Survival for cancer patients in Europe

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Summary. Comparing cancer survival among the European countries is important to evaluate the performance of Health Care Systems and reduce disparities in access to diagnostic and treatment facilities. The EUROCARE project compares survival in Europe since the nineties. The EUROCARE-4 analysed 2 690 922 adult cancer cases from 83 cancer registries in 22 European countries, diagnosed in 1995-1999, and followed to December 2003. For each cancer site, the European area weighted mean and age-standardised country-specific observed and relative survival by age and sex is computed. Within-country variation in survival is analysed for selected cancers. Survival for most solid cancers, whose prognosis depends largely on stage at diagnosis (breast, colorectal, stomach cancers, and skin melanoma), was highest in Finland, Sweden, Norway, and Iceland, lower in the UK and Denmark, and lowest in the Czech Republic, Poland and Slovenia. France, Switzerland and Italy generally had good survival, slightly below that of the Northern countries. For all cancers, five-year survival was very variable also for the different sites mix. Continuing to monitoring cancer survival in Europe is important to reduce differences in access to diagnostic and therapeutic facilities. After publication of EUROCARE results, UK and Denmark developed a National cancer plan to improve time of diagnosis and treatment.

Key words: cancer survival, cancer registries, Europe.

Riassunto *(La sopravvivenza dei pazienti oncologici in Europa)*. Il confronto della sopravvivenza dei pazienti oncologici fra paesi Europei è importante per valutare la prestazione dei sistemi sanitari e ridurre le disuguaglianze nella diagnosi e trattamento. Il progetto EUROCARE – avviato agli inizi degli anni 90 – ha analizzato e confrontato la sopravvivenza di 2 690 922 pazienti diagnosticati nel periodo 1995-99 con follow-up fino al dicembre nelle aree di 83 registri tumori in 22 stati Europei. Per ogni tumore, è stata calcolata la sopravvivenza media (osservata e relativa) a 1, 3 e 5 anni totale e specifica per paese, sesso ed età. Per alcuni tumori è stata inoltre calcolata la variabilità della sopravvivenza fra diverse aree di uno stesso paese. La sopravvivenza dei pazienti affetti da alcuni tumori solidi la cui prognosi dipende largamente dallo stadio alla diagnosi (tumore maligno della mammella, colon-retto, stomaco e melanoma cutaneo), risultava in assoluto più alta in Finlandia, Svezia, Norvegia e Islanda, inferiore in UK e Danimarca, e molto bassa nella Republic Ceca, Polonia e Slovenia. Francia, Svizzera e Italia generalmente riportavano valori soddisfacenti, solo leggermente al di sotto di quelli del Nord Europa. La variabilià geografica della sopravvivenza per tutti i tumori congiuntamente, era dovuta anche alla diversa incidenza di tumori a diversa letalità fra i paesi. La sorveglianza della sopravvivenza in Europa è importante per ridurre le disuguaglianze nella disponibilità e nell'acceso a diagnosi e trattamenti adeguati. In seguito alla pubblicazione dei risultati EUROCARE, UK e Danimarca hanno sviluppato piani oncologici per ridurre il ritardo diagnostico e migliorare il trattamento dei pazienti oncologici.

Parole chiave: sopravvivenza, tumori maligni, registri tumori, Europa.

INTRODUCTION

Cancer survival is an important indicator of the performance of the health care system in a country [1]. Comparing cancer survival among countries in Europe is an useful basis to reduce disparities in access to diagnostic and treatment facilities for European citizens. Clinicians need survival statistics from clinical series for prognostic evaluation, but only population based survival comparison can provide elements to judge the effectiveness of the health systems. Moreover, population based surviv-

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al statistics are essential for estimating cancer prevalence, defined as the proportion of alive people with a previous diagnosis of cancer, which is frequently required by health care system managers.

The EUROCARE study (EUROpean CAncer REgistries based study of cancer patients' survival), which began in 1990 [2-4], is the largest co-operative cancer registry-based study on the survival and care of European cancer patients. Its aims are to monitor, analyse and explain cancer survival trends and between-country differences in survival and care. Summary results of the EUROCARE-4 study, pertaining to patients diagnosed in 1995-1999 and later, have been published recently [5, 6], together with a more detailed monograph [7].

The EUROCARE study had a great impact on health administrations and politicians, particularly for countries with unexpected low survival with respect to similar countries. After the publication of EUROCARE data, in 2000, national cancer plans were proposed in Denmark and UK to improve cancer outcome.

The Danish plan was based on national survival estimates and on Nordic and international survival comparison, focused on the organization of surgery (centralization of expertise), monitoring indicators, better interplay between primary care and hospitals, education of health professionals, and improvement of diagnostic, oncological and radiotherapy capacity. Population-based studies were launched to monitor its impact on survival and mortality [8].

The National Health Service plan of UK made new commitments in several areas, including inequalities, speed of access, screening, staffing and improvement of cancer services, and monitoring progress [9].

The aim of the present paper is to illustrate and comment the results on comparison of survival between countries in Europe, for major cancer sites included in EUROCARE-4, by sex.

CASES AND METHODS

Cancer cases

This analysis was carried out on 2 690 922 adult (aged ≥15 years) cancer cases diagnosed in 1995-1999 (83 cancer registries). For 13 countries (Austria, Denmark, Finland, Iceland, Ireland, Malta, Norway, Sweden, England, Scotland, Wales, Northern Ireland and Slovenia) the entire population is covered by cancer registration; the other countries (Belgium, the Czech Republic, France, Germany, Italy, Netherlands, Poland, Portugal, Spain, and Switzerland) are represented by regional CRs covering variable proportions of the country population.

Data collection and checking procedures were operated according to the EUROCARE-4 protocol. Procedures for checking data quality and the results of the checks are presented elsewhere [10]. Briefly, all CRs collected data according to a standardised protocol. Additional checks, and the analyses, were carried out centrally. The checks were performed to detect errors, inconsistencies or unusual combinations of cancer site, morphology, sex and age at diagnosis. Questionable records were sent back to CRs for verification and correction: non-correctable records were excluded.

Other reasons for excluding cases from analyses were major errors (0.1% of total cases), cancers diagnosed after a previous malignancy, cases known by death certificate only (DCO), and discovered at autopsy. The number of cases lost to follow-up, number censored after less than five years of follow-up, and the percentages of microscopically verified cases are provided in [10] as indicators of data quality. *Table 1* shows the results of the checking procedure by country and cancer registry. *Table 2* reports the percent coverage of the population by cancer registration and the number of cases in analysis by country.

Cancer site and morphology were coded according to the International Classification of Diseases for Oncology, 3rd edition (ICD-O-3) [11]. For melanomas of the skin and all haematological malignancies, the morphology code was used as well as the site code to define the tumour. The site and morphology codes used are reported in [10].

Statistical methods

Relative survival − ratio of the observed survival to the survival expected in the general population of the same age and sex − was calculated in order to eliminate the effect of competing causes of mortality and facilitate survival comparisons between countries with different background mortalities. Relative survival was estimated by the Hakulinen method [12] using estimates of population life tables for each CR area.

To account for differences in the age structure of the populations studied, relative survival was adjusted for age using the international standard for cancer survival analysis (ICSS) [13]. ICSS employs standard age distributions that differ according the age pattern of incidence of the cancer: one for cancers mainly of young adults (*e.g.* testicular cancer, non-Hodgkin's lymphoma, acute lymphatic leukaemia), one for cancers whose incidence varies little with age (*e.g.* cervix uteri, thyroid and brain cancers), and one for cancers mainly of the elderly (all other cancers).

For each cancer site, the European mean survival was also weighted (area-weighted) by the contribution the population each European country made to the whole population. A detailed description of the statistical methods is provided elsewhere [10].

RESULTS

Figure 1 shows 5-year age-adjusted relative survival for eight major cancer sites and for all cancers combined in men, by country. In each cancer specific graph the red bottom bar and the vertical line show the mean area- and age- adjusted European mean figure.

Table 1 | *The EUROCARE database. Total number of cases and reference period of diagnosis by Cancer Registry. Results of the data checking process and overall proportion of malignant tumours [12]*

Country	Registry	Period of diagnosis		Total cases	Valid records	Minor errors			Major errors	Prop. malignant tumours (%)
						Unlikely behavior (not malignant)	Unlikely behavior (malignant)	Other unlikely combinations		
Austria	Austria	1983	2002	735,959	729,462	3,216	84	2,685	512	95
	Tyrol	1988	1999	34,294	34,133	60	0	101	0	99
Belgium	Flemish	1997	2001	152,684	151,774	175	33	622	80	95
Czech Republic	West Bohemia	1988	2002	62,027	61,179	7	295	505	41	91
Denmark	Denmark	1978	1999	569,509	569,294	0	0	177	38	96
Finland	Finland	1978	2002	465,613	458,597	258	1	5,332	1,425	98
France	Bas Rhin	1989	1997	37,116	37,058	0	0	57	1	100
	Calvados	1989	1997	15,851	15,789	0	0	61	1	100
	Calvados digestive	1978	1998	12,154	12,115	0	0	30	9	100
	Cote d'Ôr Digestive	1976	2002	13,032	13,009	0	0	18	5	100
	Cote d'Ôr Hemat.	1980	1999	3,572	3,547	0	0	15	10	99
	Doubs	1989	1997	16,860	16,808	3	0	48	1	96
	Haut Rhin	1989	1997	25,723	25,542	0	0	52	129	100
	Herault	1995	1997	11,214	11,176	0	0	38	0	94
	Isere	1989	1997	35,830	35,520	0	0	176	134	96
	Loire Atlantique	1991	1997	8,252	8,251	0	0	1	0	100
	Manche	1994	1997	9,078	9,064	0	0	13	1	91
	Marne	1990	1997	455	455	0	0	0	0	100
	Somme	1989	1997	18,383	18,282	0	0	80	21	100
	Tarn	1989	1997	15,058	14,985	0	0	73	0	93
Germany	Saarland	1978	2002	156,050	154,259	586	31	1,080	94	93
Iceland	Iceland	1978	2002	22,919	22,772	0	0	138	9	97
Ireland	Ireland	1994	2002	199,858	199,253	25	2	570	8	87
Italy	Alto Adige	1995	2002	18,924	18,871	0	0	52	1	99
	Biella	1995	2002	12,743	12,673	11	1	50	8	92
	Ferrara	1991	2002	35,598	35,312	102	0	109	75	94
	Firenze	1985	2002	145,723	144,814	315	8	473	113	91
	Friuli V.G.	1995	2003	90,936	90,363	0	0	572	1	98
	Genova	1986	2000	96,022	95,551	227	5	172	67	93
	Macerata	1991	1999	17,115	17,101	0	0	14	0	100
	Modena	1988	2002	59,603	59,419	0	0	182	2	100
	Napoli	1996	2000	8,806	8,766	0	0	16	24	92
	Palermo	1999	1999	599	599	0	0	0	0	97
	Parma	1978	2002	64,469	64,322	0	0	144	3	96
	Ragusa	1981	2002	25,268	25,208	0	0	60	0	93
	Reggio Emilia	1996	2003	25,770	25,720	0	0	40	10	100
	Romagna	1986	2002	106,006	105,904	0	0	97	5	93
	Salerno	1996	2001	26,923	26,733	0	1	164	25	100
	Sassari	1992	2002	24,583	24,509	3	0	71	0	96
	Torino	1985	2001	96,948	96,619	0	0	313	16	98
	Trento	1995	2000	17,833	17,713	0	0	98	22	100
	Umbria	1994	2002	50,222	50,047	0	0	175	0	100
	Varese	1980	1999	83,877	82,665	0	0	1,181	31	98
	Veneto	1987	2000	166,092	165,602	0	6	482	2	100
Malta	Malta	1993	2002	13,442	13,389	7	1	43	2	92
Norway	Norway	1978	2002	699,461	537,908	150,128	6,526	3,105	1,794	70

(Continued)

Table 1 | *(Continued)*

Poland	Cracow	1978	2002	60,141	59,075	40	42	174	810	97
	Kielce	1995	2002	34,377	33,844	4	44	146	339	99
	Warsaw	1989	2002	88,665	70,072	38	11	18,083	461	99
Portugal	South Portugal	1998	1999	32,980	32,757	0	0	51	172	100
Slovenia	Slovenia	1978	2002	144,989	144,091	3	26	787	82	100
Spain	Albacete	1995	2002	2,054	2,054	0	0	0	0	94
	Basque Country	1986	1999	111,064	110,305	6	0	263	490	99
	Castillon	1995	2002	1,765	1,760	0	5	0	0	91
	Girona	1994	2002	24,616	24,301	12	6	186	111	90
	Granada	1991	1999	12,591	12,551	0	0	40	0	100
	Murcia	1995	1998	15,190	15,062	45	0	83	0	93
	Navarra	1985	1999	39,947	39,717	34	0	158	38	95
	Tarragona	1985	1999	31,692	31,263	8	133	103	185	97
Sweden	Sweden	1978	2003	1,135,036	1,113,031	10,792	14	9,289	1,910	88
Switzerland	Basel	1981	2001	39,284	38,199	0	906	108	71	97
	Geneva	1980	2003	45,571	45,002	47	361	158	3	97
	Grisons	1989	1999	5,809	5,799	0	4	6	0	100
	St. Gallen	1988	2002	30,226	30,062	7	6	151	0	98
	Ticino	1996	2003	12,452	12,369	0	0	75	8	99
	Valais	1989	1998	10,529	10,474	3	3	26	23	99
	Zurich	1988	1998	2,148	2,018	0	0	1	129	100
The Netherlands	Amsterdam	1988	2002	174,644	171,687	82	1,461	1,409	5	97
	Eindhoven	1978	2001	80,964	79,547	168	751	497	1	94
	North Netherlands	1995	2001	64,382	63,725	215	3	436	3	93
UK England	East Anglia	1978	2002	349,567	342,829	597	878	1,966	3,297	87
	England	1995	2002	1,459,112	1,452,316	0	569	5,544	683	100
	Mersey	1978	1999	265,851	261,390	788	1,179	1,849	645	87
	North Western	1995	1999	121,901	120,609	0	572	648	72	81
	Northern&Yorkshire	1978	2002	632,122	623,839	2,307	1,796	2,139	2,041	87
	Oxford	1978	2002	232,502	229,592	287	390	1,040	1,193	99
	South Western	1978	1999	695,223	687,532	387	160	2,784	4,360	90
	Thames	1985	1999	958,521	957,427	0	0	910	184	90
	Trent	1979	1999	456,620	451,640	532	1,486	1,451	1,511	89
	West Midlands	1978	2002	610,254	603,462	1,060	1,275	1,980	2,477	87
UK N. Ireland	Northern Ireland	1993	2002	113,657	111,605	382	38	1,462	170	76
UK Scotland	Scotland	1978	2002	798,898	792,033	524	2,143	3,913	285	88
UK Wales	Wales	1978	2002	338,366	334,447	12	108	281	3,518	99
Totals				**13,742,164**	**13,439,618**	**173,503**	**21,364**	**77,682**	**29,997**	**92**

Cancer of head and neck include various type of anatomic sites with different prognosis, the poorest prognosis was carried by cancers of the hypopharynx. The European mean survival was 36.5% and there was no great variability between countries, with only France and Slovenia significantly below the European mean. The Netherland showed the top survival in Europe.

Stomach cancer incidence is decreasing in almost all European countries since many decades, but the survival of gastric cancer patients still remains poor. The European mean 5-year relative survival was 23.1%. Survival was higher than the European mean in Italy (29.8%) and in Austria (29.7%), while it was very low in UK (15.1%) and in Poland (16.4%).

The mean European survival for colorectal cancer reached 51.4%. Significantly lower survival occurred in Denmark , Ireland, England, and Eastern countries. Switzerland had the highest survival (59.9%). The lowest survival occurred in Poland (41.3%).

Lung cancer still remains one the most frequent cancer with very low survival, although its incidence in men is decreasing in most European countries

[14], the European mean survival is only 11.7%. Significantly lower survival than European mean occurred for Nordic countries (but Island with very wide confidence intervals), Ireland, UK and Eastern countries (but Poland equalling the European mean). Fairly homogenous is the survival among the Central and Southern European countries higher than the European mean. The highest occurred in Belgium (15.5%).

Survival for melanoma of the skin greatly improved since early '90, and the European mean reached, 77.1% in 1995-99. The higher survival occurred in Sweden (87.6%) and Switzerland (86.2%). Significantly lower survival than the European mean occurred in UK Wales (66.0%), Portugal (66.8%), Czech Republic (64.5%) and Poland (53.3%).

There was large variability in survival for prostate cancer across Europe. The mean European 5-year relative survival was 76.5%. In the Nordic countries survival was generally higher the European mean, except Denmark (47.7%) and Norway (74.5%); in Ireland and UK where survival was lower, in the Western and Southern countries survival was higher than or close to the European mean, while in the Eastern countries it was systemically lower.

Table 2 | *Coverage and number of cancer patients diagnosed 1995-1999 by country. All cancer combined (but non-melanoma skin cancer)*

		Number of cases		
Country	**Coverage %**	**Men**	**Women**	**Persons**
Denmark	100	47,420	54,115	101,535
Finland	100	42,345	43,273	85,618
Iceland	100	2,274	2,161	4,435
Norway	100	43,098	41,012	84,110
Sweden	100	85,619	83,209	168,828
Ireland	100	30,544	28,705	59,249
UK England	100	462,051	466,782	928,833
UK Northern Ireland	100	14,218	15,323	29,541
UK Scotland	100	56,727	59,693	116,420
UK Wales	100	28,178	28,269	56,447
Austria	100	73,962	72,239	146,201
Belgium	58	43,233	36,379	79,612
France	11	40,062	31,576	71,638
Germany	1	12,557	12,136	24,693
Netherlands	34	54,122	52,151	106,273
Switzerland	27	18,047	16,448	34,495
Italy	25	194,733	169,935	364,668
Malta	100	2,846	2,911	5,757
Portugal	43	17,385	14,184	31,569
Slovenia	100	16,308	15,524	31,832
Spain	12	50,550	35,061	85,611
Czech Republic	8	8,894	8,048	16,942
Poland	9	27,650	28,965	56,615
Total		**1,372,823**	**1,318,099**	**2,690,922**

Survival for non-Hodgkin lymphoma (NHL) showed less variation than solid tumours across Europe. The European mean survival was 49.5%. Survival for all the countries were close to the European mean, with the exception of Poland which showed significantly lower figures (40.3%).

Also survival for leukaemia (all types combined) was fairly homogenous among countries. The European mean survival was 43.2%. Statistically significant lower survival than European mean was found only in UK-Northern Ireland (30.7%) and Austria (34.1%). The highest survival occurred in France (51.4%).

There was a remarkable intercountry variation in survival for all cancer combined. The European mean survival was 45.3%. Survival was higher than the European mean in the Nordic, Western and Southern countries. Within the Nordic countries survival was exceptionally low in Denmark (37.6%), and within the Southern countries in Malta (40.5%). UK and Eastern countries had statistically significant lower figures than the European mean.

Figure 2 shows a comparison by country of age-adjusted relative survival for eight major cancers, and for all cancers combined in women.

For all the cancers considered in this article survival was higher in women than in men.

For head and neck cancers the European mean survival was 48.9%. Most counties are close or higher than the European mean survival, but significantly lower survival occurred in UK-Northern Ireland (36.9%) and Poland (37.9%). Statistically higher survival than the European mean occurred in Finland (59.7%), Sweden (56.2%) and Germany (61.2%).

The mean European survival for stomach cancer was 27.5%. Significantly lower survival was found in Poland (20.2%). Higher survival occurred in Finland (31.3%), Belgium (36.1%), Italy (34.6%) and Spain (30.4%). Women had a higher survival than men.

For colorectal cancer in women the European mean survival is 55.4%. Statistically significant lower survival than the European mean occurred in Denmark (51.2%), Ireland (52.7%), UK countries, Portugal (51.1%) and the Eastern countries. Higher survival occurred in Finland (59.0%), Norway (59.8%), Sweden (59.6%), all the Western and Southern countries, but Portugal (51.1%).

For lung cancer the European mean survival was 14.1%. Higher or close survival to the European mean were found in the Nordic countries-with the exception of Denmark, Western and Southern countries, and Eastern countries, but Slovenia. Statistically lower survival than the European mean was found in Denmark (8.4%), Ireland (10.9%), UK countries and Slovenia (8.7%).

The 5-year European mean relative survival for melanoma of the skin was 86.7%, Figures higher or close than the European mean survival were found in all the Nordic countries, Northern Ireland and UK countries, but UK Wales (79.6%), Western and Southern countries, but Malta (76.7%).

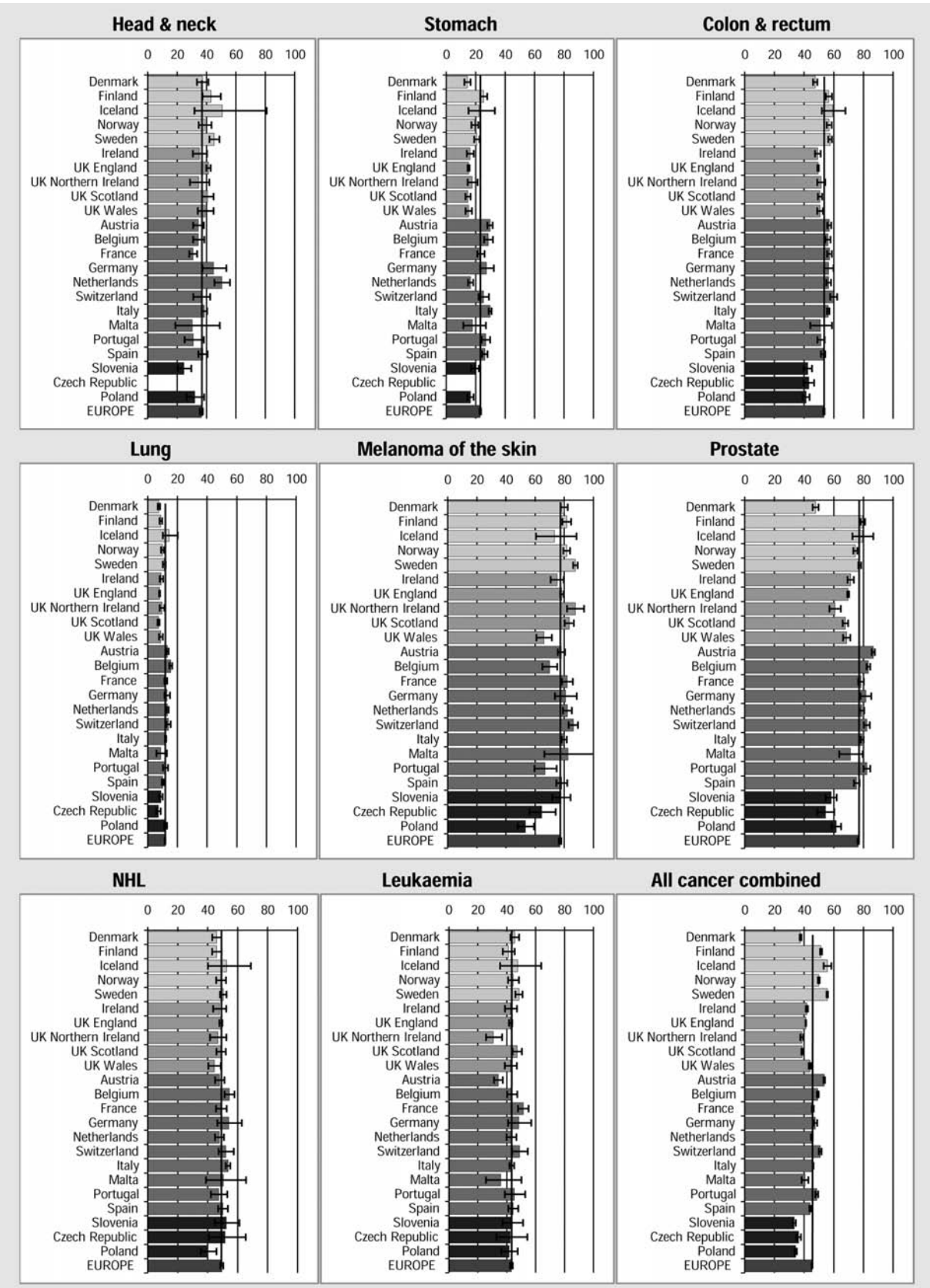

Fig. 1 | *Comparison of age-adjusted five year relative survival for major cancer for men by European country. The countries are coloured by region by a range of grey (from light grey for Nordic countries to dark grey for Eastern countries, and middle grey for Europe).*

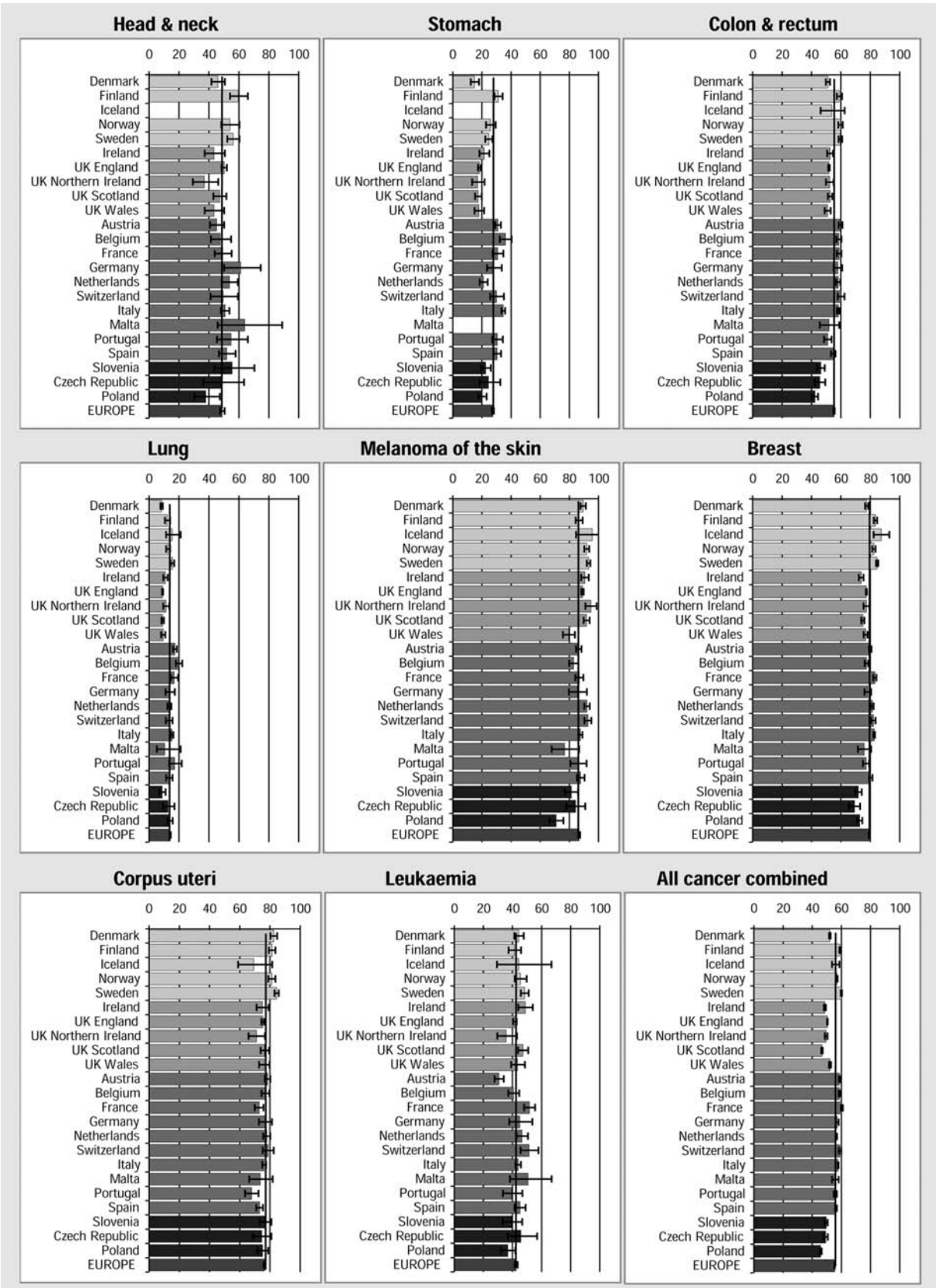

Fig. 2 | *Comparison of age-adjusted five year relative survival for major cancer for women by European country. The countries are coloured by region by a range of grey (from light grey for Nordic countries to dark grey for Eastern countries, and middle grey for Europe).*

For breast cancer the European mean survival is quite high (79.3%). Higher or close than the European mean survival were found in the Nordic countries, but Denmark (77.5%), and the Western and Southern countries, but Belgium (77.4%). Significantly lower than the European mean survival were Denmark, Ireland (73.8%) and all UK countries, and the all the Eastern countries.

For corpus uteri cancer the European mean survival was 76.4%. Survival was fairly homogenous across countries. The only country with significantly lower survival than the European mean was Portugal (67.8%). The highest survival occurred in Sweden (84.4%).

Mean European survival for all leukaemias combined was 42.5%, with fairly homogenous figures across countries. The only country with statically significant lower survival than the European mean was Austria (30.7%).

The European mean survival for all cancers combined in women was 55.4%. The countries with higher or close than the European mean survival were the Nordic countries, but Denmark (52.1%), and all the Western and Southern countries. Statistically significant lower survival than the European mean occurred in Denmark, Ireland (48.7%), all the UK countries, and all the Eastern countries.

DISCUSSION

We presented a comparison of age-adjusted relative survival among the European countries for major cancer sites in men and women. For all cancers considered in this analysis survival was higher in women than in men. The better prognosis of women than men has been variously attributed to lower prevalence of comorbidity than men, earlier stage at diagnosis, and better resistance to disease [15].

We compared survival across countries, however the statistical significance of inter-country survival differences and the country rank depends on the confidence intervals, which in turn is related to the number of cases in analysis. For instance, Island and Malta have very small populations, thus, although they have 100% coverage, the number of cases for each site are low, lower than Germany with 1% coverage. The confidence intervals for the countries with small populations are large and survival estimates may be unstable. For this reason in the graphic presentation countries are coloured according to large geographic region with similar population characteristics and health system. By this way we can compare survival in a group of countries belonging to the same area. The registry of Kielce (Poland) showed high relative c for lung and stomach cancer, due to incomplete follow-up. Then survival in Poland is a little biased for lung and stomach cancer.

The intercountry variation in survival for Head and neck is partially related to the mix of different sub-sites with different prognosis. Cancers of the hypopharynx, which carry the lowest survival are more frequent in southern Europe. The geographic trend was similar in the two sexes, although the variation was higher for women than for men, because of the small number of cases in women. Survival was higher in women than in men, however we have recently suggested that there has been a tendency to worsening survival among women in recent years. This decline is plausibly related to the increased smoking among European women [16].

Also the variation in survival for stomach cancer can be partially explained by the case mix of subsites with different prognosis. In most southern Europe countries, the incidence of stomach cancer is relatively high but declining [17]. Previous studies have found that where incidence is high, cancers more often develop in the distal part of the stomach – a sub-site with better prognosis than proximal localisations [18]. However, in many eastern European countries incidence is high [14] and survival low [1-4]. This pattern suggests that inadequate treatment and late stage at diagnosis contribute to poor survival in these countries.

Survival for colorectal cancer depends largely on the proportion of cases diagnosed at early stage, who can benefit from curative treatment [19]. The highest survival (≥ 57%) in the northern European countries, in the Netherlands, France, Switzerland, and Italy, is probably related to appropriate care and to the existence of screening programmes.

Although incidence of lung cancer is decreasing for men [14], survival was very low in all the EUROCARE-4 countries, and it was shown that it remained essentially unchanged over time since early 1990s [16]. Mean European five-year age- and area-adjusted relative survival was 12%, with countries of the central Europe showing slightly higher survival than other regions. The uniformly poor prognosis of lung cancer points the need of prevention, however studies suggest that early diagnosis may contribute to reducing mortality at least in countries where modern CT/PET equipment, and personnel to scrutinize the scans, are available [20].

The prognosis of skin melanoma was good, with European five-year relative survival at 83%, with lower geographical variation in survival that that found for other solid tumours. Eleven of the 23 countries considered had survival of 85% or more. The existing intercountry differences are likely due to differences in surveillance intensity and implementation of early diagnosis initiatives [21]. For instance, in the UK the rather high survival for melanoma – compared to the low survival for most cancers – is probably related to the implementation of surveillance and early diagnosis programmes in most UK regions [22]. The higher survival in women than in men is attributable to the fact that melanoma arise in anatomical sublocalization carrying a favourable prognosis more frequently in women than in men.

Since the introduction of PSA testing, prostate cancer incidence [23] and survival have increased remarkably in most western countries [6]. Incidence

and survival are further increased by incidental diagnosis during examinations for benign prostate disease [24]. In contrast to survival, mortality for prostate cancer is decreasing only slightly [25]. It remains unclear what proportion of prostate cancers diagnosed in preclinical phase are destined to became symptomatic [26]. High survival for this cancer may partially reflect inflated incidence, without real benefit to patients. The remarkable between-country differences in prostate cancer survival are mostly related to the different diffusion of early diagnosis practices.

Intercountry differences in survival for Non-Hodgkin Lymphoma and leukaemia are less marked that those found for solid tumours. This is likely due to the fact that that for these tumours stage at diagnosis is less prognostically important than for most solid tumours.

In most countries and in Europe overall survival for NHL and leukaemia increased over the EUROCARE study periods. Over the period 1988 to 1995, five-year survival for all leukaemias combined increased from 37% to 42%; survival for non-Hodgkin lymphoma increased from 49% to 56% [16]. Improvements in treatment are likely to be the main reason for this increase [27, 28]; earlier diagnosis than in the past may also have contributed, although this factor is less important than for solid cancers. However, the evolving classification and the poor standardization of data collected by most registries on haematological malignancies vitiates proper comparisons of survival over time and across regions.

The prognosis of NHL and leukaemia varies greatly according to its subtype and lineage. In the present study, amongst all leukaemias, survival was highest for chronic lymphatic leukaemia (5-year relative survival 69%), and lowest for acute myeloid leukaemia (14%). We have previously evidenced that morphology data available to the registries allows to estimate survival by distinct subtypes of NHL according to their cell lineage. Morphology case mix explains however only a small part of the geographic differences highlighted by EUROCARE [29].

The development of targeted treatments for many haematological malignancies (*e.g.* imatinib for treatment of CML or rituximab for B lymphoma [27, 28]) is improving the prognosis of these diseases and likely will modify their natural history in the near future. However these new treatments are very expensive and for this reason they may not be available to all patients, generating new treatment inequalities, which should be monitored by population-based survival studies.

Survival for all cancer combined is an indicator of the total cancer burden in a population, rather than a real prognostic indicator. Survival for all cancers combined increased from 47% in EUROCARE-3 (1990-1994) period to 50% (overall males and females) in the present EUROCARE-4 study. All cancers survival is higher in women than men, because the commonest cancer in women is breast cancer, with relatively good prognosis, and the commonest cancer in men is lung cancer, with poor prognosis. The large geographic variation in survival for all cancer combined is in part due to the different cancer site mix. In this analysis however, we preferred not to adjust for site mix in order to have a survival indicator based on the real number of patients by country and in the whole Europe.

We have evidenced that there is a correlation between per capita total national expenditure for health and five year relative survival for all cancers combined [5]. Higher survival in a region compared to another one can be due to higher proportions of tumours diagnosed at early stage, better access and availability of adequate treatment, lower prevalence of comorbidity. All these factors reflect the investment of resources in health, thus explaining its relationship with cancer survival.

In conclusion, EUROCARE continues to provide important indications as to the relative efficiency of national health systems in caring for their cancer patients: it no surprise that the remarkable all cancer survival differences and survival for the major cancers are directly related to national wealth [5]. However these survival increased over the EUROCARE study periods and differences have narrowed considerably since the project began, suggesting that inequalities in cancer care across Europe are also narrowing.

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