Original article

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Measuring progress against cancer in Europe: has the 15% decline targeted for 2000 come about?

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Background: Against a background of increasing cancer rates in the mid-1980s, *Europe Against Cancer* launched an ambitious programme aiming to reduce cancer mortality by 15% by the year 2000. A programme of activities and research, focussing on three major themes [prevention (particularly tobacco control), screening, and education and training], was developed together with the *European Code Against Cancer*.

Methods: To evaluate the outcome of the programme, all cancer mortality data were abstracted for each member state of the European Union (EU) until the most recent year available. For each gender group in each member state, age-specific rates were estimated for 2000. For each country–gender grouping, the standardized mortality rate (SMR) and expected numbers of deaths in 2000 were calculated based on the age-specific rates for 1985 and the population estimates for 2000. The ratio of the SMR in 2000 to that of 1985, was used as the measure to compare mortality rates.

Results: In 1985, there were 850 194 cancer deaths in the EU. Based solely on demographic considerations, this number was expected to rise to 1 033 083 in the year 2000. Between 1985 and 2000, the number of cancer deaths increased in both men (+12%) and women (+9%). The target of a 15% reduction in the expected numbers of cancer deaths in the EU was not met, although the 10% reduction in number of deaths expected in men and 8% in women, along with a 11% reduction in risk of cancer death in men and a 10% reduction in women, was noteworthy. Only Austria and Finland achieved the 15% reductions in deaths in both men and women. The UK and Luxembourg (where the small population and annual number of deaths make interpretation difficult) came close to meeting these targets, as did Italy. Portugal and Greece had the poorest performance, with increases in each gender group.

Conclusions: Cancer deaths in the EU were expected to rise from 850 194 in 1985 to 1 033 083 in 2000. It is estimated that there will be 940 510 cancer deaths that year, due to the decline in risk observed since 1985. The Europe Against Cancer programme appears to have been associated with the avoidance of 92 573 cancer deaths in the year 2000. With few exceptions, most countries are experiencing declining trends in cancer death rates, which seem set to continue, at least in the near future. Renewed tobacco control efforts are clearly needed for women, and there is a strong case for the introduction of organized breast and cervix screening programmes in all member states. Continuing to emphasize prevention within cancer control will help to promote the continuing decline in death rates in the future.

Key words: cancer, epidemiology, Europe, mortality, survival

Introduction

The Europe Against Cancer programme was launched on the initiative of the heads of state or government of the (then) European Community meeting in Milan in June 1985. Acting on proposals from the European Commission, and following favourable opinion from the European Parliament, the council adopted three basic texts defining the overall framework [1–3]. In 1986, the Commission prepared a detailed plan of action for the period 1987–1989 [4], which constituted the first stage of the programme, the objective of which was to reduce the expected number of deaths due to cancer by 15% (from 1 000 000 to 850 000) by the year 2000.

To achieve this ambitious goal the European Commission adopted a 'partnership approach', aimed at involving everyone concerned with the fight against cancer at national level. The partners were: (i) the Committee of Cancer Experts ('the scientific soul of the programme'); (ii) the cancer associations and leagues, and anti-smoking organizations of the European Community ('the spearhead of the programme'); (iii) producers of television medical programmes who help spread the message of cancer prevention; (iv) representatives of general practitioners, who play a central role in early detection and screening for cancer; and (v) senior

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officials in the Health, Education and Research Ministries. This European Commission programme was formulated by a High Level Cancer Experts Committee and has seen four 5-year cancer plans evaluated and introduced. The activities of the Committee focussed on three areas: prevention, screening, and education and training. At around the same time, the United States National Cancer Institute promoted a similar goal.

Comparison of cancer mortality rates between countries, and even over time within countries, is not without potential difficulties which must be kept in mind when interpreting the results. To be counted as a death from a particular cancer, at least three independent steps must take place: the cancer must (i) be diagnosed correctly; (ii) be entered onto the death certificate correctly; and (iii) be correctly selected as the underlying cause of death. This process does have inherent potential errors, although these vary according to different types of cancer. However, the time period covered by this study is relatively short and unlikely to be greatly affected by such variations. In addition, one impact of the European Union (EU) has been the coordination of efforts to have a closer standardization of death certification practices within the EU.

In order to evaluate the effect of the Europe Against Cancer programme on its target of reducing cancer mortality in Europe by 15% by the year 2000, all mortality data were assembled from all member states of the EU. Sweden, Austria and Finland were not member states when the target was initially developed, but have been included for completeness since many of the programmes launched were taken up by applicant member states.

Methods

Mortality data from all forms of cancer have been extracted from the World Health Organization Mortality database from 1950 onwards for current member states of the EU. Not all countries had data available for the same period of time, with data available until 1998 in Austria, Germany, Portugal and the UK, but with Belgium having no data available since 1994. Data were available until 1996 in Denmark, Finland, Ireland, Italy and Sweden, and until 1997 in France, Greece, Luxembourg, The Netherlands and Spain.

The mean numbers of deaths in each age class, from all forms of cancer, and the five leading forms of cancer (lung, stomach, colorectum, breast and prostate) were calculated over the period 1984–1986. These numbers are frequently referred to as the number of deaths in 1985. In all calculations, the baseline year for the SMR was chosen to be 1991 since this was the census year in most countries and, hence, the population numbers would be more accurately known [5].

The SMR for 2000 was estimated in two ways. First, using a linear regression of the SMR for the last 10 years of data availability and predicting the value for 2000. For a country with data available until 1998, the SMRs from 1989–1998 were used and the prediction was based on the linear model. Secondly, a generalized additive model based upon a smoothed cubic spline with six degrees of freedom (*df*) was fitted to all available data on SMRs. For most countries this covered the years 1950 until 1997/1998. This statistical model is a flexible procedure for modelling non-linear trends. The estimated value for 2000 is a linear prediction based on this model. The number of degrees of freedom controls the smoothness of the relationship, and six was chosen to ensure that the predictions were based upon the relatively more recent data. The predictions based on 5–8 *df* were all similar. The fit of the model was assessed graphically.

The age-specific population for 2000 in each gender group in each member state was estimated using both methods, with similar results, and the linear regression-predicted value was used. The 1985 (i.e. 1984–1986) age-, sex- and country-specific mortality rates were applied to these population estimates to obtain the expected number of cancer deaths assuming nothing other than the effect of demographic changes taking place.

The age-, sex- and country-specific rates of deaths for 2000 were estimated using the statistical methods outlined above. After evaluation, it was clear that the spline method, with 6 *df*, was the most appropriate. This was based on the similarity of the estimates of the methods and took into consideration that the spline would underestimate decreases and increases. These rates were then combined with the 2000 population by age group to give an estimate of the total number of deaths in 2000. The total number of deaths in the EU in 2000 was calculated by summing the predicted deaths in each country. The SMR for the EU in 1985 and 2000 was obtained using a weighted average of the SMR in all the countries, using the 1985 deaths in each country as the weights.

The SMR was calculated (referent 1985), as was the relative risk (RR), as the ratio of the SMR in 2000 to the SMR in 1985.

Confidence intervals for the estimated deaths in 2000, the SMR in 2000 and the RR in 2000 compared with 1985 were obtained using bootstrap methods. As the distribution of the bootstrap estimates were symmetric the confidence intervals reported were calculated using a normal distribution. these were similar to the bias corrected percentile limits. Both non-parametric and parametric bootstraps procedures were carried out with the results for the parametric bootstrap reported. For each country, age, year and sex the mortality rate was simulated from a Poisson distribution using the observed number of deaths and the observed populations. No bootstrapping was carried out on the population estimations. The spline model was fitted to the simulated data and projections obtained. The bootstrap variances were calculated from 1000 simulations.

Results

All forms of cancer

In the EU, the average number of cancer deaths in men in the mid-1980s (1984–1986) was 470012 (Table 1). This was expected to rise to 582165 in 2000 for essentially demographic reasons [the application of 1985 age-specific mortality rates to the (ageing) population of 2000]. In 2000, there were an estimated 526427 deaths, which represents 55738 deaths that had been avoided (Table 1). Overall, the number of cancer deaths observed, compared with those expected, in 2000 was reduced by 10% (RR = 0.90) in the EU overall, with the greatest reductions found in Luxembourg (–24%), Finland (–17%), the UK (–16%), Austria (–15%), The Netherlands (–14%) and Italy (–13%). Increases were present in Portugal (+17%) and Spain (+11%), with few alterations in Greece (+1%), Ireland (no change) and Denmark (–2%). For the same period, the risk of death due to cancer in men was reduced by 11% (RR = 0.89) in the EU overall, with the greatest reductions present in Luxembourg (–27%), Finland (–19%), the UK (–18%), Austria (–16%) and Italy (–13%). Increases were seen in Portugal (+16%) and Spain (+11%), with little alteration in risk in Greece (0%), Ireland (–1%) and Denmark (–2%) (Table 1).

Favourable downward trends have been established in many countries, which seem set to continue into the future: the exceptions to this are Portugal, Spain, Denmark, Ireland and Sweden (Figure 1).

Table 1. All cancers: men

Country	Deaths 1985	Projected deaths 2000	Ratio proj. 2000	Last year	Deaths last year	Ratio LY85	Projected deaths last year	Last year ratio	Estimated deaths 2000	Deaths 2000 LCL	Deaths 2000 UCL	Ratio 2000	SMR 1985	SMR 2000	SMR 2000 LCL	SMR 2000 UCL	RR 2000	RR LCL	RR UCL	SMR last year	RR last year
Austria	9382	11 343	1.21	1999	9610	1.02	11 234	1.17	9620	9483	9758	0.85	1.01	0.85	0.83	0.87	0.84	0.83	0.86	0.87	0.86
Belgium	15 687	18 171	1.16	1995	16 271	1.04	17 422	1.07	16 557	16 184	16 931	0.91	1.07	0.95	0.92	0.98	0.89	0.86	0.91	0.99	0.92
Denmark	7577	8201	1.08	1996	7791	1.03	8036	1.03	8026	7837	8216	0.98	1.05	1.03	0.99	1.06	0.98	0.95	1.01	1.02	0.97
Finland	5006	6527	1.30	1996	5372	1.07	6144	1.14	5440	5278	5601	0.83	1.13	0.91	0.88	0.95	0.81	0.78	0.83	0.98	0.86
France	80 074	100 820	1.26	1997	86 655	1.08	96 890	1.12	88 380	87 834	88 926	0.88	1.03	0.90	0.89	0.90	0.87	0.87	0.88	0.92	0.90
Germany	97 710	120 428	1.23	1998	108 830	1.11	117 543	1.08	108 969	108 085	109 852	0.90	1.00	0.88	0.87	0.89	0.88	0.87	0.89	0.92	0.91
Greece	11 007	14 296	1.30	1998	13 781	1.25	13 823	1.00	14 393	14 180	14 606	1.01	0.99	0.99	0.97	1.01	1.00	0.98	1.02	0.98	0.99
Ireland	3692	4189	1.13	1996	3987	1.08	4044	1.01	4171	4038	4305	1.00	0.99	0.98	0.93	1.02	0.99	0.95	1.02	0.97	0.98
Italy	78 385	102 471	1.31	1997	87 953	1.12	97 342	1.11	89 625	89 061	90 189	0.87	1.01	0.86	0.85	0.87	0.85	0.84	0.86	0.90	0.89
Luxembourg	542	664	1.23	1997	499	0.92	639	1.28	504	437	570	0.76	1.14	0.84	0.70	0.97	0.73	0.63	0.83	0.88	0.77
The Netherlands	19 343	24 001	1.24	1997	20 420	1.06	23 114	1.13	20 760	20 491	21 030	0.86	1.04	0.90	0.88	0.91	0.87	0.85	0.88	0.92	0.89
Portugal	8914	11 006	1.23	1998	12 255	1.37	10 736	0.88	12 854	12 663	13 044	1.17	0.99	1.15	1.12	1.18	1.16	1.14	1.18	1.12	1.12
Spain	40 189	53 425	1.33	1997	55 255	1.37	50 630	0.92	59 332	58 904	59 760	1.11	0.93	1.03	1.02	1.05	1.11	1.10	1.12	1.01	1.09
Sweden	10 282	11 740	1.14	1996	10 837	1.05	11 367	1.05	10 978	10 755	11 202	0.94	1.02	0.94	0.91	0.97	0.93	0.90	0.95	0.96	0.95
UK	82 222	94 883	1.15	1998	80 439	0.98	93 457	1.16	79 353	78 910	79 797	0.84	1.04	0.85	0.85	0.86	0.82	0.82	0.83	0.89	0.85
EU	470 012	582 165	1.24	1996	519 352	1.10	562 421	1.08	526 427	524 933	527 920	0.90	1.02	0.90	0.89	0.91	0.89	0.88	0.89	0.95	0.93

'Deaths 1985', mean number of deaths in 1984/1985/1986; 'Projected deaths 2000', projected number of deaths in 2000 using age-standardized rates from 1984/1985/1986; 'Ratio proj. 2000', ratio of projected deaths in 2000 to mean number of deaths in 1984/1985/1986; 'Last year', last year for which complete data are available; 'Deaths last year', number of deaths in last year; 'Ratio LY85', ratio of number of deaths in the last year to the number of deaths in 1985; 'Projected deaths last year', projected number of deaths in last year using age-standardized rates from 1984/1985/1986; 'Last year ratio', ratio of projected deaths in last year to observed deaths in last year; 'Estimated deaths 2000', estimated number of deaths in 2000; 'Deaths 2000 LCL', lower 95% confidence limit for the estimated number of deaths in 2000; 'Deaths 2000 UCL', upper 95% confidence limit for the estimated number of deaths in 2000; 'Ratio 2000', ratio of estimated number of deaths in 2000 to projected; 'SMR 1985', standardized mortality ratio 1985; 'SMR 2000', standardized mortality ratio 2000; 'SMR 2000 LCL', lower 95% confidence limit for the SMR in 2000; 'SMR 2000 UCL', upper 95% confidence limit for the SMR in 2000; 'RR 2000', relative risk = SMR2000/SMR1985; 'RR LCL', lower 95% confidence limit for the RR; 'RR UCL', upper 95% confidence limit for the RR; 'SMR last year', SMR in the last year available; 'RR last year', SMR last year/ SMR1985.

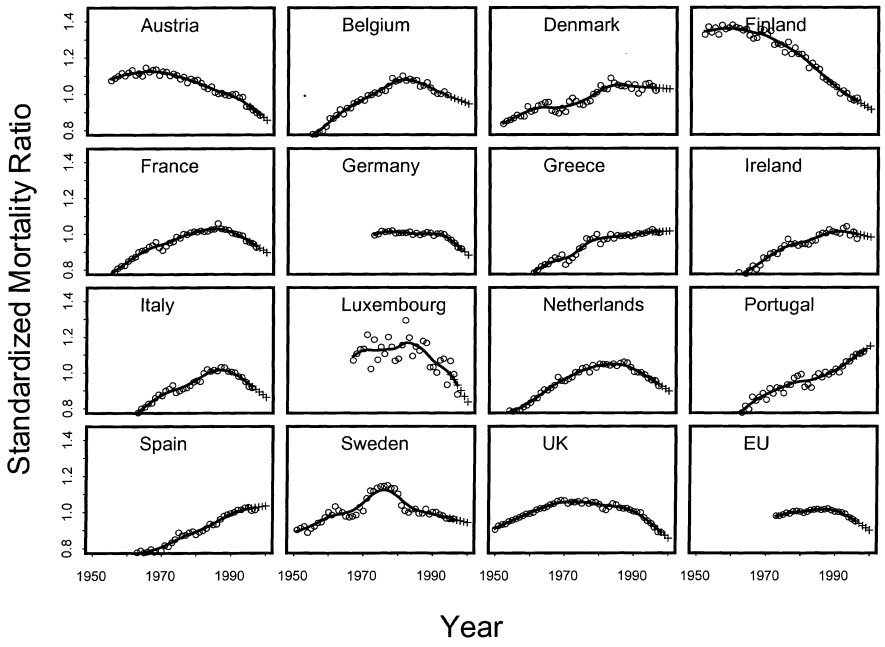

Figure 1. All cancers: men.

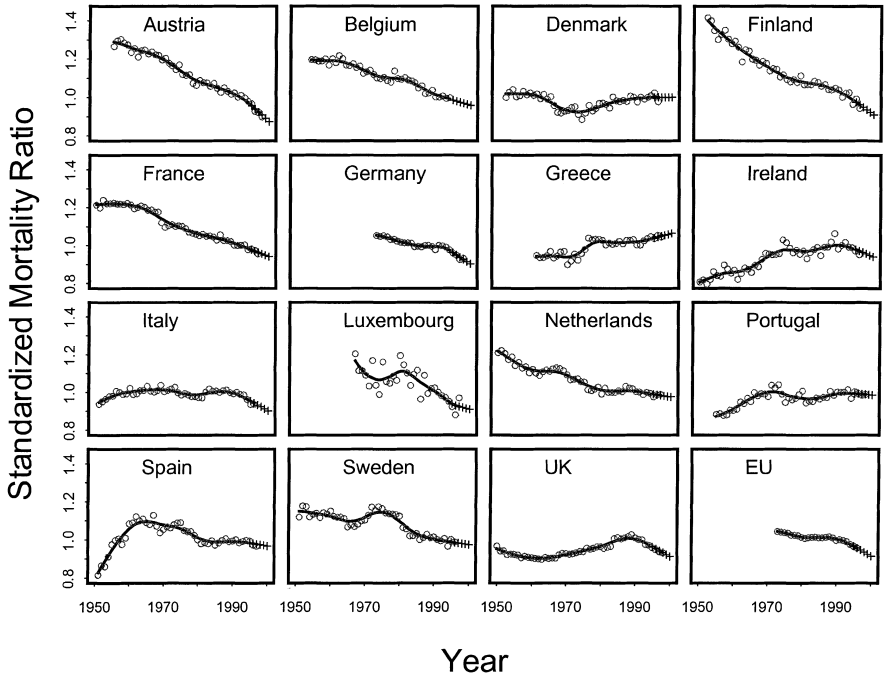

Figure 2. All cancers: women.

The good fit of the generalized additive model to the SMRs can be seen in Figure 1 (and also in subsequent figures). The fit was less good for the smaller countries, particularly Luxembourg.

In women, the average number of cancer deaths around 1985 was 380182 (Table 2). This was expected to rise to 450918 in 2000 for demographic reasons. In 2000, there were an estimated 414083 deaths, which represents 36835 deaths avoided (Table 2). Overall, the number of cancer deaths observed compared with those expected in 2000 was reduced by 8% (RR = 0.92) in the EU overall, with the greatest reductions in Austria (–15%), Finland (–15%), Luxembourg (–13%), the UK (–10%), Italy, France and Germany (–9%). Increases were observed in Greece (+2%) and Portugal (+3%), while no changes were observed in Denmark and Spain (Table 2). The risk of death was reduced by 10% (RR = 0.90) in the EU, with the greatest reductions found in Luxembourg (–18%), Austria (–16%), Finland (–14%), Italy (–11%), the UK (–10%), Germany (–9%) and France (–9%). Increases were observed in Greece (+2%), Portugal (+2%) and Denmark (+2%) (Table 2). Favourable trends in cancer death rates are evident in most countries for women (Figure 2), with few exceptions. The

Table 2. All cancers: women

Country	Deaths 1985	Projected deaths 2000	Ratio proj. 2000	Last year	Deaths last year	Ratio LY85	Projected deaths last year	Last year ratio	Estimated deaths 2000	Deaths 2000 LCL	Deaths 2000 UCL	Ratio 2000	SMR 1985	SMR 2000	SMR 2000 LCL	SMR 2000 UCL	RR 2000	RR LCL	RR UCL	SMR last year	RR last year
Austria	9527	10604	1.11	1999	9100	0.96	10526	1.16	8997	8872	9123	0.85	1.05	0.88	0.86	0.90	0.84	0.82	0.85	0.90	0.86
Belgium	11442	13210	1.15	1995	11903	1.04	12656	1.06	12197	11898	12495	0.92	1.05	0.97	0.94	1.00	0.92	0.90	0.95	1.00	0.95
Denmark	6980	7738	1.11	1996	7425	1.06	7528	1.01	7767	7587	7946	1.00	0.98	1.00	0.97	1.03	1.02	1.00	1.05	0.98	1.00
Finland	4520	5644	1.25	1996	4689	1.04	5355	1.14	4802	4649	4955	0.85	1.06	0.91	0.86	0.95	0.86	0.83	0.89	0.94	0.89
France	51888	63315	1.22	1997	55963	1.08	61142	1.09	57433	56996	57869	0.91	1.03	0.94	0.93	0.95	0.92	0.91	0.92	0.95	0.93
Germany	99113	112481	1.13	1998	103918	1.05	110437	1.06	102475	101689	103261	0.91	1.00	0.90	0.89	0.91	0.91	0.90	0.91	0.93	0.94
Greece	7044	8861	1.26	1998	8652	1.23	8588	0.99	9082	8909	9254	1.02	1.02	1.04	1.01	1.07	1.02	0.99	1.04	1.02	1.00
Ireland	3055	3644	1.19	1996	3402	1.11	3482	1.02	3532	3415	3649	0.97	0.95	0.94	0.90	0.99	0.99	0.96	1.03	0.95	1.00
Italy	54863	71208	1.30	1997	62873	1.15	67957	1.08	64661	64150	65171	0.91	1.01	0.90	0.89	0.91	0.89	0.88	0.90	0.92	0.92
Luxembourg	421	538	1.28	1997	470	1.12	513	1.09	466	403	529	0.87	1.12	0.91	0.77	1.07	0.82	0.70	0.93	0.97	0.87
The Netherlands	13990	17721	1.27	1997	16713	1.19	16986	1.02	17223	17003	17443	0.97	1.01	0.98	0.96	1.00	0.97	0.95	0.98	0.99	0.98
Portugal	7083	8556	1.21	1998	8605	1.21	8376	0.97	8777	8631	8923	1.03	0.96	0.99	0.96	1.01	1.02	1.00	1.04	0.99	1.03
Spain	26547	35199	1.33	1997	33013	1.24	33433	1.01	34844	34498	35190	0.99	0.97	0.97	0.95	0.98	1.00	0.98	1.01	0.97	0.99
Sweden	9171	10698	1.17	1996	9920	1.08	10300	1.04	10155	9946	10364	0.95	1.03	0.97	0.94	1.00	0.94	0.92	0.97	0.99	0.96
UK	74538	81501	1.09	1998	74292	1.00	80452	1.08	73753	73329	74177	0.90	1.01	0.91	0.90	0.92	0.90	0.90	0.91	0.93	0.92
EU	380182	450918	1.19	1996	411867	1.08	437731	1.06	414083	412699	415467	0.92	1.01	0.91	0.91	0.92	0.90	0.90	0.91	0.96	0.95

Column headings defined as in footnotes to Table 1.

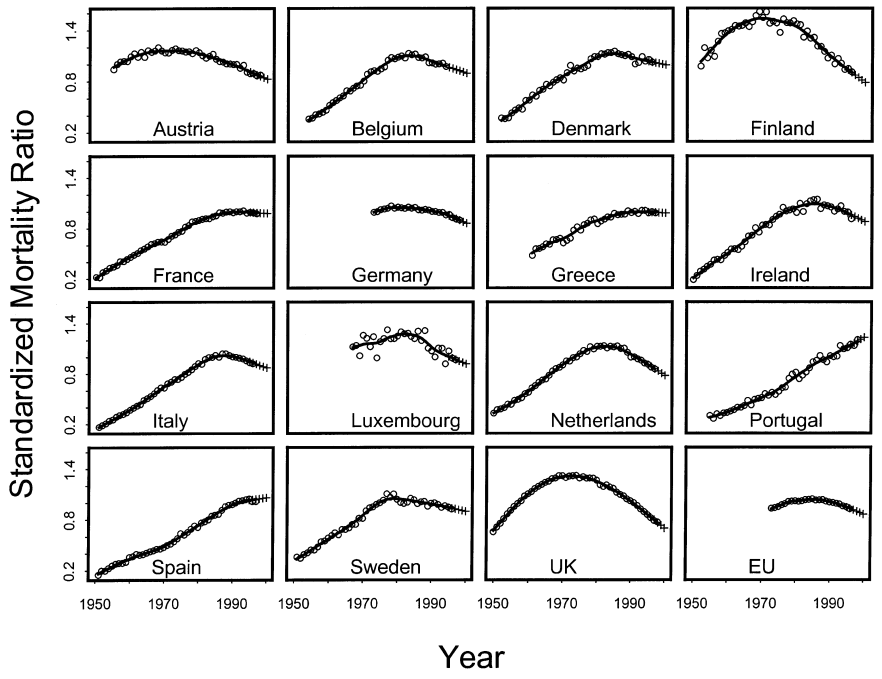

Figure 3. Lung cancer: men.

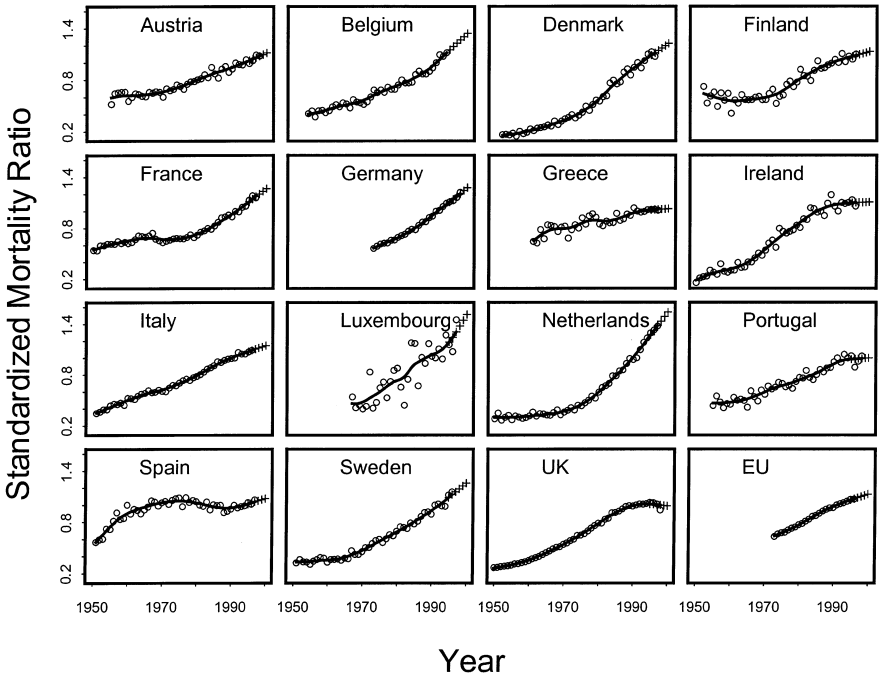

Figure 4. Trends in the risk of dying from cancer in Member States of the European Union, 1950–2000. Lung cancer: women.

declines appear to be very slow in Portugal, Spain and Sweden, and are unfavourable in Greece and Denmark (Figure 1).

Cancer of the lung

A dominant contribution to the overall cancer statistics comes from lung cancer. In men, the number of deaths from lung cancer in 1985 was 134171 (Supplementary data, table 1). This was expected to rise to 163760 in 2000 due to demographic factors. In 2000, there were an estimated 139838 lung cancer deaths, which represents 23922 deaths avoided (Supplementary data, table 1). In the EU overall, the number of lung cancer deaths observed compared with those expected in 2000 was reduced by 15% in men (RR = 0.85) (Supplementary data, table 1), with the greatest reductions in the UK (–38%), Finland (–36%), The Netherlands (–29%), Luxembourg (–24%), Austria (–23%) and Ireland (–22%). The only increases were found in Portugal (+34%), Spain (+23%), France (+2%) and Greece (+1%) (Supplementary data, table 1). The risk of dying from lung cancer in the EU fell by 17%

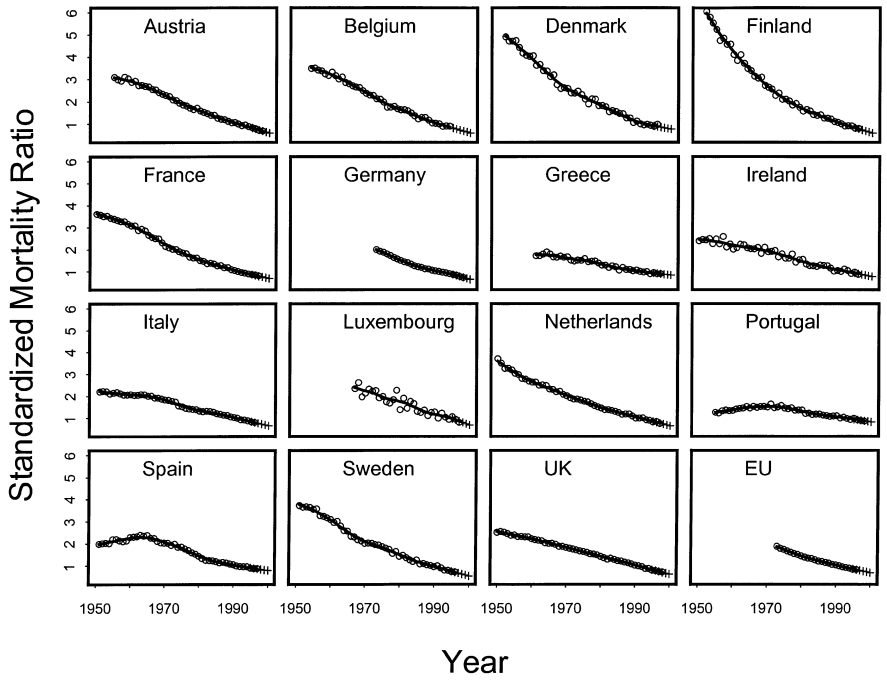

Figure 5. Trends in the risk of dying from cancer in Member States of the European Union, 1950–2000. Stomach cancer: men.

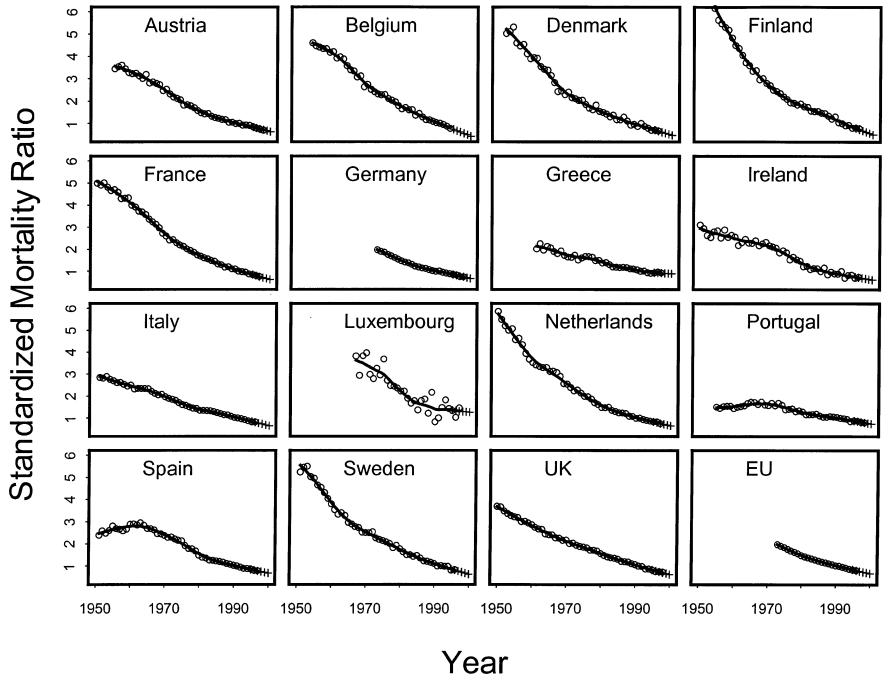

Figure 6. Trends in the risk of dying from cancer in Member States of the European Union, 1950–2000. Stomach cancer: women.

in men (RR = 0.82) (Supplementary data, table 1), with the greatest reductions in the UK (–40%), Finland (–40%), The Netherlands (–30%), Luxembourg (–25%), Ireland (–23%) and Austria (–23%). The only increases were found in Portugal (+31%), Spain (+24%) and France (+3%) (Supplementary data, table 1). Favourable downward trends in the risk of lung cancer death are present in all countries of the EU except France and Greece, but especially in Spain and Portugal (Figure 3).

In women, the number of deaths from lung cancer in the EU in 1985 was 29 948 (Supplementary data, table 2). This total was expected to rise to 33 533 in 2000, although the estimated total number of lung cancer deaths was 44 146, i.e. 10 613 more than expected (Supplementary data, table 2). Overall in the EU, the number of lung cancer deaths observed compared with those expected in 2000 increased by 32% in women (RR = 1.32) (Supplementary data, table 2), with increases evident in each country,

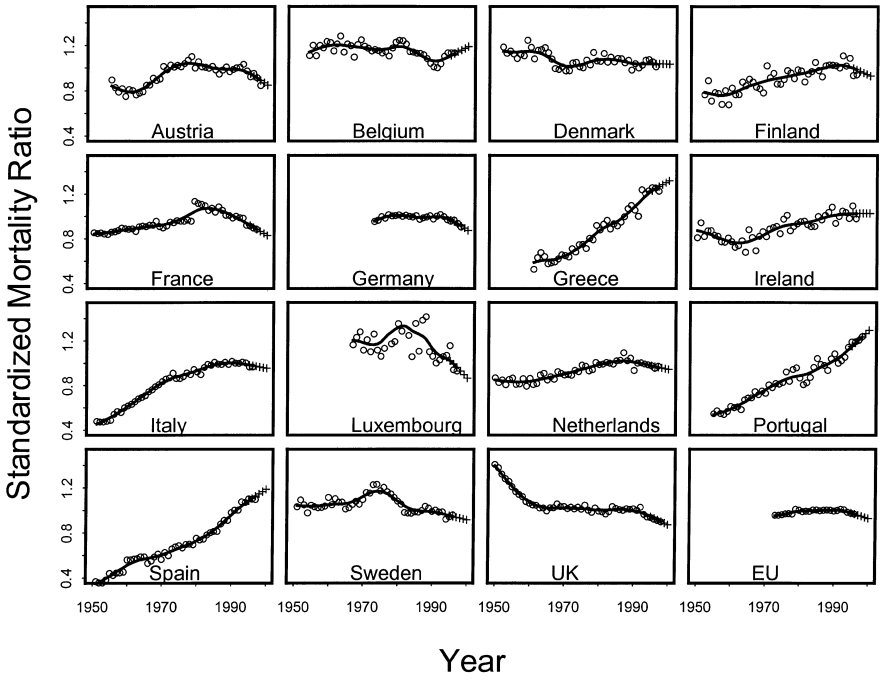

Figure 7. Trends in the risk of dying from cancer in Member States of the European Union, 1950–2000. Colorectal cancer: men.

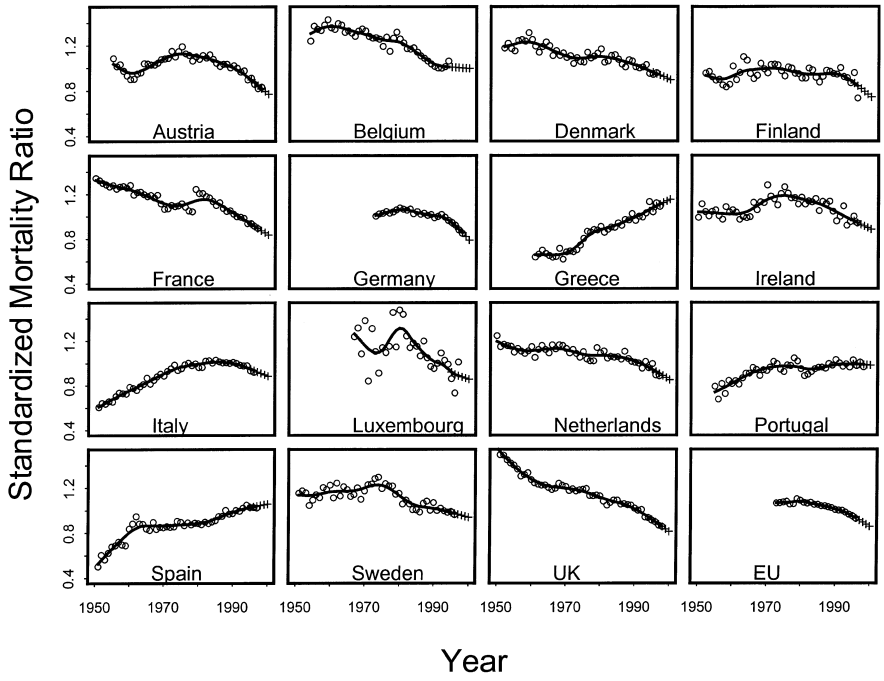

Figure 8. Trends in the risk of dying from cancer in Member States of the European Union, 1950–2000. Colorectal cancer: women.

ranging from +8% in the UK to an astonishing increase of 84% in The Netherlands (Supplementary data, table 2). Overall in the EU, the risk of death from lung cancer in women rose by 29% (RR = 1.29), with increases evident in each country ranging up to an increase of 95% in The Netherlands (Table 2). Only in the UK does it seem that a favourable trend could materialize in the near future, with large increases still occurring in all other countries (Figure 4).

Stomach cancer

In men, there were 42 119 deaths from stomach cancer in the EU in 1985 (Supplementary data, table 3). This total was expected to rise to 52 900 by 2000 for the demographic reasons outlined above. In 2000, it was estimated that there would be 30 879 deaths, which represents 22 021 deaths avoided. Overall in the EU, the number of stomach cancer deaths observed compared with those expected in 2000 was reduced by 42% in men (RR = 0.58) (Sup-

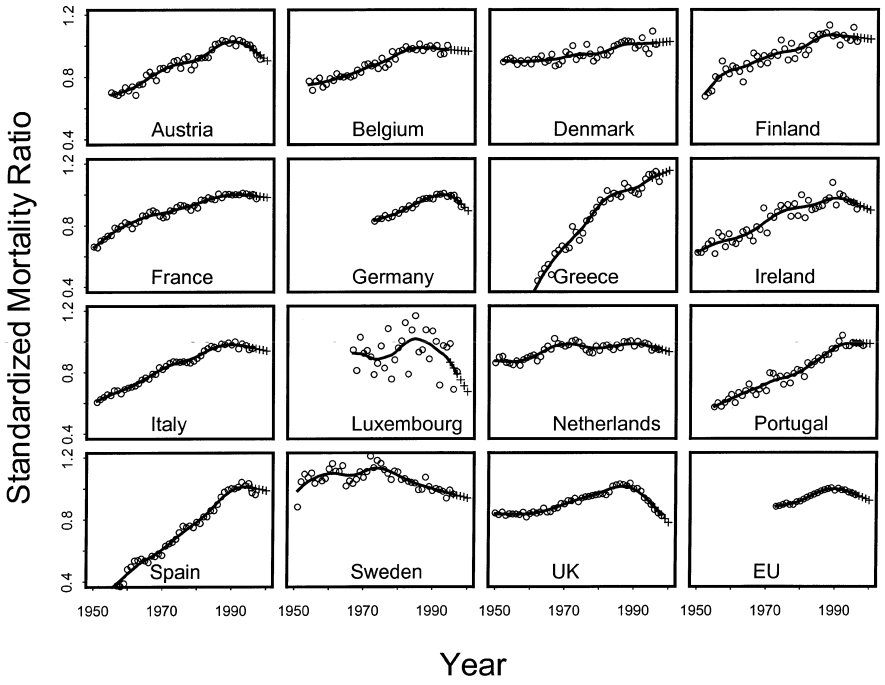

Figure 9. Trends in the risk of dying from cancer in Member States of the European Union, 1950–2000. Breast cancer.

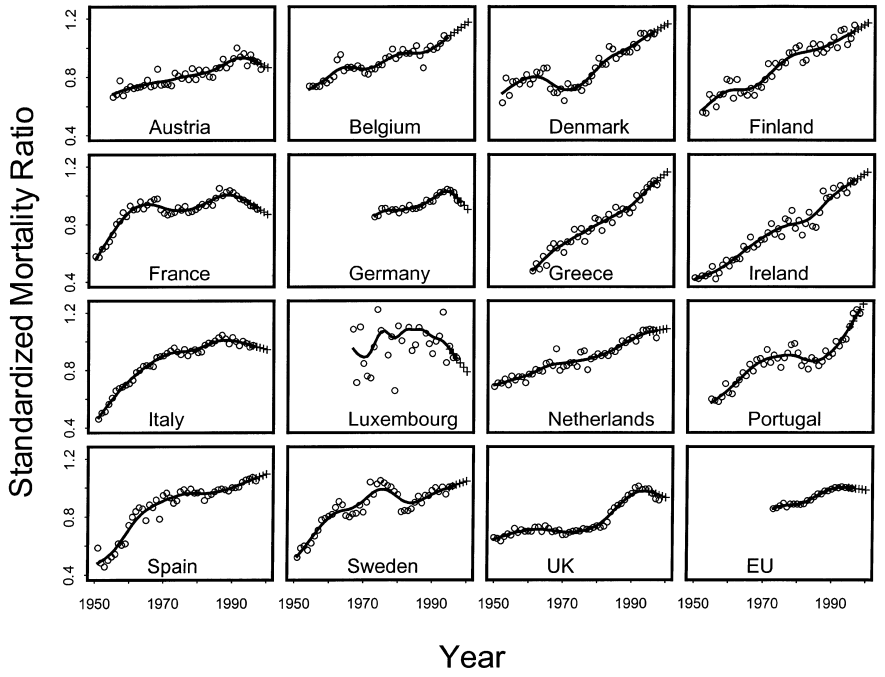

Figure 10. Trends in the risk of dying from cancer in Member States of the European Union, 1950–2000. Prostate cancer.

plementary data, table 3), and the risk of dying from stomach cancer in men fell by 45% (RR = 0.55), with declines found in each member state (Supplementary data, table 3). Favourable downward trends are being observed in each country (Figure 5).

In women, there were 32405 deaths from stomach cancer in 1985 in the EU (Supplementary data, table 4), and this total was expected to rise to 40335 in 2000 for demographic reasons. It is estimated that data for 2000 will reveal 22169 deaths, which represents 18 166 deaths avoided. Overall in the EU, the number of deaths observed compared with that expected in 2000 was reduced by 45% (RR = 0.55), and the risk of dying from stomach cancer in women fell by 48% (RR = 0.52), with declines found in each member state (Figure 6).

Colorectal cancer

For the purpose of examining cancer mortality data, cancers of the colon and rectum have been combined for reasons outlined in detail elsewhere [6].

Table 3. Differences in each form of cancer in men and women between 1985 and 2000 in the EU

Site	Men	Women	Combined
All cancer	–55 738	–36 835	–92 573
Oral cancer	–2285	+222	–2063
Oesophagus cancer	–871	+242	–649
Stomach cancer	–22 021	–18 166	–40 187
Colorectal cancer	–3535	–12 153	–15 688
Pancreas cancer	–601	+908	+307
Larynx cancer	–5095	–123	–5218
Lung cancer	–23 922	+10 613	–13 309
Malignant melanoma	–	+206	–
Breast cancer	***	–2666	–2666
Uterine cancer	***	–9798	–
Ovary cancer	***	+304	–
Prostate cancer	+4200	***	+4200
Bladder cancer	–4817	–1047	–5918
Kidney cancer	+322	–291	+41
Leukaemia	–1973	–1160	–3133
Lymphoma	+2687	+ 3228	+5915

–, number too small to be displayed.
***, not available.

In men, there were 53 746 deaths from colorectal cancer in the EU in 1985 (Supplementary data, table 5) and this total was expected to rise to 67 297 in 2000. In 2000, it is estimated that there will be 63 762 deaths from colorectal cancer, representing 3535 deaths avoided (Supplementary data, table 5). Favourable trends in risk are present in the majority of member states (Figure 7), although there are strongly increasing trends in risk present in Spain, Portugal and Greece (Figure 7).

In women, there were 60 417 deaths from colorectal cancer in the EU in 1985, which was expected to rise to 73 857 in the year 2000 (Supplementary data, table 6). In 2000, there will be an estimated 61 704 colorectal cancer deaths in women, which represents 12 153 deaths avoided. Favourable trends in risk are established in all countries, with the exception of Greece, Portugal and Spain (Figure 8).

Breast cancer

In 1985, there were 68 428 deaths from breast cancer in the EU (Supplementary data, table 7) and it was expected that there would be 79 608 breast cancer deaths in 2000. In 2000, 76 942 deaths were estimated (Supplementary data, table 7), which represents 2666 deaths avoided. In the EU, the number of breast cancer deaths was reduced by 3% in 2000 compared with the number expected using projections from 1985. The risk of dying from breast cancer fell by 5% (RR = 0.95), with notable decreases in Luxembourg (–42%), the UK (–24%) and Sweden (–9%). The largest increases in risk are apparent in Spain (+15%), Portugal (+11%) and Greece (+7%) (Figure 9).

Prostate cancer

In 1985, there were 43 177 deaths from prostate cancer in the EU (Supplementary data, table 8) and it was expected that there would be 55 800 deaths from prostate cancer in 2000. In 2000, there were an estimated 60 000 deaths, which represents 4200 deaths more than expected. In the EU, the risk of dying from prostate cancer rose by 5% (RR = 1.05), with risk rising in all countries except France, Italy, Luxembourg and Germany (Supplementary data, table 8). The trend in risk seems to be increasing in most member states, with the exceptions of Austria, France, Germany, Italy, Luxembourg and the UK (Figure 10).

Discussion

There are certain methodological issues to consider when interpreting the analysis presented here. First, the number of cancer deaths and the national populations for the year 2000 have had to be estimated since published data for that year are not yet available from all member states, and it may be some time before all the data, become available. The results obtained for the year 2000 are compared with the data available for the last year for which mortality data are available. The overall findings are comparable, although those based on the last year available are slightly more conservative compared with 2000 estimations.

Secondly, predictions for 2000 will tend to be conservative in that the true changes, which will be calculable when all data become available at some point in the future, may be greater. This can be explained by observing that over the period 1985–2000, the trends in most cancer types considered herein were reaching a peak. Both estimation methods are based on models that tend to under-predict. Under-prediction should be less with the spline method.

Thirdly, and of practical importance, the estimates give an over-precise indication of the accuracy of the statistical procedures. However, these over-precise estimates have continued to be used to help issues such as the total number of deaths approximating to the sum of all the component parts.

The Europe Against Cancer programme was established in the 1980s against a background of increasing cancer incidence and death rates, particularly in men, virtually worldwide. The high-level European Cancer Experts Committee ('the Cancer Experts Committee') was created to direct and to supervise the programme. The Cancer Experts Committee, chaired initially by Professor Maurice Tubiana (Paris, France) and later by Professor Umberto Veronesi (Milan Italy), was almost exclusively comprised of clinicians involved in the treatment of cancer patients. The Committee took the strategic decision to concentrate on prevention rather than to focus on cancer treatment. A European Code Against Cancer was devised and later subjected to scientific scrutiny and revised [7], and a target to reduce cancer mortality in Europe by 15% by the year 2000 was launched. This ambitious target was widely publicized.

The main areas of activity of the Europe Against Cancer programme focussed on prevention, with an emphasis on tobacco control, screening, and education and training. The European Directive on Tobacco Advertising emerged from this Committee,

and it was its report [8] that led to the wider ranging Tobacco Directive recently approved by the European Parliament. The programme also funded the establishment of tobacco control networks throughout the EU.

Demonstration programmes were established in breast and cervix cancer screening throughout the member states via the creation of networks. A series of guidelines for quality control were established for cervical [9] and breast cancer [10] screening, which have become accepted European standards.

In general terms, the Europe Against Cancer programme stressed prevention in all cancer control activities and created an environment within the member states, as well as neighbouring countries, where cancer control activities could flourish.

Overall, the number of cancer deaths observed in 2000 compared with that expected based on mid-1980s age-specific mortality rates, was reduced by 10% in men in the EU, while in women it decreased by 8%. Although the target of a 15% reduction was not met, the effects of the programme should by no means be viewed as a failure. A more detailed consideration gives some clear insights.

At first glance, the outcome of all this activity is not overly encouraging. Between 1985 and 2000, the numbers of cancer deaths in the EU increased by 12% in men and 9% in women. In total this means that there were 90316 more deaths from cancer in 2000 than in 1985 (56415 in men and 33901 in women). Based solely on demographic factors however, applying the age-specific rates of 1985 to the estimated population of 2000, an increase of 182889 deaths was expected by the year 2000. Thus, during the Europe Against Cancer programme, 92573 cancer deaths were avoided in the EU, about half of the expected increase.

Aside from Luxembourg, whose population of only 500000 makes calculation and comparison of annual rates statistically fraught, the countries that experience large declines in all forms of cancer in men also experience large declines in lung cancer. Successful tobacco control actions, started earlier than the Europe Against Cancer activities but continued throughout, have made a major contribution to the declines in cancer death rates in men. A good example of this is the situation described in the UK [11]. In fact, since the risk of cancer at several sites other than the lung is associated with tobacco smoking (including oral cavity, larynx, oesophagus, kidney, bladder, etc. [8]), those countries that experience declines in lung cancer also experience declines in all other forms of cancer combined. In reality, these declines are smaller than they are for lung cancer and reflect the smaller attributable fraction for smoking to this combined group of cancers.

In women the situation is, in many respects, the exact opposite. Nine (of 15) countries experienced declines of >10% in risk of death from all forms of cancer when lung cancer was excluded. However, the risk of dying from lung cancer in women increased substantially in every country considered: the weighted increase is 30%. The failure of tobacco control in women is a great disappointment, particularly since it has been known for >50 years [12–16] that smoking cigarettes causes lung cancer. The fact that women are increasingly smoking, and smoking more, represents a great failure of public health in the recent past and its major challenge for the near future.

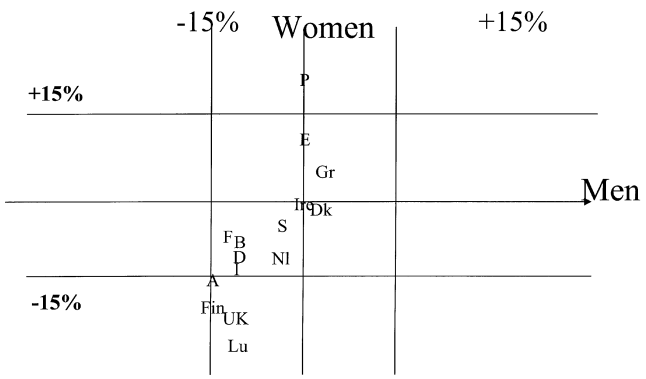

Figure 11. Changes in deaths in men and women.

The influence of different patterns of cigarette smoking on incidence rates in men and women, and in different countries, is emphasized once more. If women in each country had experienced the same decline in lung cancer as men, then the overall target of the Europe Against Cancer programme may have been achieved in women and also overall. Tobacco control must continue to be a number-one priority, and women, alongside deprived populations of both sexes [17], must be a priority target.

Women around the world have taken up cigarette smoking with gusto. For many years it appeared that their lung cancer rates were low and that tobacco was not having the same effect on men. This complacency, which crept in during the two decades from the mid-1960s in particular, is now exposed as false, and neither is there evidence that the effect of cigarette smoking on lung cancer risk is greater in women than in men [18]. The dominance of the effect of smoking duration [19] means that a long period of time will pass from exposure (large numbers of women smoking) to effect (high levels of lung cancer). Lung cancer now exceeds breast cancer as the leading cause of cancer death in women in the United States, Canada, Scotland and several other countries. In Canada, breast cancer mortality has remained at least constant for nearly four decades while lung cancer death rates have increased between 3- and 4-fold during the same period [20]. While the higher case-fatality of lung cancer may be one factor in the mortality rates overtaking breast cancer, there is increasing evidence that there are regions of the world where the gap in the incidence rate is now closing. In Glasgow for example, an area where lung cancer incidence has historically been high, by 1990 the incidence rate for lung cancer (115 per 100000) exceeded that for breast cancer (105 per 100000) [21].

The largest contribution to the decline in cancer deaths came from stomach cancer in each gender (Table 3). Even over a relatively short period of time (1985–2000), this decline is remarkable. It is also unexplained, not only in terms of Europe Against Cancer, and unsustainable since the mortality rates are getting lower and there are increasingly fewer chances for prevention.

The greater decline in colorectal cancer in women compared with men is also quite striking (Table 3). It is speculative to consider that this may in part be due to the increasing penetration of oral contraceptives and, particularly, hormone replacement therapy (HRT) [22], both of which have consistently been associated with a decreased risk of colorectal cancer. For oral contraceptive and

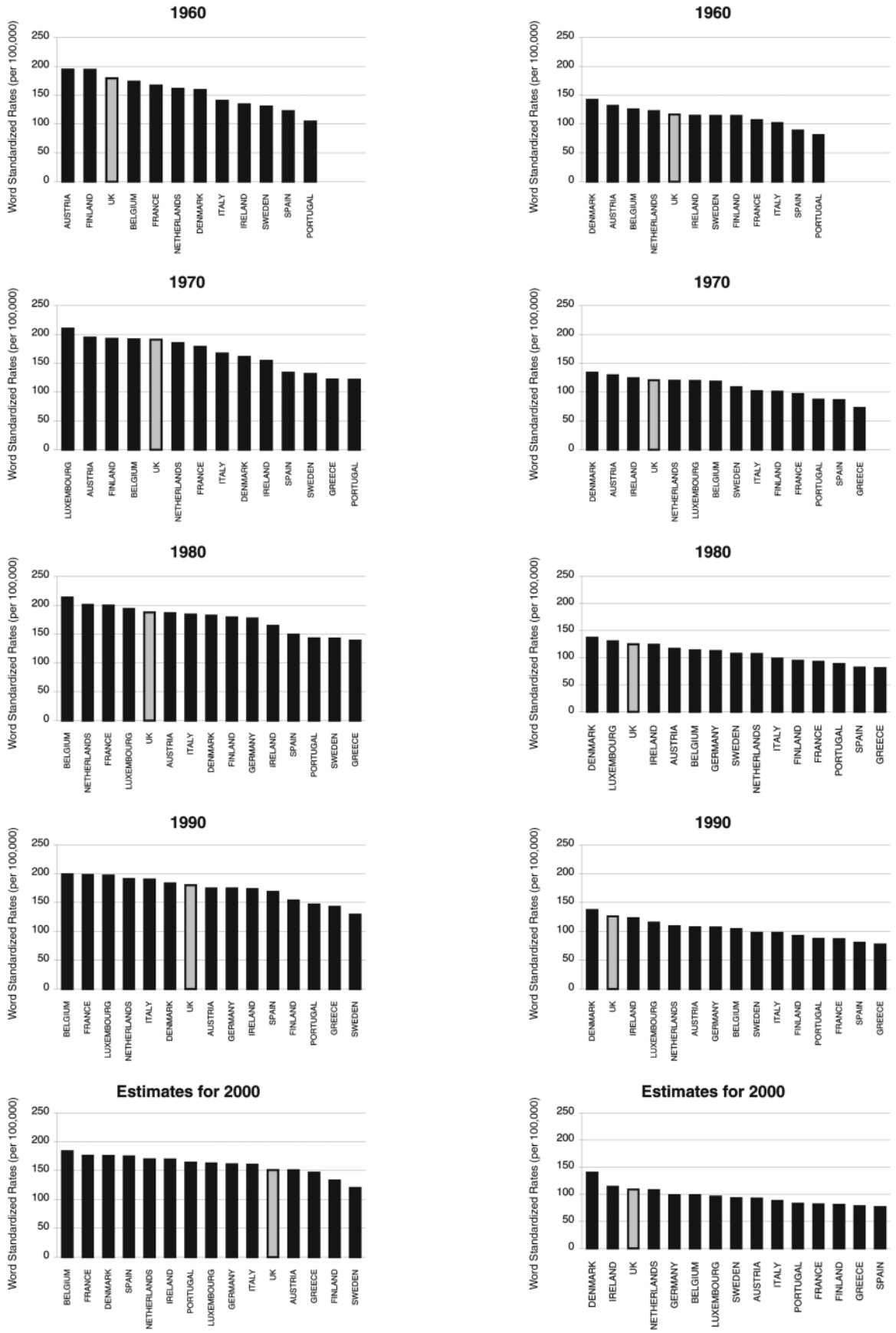

Figure 12. All-ages, age-standardised mortality rates per 100 000 from all forms of cancer in the EU Member States in men (left column) and women (right column) in 1960, 1970, 1980, 1990 and 2000..

HRT users separately, there has been an overview of all the case–control and cohort studies investigating this association. Overall, the risk of colorectal cancer in users of oral contraceptives (compared with never-users) was reduced by 18% [RR = 0.82, 95% confidence interval (CI) 0.74 to 0.92] [23]. For HRT, the risk of colorectal cancer was reduced overall by 20% among users compared with non-users (RR = 0.8, 95% CI 0.78 to 0.82) [24].

A major failure in Europe over the past 15 years has been the inability to bring about decreases in the mortality rate for breast cancer in many countries. Controversy still surrounds the question of whether tamoxifen or mammographic screening is the cause of the reduction in mortality found in the UK [25]. It is difficult to imagine tamoxifen being systematically used more in the UK than in the other member states. Only the UK (RR = 0.76), Sweden (RR = 0.90), The Netherlands (RR = 0.95), Finland (RR = 0.95) and Luxembourg (RR = 0.62) have national organized breast screening programmes. The case for organized national breast cancer screening programmes remains stronger then ever.

Only Finland and Austria achieved reductions of 15% in cancer mortality in each gender group; the UK and Luxembourg achieved it in men and came close in women, and Italy came close in each group (Figure 11). These countries can be considered to have the most effective overall programmes to reduce cancer mortality, whether directly or indirectly associated with the Europe Against Cancer programme. In contrast, cancer control seems to be failing in Spain, Portugal and Greece, and needs a boost in Denmark and Ireland where new efforts are surely needed.

It may at first glance seem strange to see the UK among the group of countries where the greatest reduction in cancer mortality has taken place, given the publicity surrounding the 'poor survival' rates as published in Eurocare surveys [26, 27]. However, the conclusions of these studies have been questioned, as has the role of the 5-year survival rate in comparing differences in advances in cancer control between countries [28–32]. It is clear that the UK has been experiencing reducing levels of cancer death, that these rates are currently low by EU standards, and that they seem set to continue to decline. While there has been little change in the situation among women, the cancer death rate in men in the UK has fallen in absolute terms (from 180 per 100000 per annum in 1960 to 150 per 100000 per annum in 2000) and also in relative terms (from being third from the top in 1960 to being fifth from the bottom in 2000) (Figure 12). The UK has the largest fall in lung cancer in men in the EU, has the only stabilization of lung cancer mortality in women in the EU, has the greatest decline in breast cancer in women in the EU, and has been one of the most successful countries in terms of fulfilling the Europe Against Cancer target of a 15% reduction in cancer mortality.

There are strong suggestions that the risk of cancer death is set to continue to fall in many countries into the foreseeable future, although Spain and Portugal pose significant cause for concern at present. The reversal of a continually increasing trend has been a success that has been associated with the activities of the Europe Against Cancer programme, whose target and programme of activities were set to encourage cancer control in the EU. The major achievement of Europe Against Cancer has been the emphasis on prevention and the increased awareness of the importance of this aspect in wide-ranging cancer control programmes. The impact of this awareness will, hopefully, continue to expand and grow, and continue to reduce the death rates from cancer in Europe.

The success of such a public health-based programme, as compared with a programme centred on basic research or drug development, should also act as a stimulus to review current funding priorities for cancer research and cancer control.

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