.8	10 856	4.5	5.3	0.4	1.8
		Males, mortality 1990					Females, mortality 1990			
Austria	187	4.0	5.3	0.5	1.9	173	2.9	3.7	0.3	1.8
Belgium	389	5.6	7.8	0.6	2.5	363	4.0	5.5	0.4	3.1
Denmark	163	4.9	6.4	0.6	2.1	126	3.3	4.4	0.4	1.8
Finland	130	4.5	5.7	0.5	2.6	127	3.5	4.4	0.4	2.7
France	1387	3.9	5.1	0.4	1.6	990	2.3	2.9	0.3	1.8
Germany	2057	4.2	5.4	0.5	2.0	1870	3.0	3.8	0.3	1.8
Greece	458	6.6	8.7	0.8	3.8	361	4.7	6.0	0.5	4.9
Ireland	109	5.5	7.5	0.6	2.8	73	3.2	4.2	0.3	2.2
Italy	1764	4.6	6.1	0.5	2.1	1385	3.0	3.9	0.3	2.3
Luxembourg	14	5.2	7.8	0.5	2.7	16	5.3	7.0	0.7	3.6
Netherlands	348	4.0	5.1	0.5	1.8	255	2.6	3.3	0.3	1.7
Portugal	214	3.8	4.8	0.4	2.1	160	2.3	2.9	0.3	2.0
Spain	865	3.6	4.7	0.4	1.8	635	2.2	2.9	0.3	2.1
Sweden	298	5.1	6.6	0.6	2.8	238	3.6	4.5	0.4	2.5
U.K.	1757	4.8	6.2	0.6	2.1	1330	3.2	4.1	0.4	1.7
EU	10 140	4.4	5.7	0.5	2.0	8102	2.9	3.7	0.3	2.0

†ASR (W), age-standardised rate (world population) per 100 0000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Table 18. *Estimated incidence and recorded mortality from thyroid cancer in European Union countries in 1990, by sex*

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
		Males, incidence 1990					Females, incidence 1990			
Austria	88	1.8	2.5	0.2	0.7	242	4.0	5.1	0.4	1.2
Belgium	127	1.9	2.6	0.2	0.6	152	1.8	2.5	0.2	0.8
Denmark	22	0.6	0.8	0.1	0.3	75	1.9	2.5	0.2	0.8
Finland	48	1.5	2.1	0.2	0.6	210	6.1	7.5	0.6	2.4
France	604	1.7	2.3	0.2	0.5	872	1.9	2.6	0.2	1.0
Germany	1115	2.1	2.9	0.2	0.8	1722	2.4	3.3	0.3	1.0
Greece	28	0.4	0.6	0.0	0.2	125	1.5	2.0	0.2	1.0
Ireland	20	0.9	1.4	0.1	0.4	30	1.3	1.8	0.2	0.6
Italy	410	1.1	1.5	0.1	0.4	1652	3.6	4.9	0.4	1.8
Luxembourg	5	1.9	2.8	0.2	0.8	7	2.0	3.0	0.3	1.1
Netherlands	82	0.9	1.1	0.1	0.3	218	2.2	2.7	0.2	0.9
Portugal	38	0.7	0.9	0.1	0.3	166	2.2	3.0	0.2	1.3
Spain	160	0.7	0.9	0.1	0.3	628	2.2	3.0	0.2	1.4
Sweden	82	1.3	1.7	0.1	0.5	220	3.4	4.3	0.3	1.2
U.K.	284	0.7	1.0	0.1	0.2	703	1.7	2.1	0.2	0.6
EU	3113	1.3	1.8	0.1	0.4	7022	2.4	3.3	0.3	1.0
		Males, mortality 1990					Females, mortality 1990			
Austria	27	0.5	0.7	0.0	0.3	77	0.8	1.2	0.1	0.8
Belgium	38	0.5	0.7	0.1	0.2	60	0.5	0.8	0.1	0.5
Denmark	11	0.3	0.4	0.0	0.1	25	0.4	0.7	0.0	0.3
Finland	15	0.5	0.7	0.1	0.3	37	0.7	1.0	0.1	0.8
France	177	0.4	0.6	0.1	0.2	326	0.5	0.8	0.1	0.6
Germany	291	0.5	0.8	0.1	0.3	687	0.7	1.0	0.1	0.7
Greece	13	0.2	0.2	0.0	0.1	34	0.3	0.5	0.0	0.5
Ireland	8	0.4	0.5	0.1	0.2	15	0.4	0.7	0.0	0.5
Italy	214	0.5	0.7	0.1	0.3	447	0.7	1.1	0.1	0.7
Luxembourg	2	0.8	1.1	0.1	0.4	2	0.4	0.7	0.1	0.5
Netherlands	30	0.3	0.4	0.0	0.2	79	0.5	0.8	0.1	0.5
Portugal	29	0.4	0.6	0.1	0.3	57	0.5	0.8	0.1	0.7
Spain	93	0.3	0.5	0.0	0.2	164	0.4	0.6	0.0	0.6
Sweden	29	0.3	0.5	0.0	0.3	55	0.5	0.7	0.1	0.6
U.K.	101	0.2	0.3	0.0	0.1	242	0.4	0.5	0.0	0.3
EU	1078	0.4	0.6	0.0	0.2	2307	0.6	0.8	0.1	0.6

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Table 19. *Estimated incidence and recorded mortality from non-Hodgkin's lymphoma in European Union countries in 1990, by sex*

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	400	7.9	11.0	0.9	3.0	413	5.4	7.6	0.6	2.5
Belgium	477	6.9	9.6	0.8	2.2	397	4.2	5.9	0.5	2.1
Denmark	354	9.6	13.1	1.1	3.5	304	6.3	8.9	0.7	2.4
Finland	318	10.2	14.3	1.1	3.2	345	7.6	10.7	0.9	2.6
France	3688	9.5	13.2	1.0	3.1	3098	5.7	8.1	0.6	3.6
Germany	4422	8.3	11.5	0.9	3.0	4171	5.1	7.1	0.6	2.5
Greece	376	5.7	7.3	0.6	2.4	236	3.0	3.9	0.3	2.0
Ireland	186	9.3	12.3	1.1	3.5	179	7.9	10.7	0.9	3.5
Italy	4703	12.3	16.2	1.4	4.1	3545	7.3	9.8	0.8	3.9
Luxembourg	24	9.0	13.0	1.0	3.1	23	6.1	9.0	0.7	3.3
Netherlands	1004	10.7	14.6	1.2	3.4	852	7.0	9.7	0.8	3.2
Portugal	546	9.5	12.2	1.0	4.0	404	5.6	7.3	0.6	3.2
Spain	2305	9.7	12.5	1.0	3.6	1642	5.6	7.4	0.6	3.6
Sweden	737	10.7	14.9	1.2	3.9	592	6.8	9.6	0.8	3.0
U.K.	3618	9.0	12.4	1.0	3.1	3314	6.3	8.8	0.7	2.8
EU	23 158	9.5	12.8	1.0	3.3	19 515	5.9	8.1	0.7	3.0
	Males, mortality 1990					Females, mortality 1990				
Austria	207	3.8	5.6	0.4	2.1	212	2.2	3.4	0.3	2.2
Belgium	223	3.0	4.5	0.3	1.4	200	2.0	2.9	0.2	1.7
Denmark	189	4.7	6.8	0.6	2.4	153	2.8	4.1	0.3	2.1
Finland	179	5.4	8.2	0.6	3.5	228	4.3	6.4	0.5	4.8
France	1657	4.0	5.8	0.4	2.0	1458	2.4	3.5	0.2	2.7
Germany	2014	3.6	5.2	0.4	2.0	2098	2.2	3.3	0.3	2.1
Greece	135	1.7	2.5	0.2	1.1	92	1.0	1.4	0.1	1.2
Ireland	106	4.9	7.1	0.6	2.8	87	3.7	5.2	0.5	2.7
Italy	1781	4.3	6.0	0.5	2.1	1538	2.6	3.8	0.3	2.6
Luxembourg	10	3.7	5.6	0.4	1.9	12	2.4	3.8	0.2	2.7
Netherlands	489	4.8	7.2	0.6	2.5	482	3.3	5.0	0.4	3.1
Portugal	186	3.1	4.1	0.4	1.8	157	1.9	2.6	0.2	2.0
Spain	896	3.5	4.8	0.4	1.9	678	2.0	2.8	0.2	2.3
Sweden	391	5.2	7.5	0.6	3.7	304	2.8	4.2	0.3	3.2
U.K.	2159	5.0	7.3	0.6	2.6	1887	3.1	4.5	0.3	2.4
EU	10 622	4.0	5.8	0.5	2.1	9586	2.5	3.6	0.3	2.4

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Table 20. Estimated incidence and recorded mortality from Hodgkin's disease in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
		Males, incidence 1990					Females, incidence 1990			
Austria	92	2.1	2.4	0.2	1.3	87	1.7	1.9	0.1	0.8
Belgium	112	2.0	2.2	0.2	0.5	68	1.2	1.3	0.1	0.4
Denmark	78	2.5	2.9	0.2	0.7	44	1.4	1.5	0.1	0.4
Finland	60	2.1	2.4	0.2	0.9	47	1.5	1.7	0.1	0.5
France	713	2.3	2.5	0.2	0.6	466	1.5	1.5	0.1	0.5
Germany	1521	3.5	3.7	0.3	1.0	990	2.2	2.3	0.1	0.6
Greece	185	2.9	3.6	0.3	1.2	122	1.9	2.2	0.2	1.00
Ireland	46	2.5	3.0	0.2	0.8	44	2.4	2.4	0.2	0.9
Italy	925	2.8	3.1	0.2	0.8	620	1.7	1.9	0.2	0.7
Luxembourg	5	2.2	2.3	0.2	0.8	3	1.6	1.5	0.1	0.4
Netherlands	205	2.4	2.6	0.2	0.7	137	1.6	1.7	0.1	0.5
Portugal	107	2.0	2.2	0.2	0.8	60	1.0	1.1	0.1	0.5
Spain	548	2.5	2.8	0.2	0.9	295	1.2	1.4	0.1	0.7
Sweden	101	2.0	2.2	0.2	0.6	73	1.4	1.5	0.1	0.3
U.K.	787	2.4	2.7	0.2	0.7	555	1.7	1.7	0.1	0.5
EU	5485	2.7	3.0	0.2	0.8	3611	1.7	1.8	0.1	0.6
		Males, mortality 1990					Females, mortality 1990			
Austria	63	1.3	1.7	0.1	0.7	66	0.7	1.0	0.1	0.7
Belgium	43	0.6	0.8	0.1	0.3	32	0.4	0.5	0.0	0.3
Denmark	37	1.1	1.3	0.1	0.5	18	0.4	0.6	0.1	0.3
Finland	27	0.8	1.2	0.1	0.5	16	0.3	0.5	0.0	0.3
France	228	0.6	0.8	0.1	0.3	109	0.2	0.3	0.0	0.2
Germany	425	0.8	1.1	0.1	0.4	410	0.5	0.7	0.1	0.4
Greece	96	1.3	1.8	0.1	0.8	53	0.6	0.8	0.1	0.7
Ireland	20	1.1	1.3	0.1	0.5	5	0.2	0.3	0.0	0.2
Italy	339	0.9	1.1	0.1	0.4	228	0.5	0.7	0.1	0.4
Luxembourg	1	0.4	0.5	0.0	0.2	2	0.8	1.0	0.1	0.7
Netherlands	73	0.8	1.0	0.1	0.4	64	0.5	0.7	0.0	0.4
Portugal	28	0.5	0.6	0.0	0.3	23	0.3	0.4	0.0	0.3
Spain	198	0.8	1.0	0.1	0.4	117	0.4	0.5	0.0	0.4
Sweden	22	0.3	0.4	0.0	0.2	11	0.1	0.2	0.0	0.1
U.K.	236	0.7	0.8	0.1	0.3	189	0.4	0.5	0.0	0.2
EU	1836	0.8	1.0	0.1	0.4	1343	0.4	0.6	0.0	0.3

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Table 21. Estimated incidence and recorded mortality from multiple myeloma in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
	Males, incidence 1990					Females, incidence 1990				
Austria	143	2.7	4.0	0.3	0.9	180	2.0	3.0	0.3	1.0
Belgium	190	2.5	3.8	0.3	0.9	239	2.2	3.3	0.3	1.3
Denmark	127	3.1	4.6	0.4	1.2	114	2.2	3.2	0.3	0.9
Finland	109	3.3	5.0	0.4	0.9	129	2.4	3.6	0.3	1.2
France	1051	2.4	3.7	0.3	0.9	1120	1.8	2.7	0.2	1.3
Germany	1528	2.7	4.0	0.3	1.0	1734	1.9	2.8	0.2	1.1
Greece	113	1.4	2.1	0.2	0.7	108	1.1	1.6	0.2	0.9
Ireland	91	4.0	6.2	0.5	1.7	67	2.4	3.6	0.3	1.3
Italy	1059	2.3	3.5	0.3	0.9	1071	1.7	2.6	0.2	1.2
Luxembourg	7	2.6	3.9	0.3	1.0	8	1.8	2.9	0.2	5.4
Netherlands	341	3.4	5.1	0.4	1.1	309	2.2	3.3	0.3	1.2
Portugal	118	1.8	2.6	0.2	0.9	119	1.3	1.9	0.2	0.9
Spain	554	1.9	2.9	0.2	0.9	537	1.4	2.1	0.2	1.2
Sweden	300	3.7	5.7	0.4	1.6	244	2.3	3.5	0.3	1.2
U.K.	1481	3.2	4.9	0.4	1.3	1487	2.3	3.4	0.3	1.2
EU	7212	2.6	3.9	0.3	0.9	7466	1.9	2.8	0.2	1.1
	Males, mortality 1990					Females, mortality 1990				
Austria	89	1.6	2.4	0.2	0.9	130	1.3	2.0	0.1	1.3
Belgium	152	1.9	3.0	0.2	1.0	205	1.7	2.7	0.2	1.8
Denmark	115	2.6	4.1	0.3	1.5	109	1.8	2.8	0.2	1.5
Finland	70	2.0	3.2	0.2	1.4	117	2.1	3.3	0.3	2.5
France	830	1.8	2.8	0.2	1.0	956	1.3	2.1	0.1	1.8
Germany	1256	2.2	3.3	0.3	1.2	1551	1.5	2.4	0.2	1.5
Greece	91	1.1	1.6	0.1	0.8	93	0.9	1.4	0.1	1.3
Ireland	90	4.1	6.2	0.5	2.3	52	1.8	2.8	0.3	1.6
Italy	961	2.1	3.2	0.2	1.1	992	1.5	2.3	0.2	1.7
Luxembourg	6	2.1	3.3	0.2	1.1	7	1.6	2.4	0.2	1.6
Netherlands	288	2.8	4.3	0.3	1.4	323	2.0	3.2	0.2	2.1
Portugal	115	1.7	2.5	0.2	1.1	111	1.2	1.8	0.2	1.4
Spain	513	1.8	2.7	0.2	1.1	468	1.2	1.8	0.1	1.6
Sweden	255	3.1	4.8	0.4	2.4	238	1.9	3.0	0.2	2.5
U.K.	1148	2.4	3.7	0.3	1.4	1160	1.7	2.6	0.2	1.5
EU	5979	2.1	3.2	0.2	1.2	6512	1.5	2.3	0.2	1.6

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

Table 22. Estimated incidence and recorded mortality from leukaemia in European Union countries in 1990, by sex

	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All	No./ Year	ASR (W)†	ASR (E)‡	CR*	% All
		Males, incidence 1990					Females, incidence 1990			
Austria	391	7.9	10.5	0.7	2.8	387	5.3	6.9	0.5	2.4
Belgium	571	8.3	11.4	0.8	2.7	489	5.3	7.0	0.5	2.7
Denmark	337	9.4	12.5	0.0	3.1	260	5.8	7.4	0.6	2.0
Finland	194	6.8	8.7	0.6	2.5	179	4.9	5.8	0.4	1.7
France	3162	8.3	11.1	0.8	2.7	2639	5.3	6.8	0.5	3.0
Germany	4138	8.3	11.0	0.8	2.9	3955	5.3	6.8	0.5	2.4
Greece	562	8.1	10.5	0.8	3.2	395	5.4	6.5	0.5	3.0
Ireland	187	8.6	12.1	0.8	3.5	131	5.0	6.8	0.4	2.5
Italy	3488	9.4	12.1	0.9	2.7	2742	6.1	7.4	0.5	2.7
Luxembourg	19	8.5	10.8	0.7	2.9	19	5.4	7.3	0.5	2.7
Netherlands	688	7.7	10.1	0.8	2.5	512	4.8	5.9	0.4	2.1
Portugal	439	8.1	9.6	0.7	2.8	378	6.4	6.9	0.5	2.7
Spain	1798	8.1	9.7	0.7	2.5	1433	5.5	6.4	0.5	2.8
Sweden	554	8.4	11.0	0.8	2.5	444	5.9	7.4	0.6	2.0
U.K.	3067	7.8	10.2	0.8	2.6	2598	5.1	6.5	0.5	2.2
EU	19 595	8.3	10.8	0.8	2.7	16 561	5.5	6.8	0.5	2.5
		Males, mortality 1990					Females, mortality 1990			
Austria	292	5.3	7.7	0.5	3.0	295	3.7	5.2	0.4	3.1
Belgium	457	6.1	9.0	0.6	2.9	405	3.7	5.4	0.4	3.5
Denmark	270	6.8	9.6	0.7	3.5	193	3.6	5.0	0.3	2.7
Finland	158	4.9	7.2	0.5	3.1	128	2.8	3.8	0.3	2.7
France	2515	6.0	8.6	0.6	3.0	2232	3.8	5.3	0.4	4.2
Germany	3251	5.8	8.4	0.6	3.2	3212	3.6	5.1	0.4	3.1
Greece	436	5.4	7.7	0.5	3.6	265	3.2	4.1	0.3	3.6
Ireland	139	6.2	9.2	0.5	3.6	101	3.6	5.1	0.3	3.1
Italy	2652	6.3	8.9	0.6	3.1	2178	4.0	5.4	0.4	3.6
Luxembourg	22	8.4	12.1	1.0	4.2	11	1.8	3.2	0.1	2.5
Netherlands	555	5.4	8.0	0.5	2.8	455	3.3	4.7	0.3	3.0
Portugal	300	4.8	6.4	0.5	2.9	276	3.7	4.7	0.3	3.5
Spain	1291	5.0	6.8	0.5	2.7	1106	3.6	4.6	0.3	3.7
Sweden	360	4.9	6.8	0.5	3.4	298	3.0	4.2	0.3	3.1
U.K.	2082	4.9	6.9	0.5	2.5	1799	3.2	4.3	0.3	2.3
EU	14 780	5.6	8.0	0.6	3.0	12 954	3.6	4.9	0.3	3.2

†ASR (W), age-standardised rate (world population) per 100 000.
‡ASR (E), age-standardised rate (European population) per 100 000.
*CR, cumulative rate 0–74 years (as per cent).

in the Nordic countries, where there is a long tradition of anticancer research based on data from cancer registries, including numerous epidemiological studies of risk factors, screening evaluation studies and studies of cancer survival. The value of population-based cancer registry data in clinical research, including survival studies, and in the evaluation of national cancer control policies is also important. There is increasing interest in the potential of cancer registries in Europe, notably in countries in which there was little registry activity in the past. For example, national registration systems are under development in Greece and Portugal, and all Länder (regions) in Germany are required by law to establish population-based cancer registries by 1999. The European Network of Cancer Registries aims to support such developments, to ensure that the data collected by all registries in Europe are comparable. Ultimately, the value of these data depends on their use. Registries require the means to collect accurate data, but support for research and a cancer control context are also required.

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