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The EUROCARE-4 database on cancer survival in Europe: Data standardisation, quality control and methods of statistical analysis

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ABSTRACT

This paper describes the collection, standardisation and checking of cancer survival data included in the EUROCARE-4 database. Methods for estimating relative survival are also described. Incidence and vital status data on newly diagnosed European cancer cases were received from 93 cancer registries in 23 countries, covering 151,400,000 people (35% of the participating country population). The third revision of the International Classification of Diseases for Oncology was used to specify tumour topography and morphology. Records were extensively checked for consistency and compatibility using multiple routines; flagged records were sent back for correction. An algorithm assigned standardised sequence numbers to multiple cancers. Only first malignant cancers were used to estimate relative survival from registry, year, sex and age-specific life tables. Age-adjusted and Europe-wide survival were also estimated.

The database contains 13,814,573 cases diagnosed in 1978–2002; 92% malignant. A negligible proportion of records was excluded for major errors. Of 5,753,934 malignant adult cases diagnosed in 1995–2002, 5.3% were second or later cancers, 2.7% were known from death certificates only and 0.4% were discovered at autopsy. The remaining 5,278,670 cases entered the survival analyses, 90% of these had microscopic confirmation and 1.3% were censored alive after less than five years' follow-up. These indicators suggest satisfactory data quality that has improved since EUROCARE-3.

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1. Introduction

EUROCARE, which started in 1990, is the largest international collaborative population-based study on the survival of cancer patients. In addition to numerous papers on particular aspects of cancer survival, the study has published three major monographs on European cancer survival, one for each of the diagnosis periods 1978–1985,[1] 1985–1989[2] and 1990–1994.[3] The study has involved progressively more countries and cancer registries (CRs) over time, and has now archived data on over 13,800,000 cancer cases. The EUROCARE database is a unique and valuable resource for analysing and comparing cancer outcomes not only across European countries and regions, but also over time (since 1978); it has, at the same time, accumulated a large and precious database on outcomes for rare tumours.[4]

The current EUROCARE round, EUROCARE-4, gathered incidence data from 93 European CRs on patients diagnosed from 1978 up to 2002, with vital status information available up to 31st December 2003 or later. Two major novelties have been introduced in EUROCARE-4. First, the Third Revision of the International Classification of Diseases for Oncology (ICD-O-3) was used to specify cancer topography and morphology.[5] Second, in addition to the traditional *cohort* survival analysis of patients diagnosed in 1995–1999 and followed-up over time, we now present a *period* survival analysis, which includes the most recent cases (diagnosed in 2000–2002) for which the minimum follow-up of 5 years is not available and for which survival in the missing years was estimated from the survival experience of patients diagnosed in the previous years.

Summary EUROCARE-4 cohort[6] and period[7] analyses, by country, for selected cancer sites had been published previously. The present issue of the *European Journal of Cancer*, constituting the fourth general EUROCARE monograph, provides a more exhaustive presentation of the EUROCARE-4 estimates. The present paper describes the characteristics of the EUROCARE-4 database in detail, the methods used to standardise and check the data and the methods used to perform the survival analyses.

1.1. *The EUROCARE-4 database: participating CRs and populations covered*

Ninety-three CRs from 23 European countries contributed to EUROCARE-4, 83 contributed data on cancers diagnosed in both children (0–14 years) and adults (15–99 years) (Table 1a) and 10 contributed data on childhood cancers only (Table 1b). All these registries contributed cases for the survival analyses of cohorts diagnosed in 1995–1999.[8] Registries meeting the criteria described in Brenner et al.[9] were selected for the *period* survival analyses.

Thirteen countries have national cancer registration: Austria, Denmark, Finland, Iceland, Ireland, Malta, Norway, Slovenia, Sweden, England, Northern Ireland, Scotland and Wales. Germany has national coverage for childhood cancers only. The remaining countries have cancer registration between 8% and 58% of their populations, with the conspicuous exception of Germany, where only 1.3% of the adult population is covered. The mean population covered over the period 1995–1999 was about 151,407,000, corresponding to 35% of the population of the countries participating in EUROCARE-4 and 30% of the population of the European Union (excluding Norway, Switzerland and Iceland which are not EU members).

Thirty-two more CRs were included in EUROCARE-4 than in EUROCARE-3. This resulted in three new countries being represented (Belgium, Ireland and Northern Ireland) and increased coverage for several others (from 62% to 100% for England, 15% to 25% for Italy, 2% to 10% for France, 12% to 27% for Switzerland and 8% to 100% for Austria). As in the previous EUROCARE publications, results by country for United Kingdom (UK) are presented separately for England, Scotland, Wales and Northern Ireland.

Five CRs involved in the previous EUROCARE studies are not included in EUROCARE-4, either because they did not send in updated data by the final deadline (Estonia and Slovakia) or because they no longer participate in EUROCARE.

Some CRs have changed their catchment areas since EUROCARE-3. Since 1996 the English East Anglia CR covered Bedfordshire (previously covered by Thames CR). The Northern and Yorkshire CR covered only Yorkshire from 1978 to 1997, but the whole of Northern England since 1998. The English South and West Registry now includes the populations of 'Wessex' and South-West England. The Thames CR catchment area now (since 1985) includes the territories of the old North and South Thames regions.

Twelve CRs (specialised and general) from France, Italy, Spain and Switzerland sent data only for one or more specific cancer sites, so for these countries the extent of national coverage varied with the cancer site (Table 1a). The populations of Calvados and Cote d'Or are each covered by two CRs (digestive tract and other in Calvados; digestive tract and haematopoietic system in Cote d'Or). All CRs providing data only for the selected sites were excluded from the all cancers combined analyses.

The population covered by the Tyrol CR is also included in the Austrian National CR. The English National database, provided by the UK Office for National Statistics, gathered data from all English CRs in the period 1995–2002. For the period 1995–1999 the nine regional English registries overlap completely with the English National database, and their data were used for the analyses (on both regional and national scale). However, the English National database was used for the country-specific *period* survival analyses,[9] since some of the regional English registries contributed data on diagnoses in 2000–2002 not as individual registries but only as part of the National database.

2. Data collection and standardisation

2.1. *Study protocol and data collection*

The EUROCARE-4 study protocol[10] required the collection of the following items for each cancer case: sex; dates of birth, diagnosis and last ascertainment of vital status; vital status; codes indicating cancer topography, morphology and behaviour; sequence number of the tumour to distinguish first from subsequent primary cancers; whether the diagnosis was microscopically verified; and anonymous patient identification number. The latter number uniquely identifies each

Table 1a – Countries and cancer registries participating in EUROCARE-4 with mean population size covered by registration in 1995–1999 and proportion (%) of national population covered. Countries with nation-wide cancer registration in bold.

Country	Registry	Mean population	% National coverage
Austria	**Austria (national)**	**7,963,020**	**100.0**
	Tyrol	662,087	8.2
Belgium	Flanders	5,919,586	58.2
Czech Republic	West Bohemia	858,903	8.3
Denmark[A]	**Denmark**	**5,270,061**	**100.0**
Finland	**Finland**	**5,130,979**	**100.0**
France	Bas Rhin	1,009,792	1.7
	Calvados[a]	641,148	1.1
	Calvados digestive[b]	641,148	1.1
	Cote d'Or digestive[b]	505,083	0.9
	Cote d'Or haematol.[c]	505,083	0.9
	Doubs	497,493	0.8
	Haut Rhin	700,241	1.2
	Hérault	872,683	1.5
	Isère	1,076,495	1.8
	Loire Atlantique[d]	1,114,479	1.9
	Manche	480,850	0.8
	Marne & Ardennes[e]	857,539	1.5
	Somme	553,801	0.9
	Tarn	342,400	0.6
	French Registries	8,652,004	10.5–14.7
Germany	Saarland	1,079,880	1.3
Iceland	**Iceland**	**270,581**	**100.0**
Ireland	**Ireland**	**3,659,684**	**100.0**
Italy	Alto Adige	456,085	0.8
	Biella	190,031	0.3
	Ferrara	351,964	0.6
	Firenze	1,155,529	2.0
	Friuli V.G.	1,185,933	2.1
	Genova	917,278	1.6
	Macerata	300,354	0.5
	Modena	617,191	1.1
	Napoli	538,607	0.9
	Palermo[f]	1,241,727	2.2
	Parma	394,148	0.7
	Ragusa	294,574	0.5
	Reggio Emilia	441,490	0.8
	Romagna	970,735	1.7
	Salerno	1,090,072	1.9
	Sassari	470,264	0.8
	Torino	914,194	1.6
	Trento	456,629	0.8
	Umbria	831,147	1.5
	Varese	809,768	1.4
	Veneto	1,991,191	3.5
	Italian Registries	14,998,047	25.3-27.4
Malta	**Malta**	**373,866**	**100.0**
Norway	**Norway**	**4,394,802**	**100.0**
Poland	Cracow	738,796	1.9
	Kielce	1,183,001	3.1
	Warsaw	1,616,103	4.2
	Polish Registries	**3,537,900**	**9.2**
Portugal	South Portugal	4,401,902	43.4
Slovenia	**Slovenia**	**1,985,998**	**100.0**
Spain	Albacete[g]	358,533	0.9
	Basque Country	2,094,584	5.3
	Castellón[f]	460.454	1.2

(*continued on next page*)

Table 1a – *continued*

Country	Registry	Mean population	% National coverage
	Girona	523,244	1.3
	Granada[h]	808,926	2.0
	Murcia	1,101,177	2.8
	Navarra	531,028	1.3
	Tarragona	578,478	1.5
	Spanish Registries	6,456,423	12.2–16.3
Sweden	**Sweden**	**8,840,065**	**100.0**
Switzerland	Basel	435,638	6.1
	Geneva	401,080	5.6
	Grisons[i]	224,742	3.2
	St. Gallen	512,538	7.2
	Ticino	306,117	4.3
	Valais	272,843	3.8
	Zurich[j]	1,181,050	16.6
	Swiss Registries	3,334,008	27.1-46.8
The Netherlands	Amsterdam	2,771,383	17.6
	Eindhoven	964,196	6.1
	North Netherland	1,634,598	10.4
	Dutch Registries	5,370,176	34.1
UK England	**England (National)**	**49,331,205**	**100.0**
	East Anglia[k]	2,682,456	5.4
	Mersey & Cheshire	2,373,083	4.8
	North Western	4,142,732	8.4
	Northern & Yorkshire[l]	6,555,870	13.3
	Oxford	2,665,408	5.4
	South West	6,574,540	13.3
	Thames	13,583,860	27.5
	Trent	4,791,608	9.7
	West Midlands	5,265,109	10.7
	English Registries	48,634,667	98.6
UK N. Ireland	**Northern Ireland**	**1,667,784**	**100.0**
UK Scotland	**Scotland**	**5,085,648**	**100.0**
UK Wales	**Wales**	**2,900,615**	**100.0**
European Countries in EUROCARE-4		**151,407,460**	**35.5**
EU Countries in EUROCARE-4		**143,408,070**	**29.9**

A Denmark provided data for the 45 specific cancer sites listed in Table 2 only.
a Non-digestive system cancers.
b Digestive system cancers only.
c Haematological malignancies only.
d Colon, rectum and female breast only.
e Thyroid only.
f Female breast only.
g Female breast and male lung only.
h Tongue, oral cavity, oropharynx, head and neck, oesophagus, stomach, colon, rectum, biliary tract, larynx, lung-bronchus-trachea, skin melanoma, breast, cervix, corpus uteri, Hodgkin disease and non-Hodgkin lymphoma only.
i Stomach, colon, rectum, lung-bronchus-trachea, skin melanoma, breast, cervix and prostate only.
j Colorectum only.
k Mean population 1996–1999.
l Mean population 1998–1999.

patient, and was used to facilitate the review and correction of errors and inconsistencies. Date of case registration and basic information on stage at diagnosis were also requested, but were not compulsory since they were not always available to all CRs. A data field on each record indicated whether it had been subjected to the checking routines of the International Agency for Research on Cancer (IARC).[11]

Registries participating in the previous EUROCARE rounds were asked to send in their entire dataset, so that the updated information on the cases diagnosed before the EUROCARE-4 round was available. The data were archived in a dedicated server at the Istituto Superiore di Sanità, Rome, which is the data analysis centre for EUROCARE.

2.2. *Standardisation of tumour identification numbers*

Only first primary tumours were included in the survival analyses, although data on multiple tumours were collected and

Table 1b – Specialised childhood (0–14 years) cancer registries participating in EUROCARE-4, with mean population size covered by registration in 1995–1999 and proportion (%) of national population covered. Countries with nation-wide cancer registration in bold.

Country	Registry	Mean population	% National coverage
France	Bretagne	535,933	4.9
	Lorraine	455,294	4.1
	French Registries	991,228	9.0
Germany	Germany Berlin	500,505	3.8
	Germany East	2,142,038	16.3
	Germany West	10,473,996	79.7
	German Registries	**13,116,539**	**100**
Italy	Marche	189,046	2.3
	Piedmont	511,451	6.2
	Italian Registries	700,497	8.5
Spain	Comunitat Valenciana	405,460	6.5
	Spain RNTI	774,395	12.4
	Spanish Registries	1,179,855	18.9
UK	**England and Wales**	**10,028,100**	**100**

checked, and for the first time the effects of the inclusion of multiple tumours on the relative survival estimates were evaluated.[12] Procedures for assigning tumour sequence numbers to multiple primary cancers in a single person are not uniform across CRs, and this may have an impact on the survival estimates, due to the lack of standardisation in the selection of first tumour. For this reason, we assigned a *recoded tumour sequence number*, generated from the patients' identification number (to identify the patient), the behaviour, site and morphology (to identify the tumour and whether it is malignant) and the month and year of diagnosis (to determine the order of diagnosis of multiple primaries). Recoded tumour sequence numbers followed separate numbering orders for: (a) malignant tumours (excluding non-melanoma and non-sarcoma skin cancers) and (b) non-melanoma and non-sarcoma malignant skin cancers plus benign/*in situ* tumours. Not all CRs provided data on the latter category.

Since patient identification numbers are required to generate recoded tumour sequence numbers, the latter could not be generated for the cases from 14 CRs that provided tumour rather than patient identification codes. For these CRs, the original tumour sequence number was used instead. The original tumour identification number was also preferred for (a) CRs providing data on certain cancer sites only (Cote d'Or Haematologique, Denmark, Granada, Grisons and Zurich) and (b) CRs in operation prior to 1978 (Iceland, Sweden and Finland). The latter CRs, with long operating times, have cancers archived that were diagnosed earlier than the earliest cases archived in EUROCARE. So, from their data the order of diagnosis of multiple tumours in a single person can be detected with a higher level of precision than from the EUROCARE database.

We calculated *recoded* tumour sequence numbers for 61 CRs. For these CRs, we compared the proportions of multiple tumours calculated from *recoded* and *original* tumour identification numbers. We found that the percentages were often closely similar (absolute differences were on average 0.1 and never exceeded 2 percentage points) indicating that most CRs followed similar procedures to those we followed for identifying the multiple tumours and for determining the order of diagnosis. By contrast, when we considered the long-established registries of Iceland, Sweden and Finland, as expected, the number of multiple primaries determined from original tumour identification numbers was considerably greater than that determined from recoded identification numbers.

2.3. *Standardisation of topography and morphology codes*

The EUROCARE-4 protocol[10] stipulates that topography should be specified according to ICD-9, ICD-10 or ICD-O; and that morphology should be according to ICD-O-2 or ICD-O-3. ICD-O was in fact mainly used to code topography, followed by ICD-10; ICD-9 was used rarely. The diagnosis period was the main determinant of whether morphology was specified by ICD-O-2 or ICD-O-3. ICD-O-3 was chosen as a reference for coding the topography and morphology of all EUROCARE-4 cases. ICD-O-3 was also used in the subsequent checking procedures, so as to ensure the maximum compatibility with IARC data-checking programs. Since most CRs provided topography and morphology codes in this form, the amount of trans-coding required was fairly limited.

ICD-O-2 morphology codes were translated automatically to ICD-O-3 using a trans-coding table.[10] A similar table was used for an automatic conversion of the few cases with ICD-O-1 codes. ICD-9 and ICD-10 site codes were converted into ICD-O-3 topography codes using specific trans-coding tables.[10]

ICD-9/10 codes indicating benign, *in situ* or borderline behaviour were translated only after an automatic checking that they were compatible with the behaviour of the corresponding ICD-O-3 categories. ICD-9/10 codes with the morphology information were checked in the same way. Compatible codes are shown in Table A1 (Appendix). Incompatible ICD-9/10 codes were not translated, and during subsequent data checking these were treated as

topography–behaviour or topography–morphology inconsistencies. When the morphology field was blank, the morphological information carried by ICD-9/10 topography codes was not lost but was used to automatically impute the corresponding morphology code.

2.4. *Forty-five major cancer sites*

We considered 45 major cancer sites, as well as all cancers combined – consisting of all malignant cancers except non-melanoma and non-sarcoma skin cancers – in the EUROCARE-4 analyses. The ICD-O-3 codes contributing to the 45 major sites are shown in Table 2. Usually only malignant cancers were included within these sites: the few exceptions are specified in Table 2. With few exceptions these 45 cancer sites correspond to those used in the previous EUROCARE studies to ensure the maximum comparability. These sites are also closely similar to those used by the Surveillance, Epidemiology and End Results (SEER) programme[13] for presenting the latest United States (US) Cancer Statistics Reviews.[14] However, there were some differences: in EUROCARE, the colon and rectum site included anus, anal canal and not otherwise specified intestinal sites; lung included trachea and bronchi and soft tissues included heart. Different definitions were also used for bladder, liver and acute myeloid leukaemia. Finally, choroid melanoma was not included in SEER but is present in EUROCARE.

3. Data quality control

Automated procedures checked each data field and combinations of fields in each case record, including benign and *in situ* cases, and cases with diagnosis date prior to 1995. The consistency of each field was checked first by comparing with the valid ranges contained in the EUROCARE-4 protocol.[10] Topographies and morphologies were checked against ICD-O-3 lists.[5]

Checks on combinations of data fields concerned:

- Consistency between dates of birth, diagnosis and follow-up.
- Consistency of site–morphology combinations. The standard IARC routines[11] were applied first, followed by those of EUROCARE (Table A2 Appendix).
- Consistency of age–site, age–morphology, sex–site and sex–morphology combinations. Unlikely combinations were checked against IARC criteria.[11]
- Consistency of morphology–behaviour combinations. Combinations not listed in ICD-O-3 classification were flagged as unlikely.

Records with invalid fields or impossible or unlikely combinations were sent back to the CRs for revision. Records returned after revision were re-checked. A specific field kept track of checking requests and their results, which were used to decide the eventual fate of the record. Duplicate records were not admitted to the EUROCARE-4 database. Missing, invalid or inconsistent date, sex, site, morphology and behaviour fields were coded as *major* errors. Records with major errors entered the EUROCARE-4 database, but were excluded from the survival analyses. Unlikely combinations of age/sex/site/morphology, confirmed after review by the CR, as well as unlikely combinations of morphology and behaviour were coded as *minor* errors and included in both the database and the survival analyses.

The numbers of cases included in the EUROCARE-4 database, for each CR, with diagnosis period, as well as the summary results of the checking procedures are presented in Table 3, separately for the all ages and childhood CRs. Overall about 13,815,000 cases, diagnosed from 1978 to 2002, were admitted to the EUROCARE-4 database.

After checking and correcting where possible, 97.8% of the admitted records were error free, 0.22% contained major errors and the rest were minor errors. For CRs covering all ages, most (70%) of the 271,102 records with minor errors had unlikely behaviour–morphology combinations. For the specialised childhood CRs, unlikely combinations of other variables formed most (98%) of the 3,663 minor errors. Overall, 21,409 minor errors (11% of all minor errors) were due to unlikely behaviour–morphology combinations in malignant cases. Of the total 171,830 non-malignant cases with unlikely behaviour, about 87% (150,128) came from Norway. Of these, 60% were cervix uteri carcinomas of uncertain behaviour (ICD-O-3 code: 8010/1) and 7% were skin tumours of uncertain behaviour (NOS squamous cell carcinoma) (ICD-O-3 code 8070/1).

Overall 8.4% of tumours were benign/*in situ*, with a marked variation between the registries: from 30% in Norway to zero or almost zero in many French and Italian CRs. These differences reflect disparate practices for the collection or provision of data on non-malignant tumours, rendering cross-registry analyses of these neoplasms particularly difficult. Most non-malignant tumours occurred at the uterine cervix (50%), bladder (10%) and large bowel (8%) sites.

3.1. *Data changes after 2007*

The analyses presented in this issue of the *European Journal of Cancer* were carried out in February 2008, eight months after the first two EUROCARE-4 summary papers[6,7] had been drafted. During this period, the datasets of several CRs were modified. Some changes consisted of updates or late corrections: queried records from the Swedish registry were returned; 2000–2002 diagnosis period data from the Cote d'Or haematological registry were included; up to date follow-up information arrived from the North Netherlands registry. Other changes were made to resolve the problems that emerged during the analyses. The most important of these was to change the date of closure of follow-up for the Austrian national CR from 31st December 2003 to 31st December 2002 since vital status information during 2003 was incomplete, selectively so for the patients still alive. Corrections were also made to the multiple tumour indicators for the CRs of Finland, Iceland and Sweden to take account of information on the cancers diagnosed prior to 1978, that were available to these registries but not present in the study database.

Table 2 – Cancer sites included in EUROCARE-4 survival analyses. Site definitions are according to the third revision of the International Classification of Diseases for Oncology (ICD-O-3).

Cancer site	Details	ICD-O-3 site	ICD-O-3 morphology
Lip	Excluding skin of lip	C00	Excluding 9590–9989
Tongue and lingual tonsil	Base of tongue and other or unspecified parts	C019–C029	Excluding 9590–9989
Oral Cavity	Gum, floor of mouth, other and unspecified mouth	C03–C06	Excluding 9590–9989
Salivary Glands	Parotid gland and other major salivary glands	C079–C089	Excluding 9590–9989
Oropharynx	Oropharynx including tonsil (fossa pillars)	C09–C10	Excluding 9590–9989
Nasopharynx		C11	Excluding 9590–9989
Hypopharynx	Pyriform sinus and hypopharynx	C129,C13	Excluding 9590–9989
Head and neck	Tongue, gum, floor of mouth, other and unspecified mouth, oropharynx, nasopharynx, hypopharynx, other oral cavity and pharynx	C01–C06, C09–C14	Excluding 9590–9989
Oesophagus		C15	Excluding 9590–9989
Stomach		C16	Excluding 9590–9989
Small intestine	Excluding ileocaecal valve	C17	Excluding 9590–9989
Colorectum	Colon, rectum, rectosigmoid junction, anal canal, anus and intestine NOS	C18–C21, C260	Excluding 9590–9989
Colon	Colon excluding rectosigmoid junction	C18	Excluding 9590–9989
Rectum	Rectum, rectosigmoid junction, anal canal and anus	C19, C20, C21	Excluding 9590–9989
Liver, primary	Liver and intrahepatic bile ducts (excluding metastatic and uncertain behaviour)	C22	Excluding 9590–9989
Gallbladder and biliary tract	Gallbladder, ampulla of Vater and extrahepatic bile ducts	C23–C24	Excluding 9590–9989
Pancreas		C25	Excluding 9590–9989
Nasal cavities and sinuses	Nasal cavities accessory sinuses, middle and inner ear	C30–C31	Excluding 9590–9989
Larynx		C32	Excluding 9590–9989
Lung, bronchus and trachea	Trachea, bronchus and lung (excluding mesotheliomas)	C339,C34	Excluding 9590–9989 and 9050–9055
Pleura		C384	Excluding 9590–9989
Bone and cartilages	Bones, joints and articular cartilage	C40–C41	Excluding 9590–9989
Soft tissue	Connective subcutaneous and other soft tissues (excluding heart)	C380,C47,C49	Excluding 9590–9989
Melanoma of skin		C440–C449	8720–8790
Breast		C500–C509	Excluding 9590–9989
Cervix uteri		C53	Excluding 9590–9989
Corpus uteri	Corpus, isthmus, other	C54	Excluding 9590–9989
Ovary and uterine adnexa	Ovary and other uterine adnexa	C569, C570–C574, 577	Excluding 9590–9989
Vagina and vulva	Vagina, vulva and other and unspecified female genital organs	C51, C529, C578, C579	Excluding 9590–9989
Prostate		C619	Excluding 9590–9989
Testis		C62	Excluding 9590–9989
Penis	Penis and other male genital organs	C60, C63	Excluding 9590–9989
Bladder	Urinary bladder (including benign neoplasms)	C67	Excluding 9590–9989
Kidney	Kidney and other and unspecified urinary organs (excluding bladder)	C64–C66, C68	Excluding 9590–9989
Melanoma of choroid		C693	8720–8790
Brain	Excluding meningiomas	C71	Excluding 9530–9539 and 9590–9989
Thyroid gland		C739	Excluding 9590–9989
Hodgkin's disease[a]			9650–9667
Non-Hodgkin's lymphoma		[a]	9590–9596, 9670–9671, 9673, 9675, 9678–9680, 9684, 9687, 9689–9691, 9695, 9698–9702, 9705, 9708–9709, 9714–9719, 9727–9729, 9827
		Excluding C420, C421,C424	9823
Multiple myeloma[a]			9731–9732, 9734
Leukaemia[a]			9733, 9742, 9800–9946
Acute lymphatic leukaemia[a]			9826, 9835–9837
Chronic lymphatic leukaemia		C420,C421,C424	9823
Acute myeloid leukaemia[a]			9840, 9861, 9866, 9867, 9870–9874, 9891, 9895–9897, 9910, 9920, 9931
Chronic myeloid leukaemia[a]			9863, 9875, 9876, 9945, 9946

a No selection according to tumour site was carried out.

4. Data quality indicators

The main data quality indicators for the adult cases diagnosed from 1995 to 2002 are presented in Table 4. Quality indicators for the childhood cases are reported separately.[15] For the 5,761,843 malignant cases diagnosed in 1995–2002, only a negligible proportion (7909 cases; 0.14%) had *major* errors and had to be excluded from the analyses, leaving 5,753,934 valid records (i.e. error free or containing *minor* errors). Second or subsequent tumours, cases known by death certificate only (DCO), and those incidentally discovered at autopsy were also excluded from the survival analyses, in accordance with the standard procedures, leaving 5,278,670 cases for the analyses.

Overall, 5.3% of the cancers were subsequent primaries, but figures of 10% or more characterised the registries (Basel, Geneva, Finland, Iceland, Norway, Sweden and Scotland) operating for a long time.

Overall, 2.7% of the cases were DCO, ranging from zero to 10.2% in Austria, 12.5% in Wales and 14.1% in Thames. Zero proportions were found for the CRs that do not use the information of death certificates in the registration (such as those in France, Portugal and Sweden). Overall, only 0.4% of valid primary cancers were discovered at autopsy. However, proportions were considerably higher in Basel (2.9%), Sweden (2.2%) and West Bohemia (5.7%).

About 90% of the 5,278,670 cases included in the survival analyses were microscopically verified, although again the proportion varied widely with country. Excluding the outlier Wales, for which a large proportion of pathology records were not available to the registry, the proportion with the microscopic verification varied from 74% in Cracow to 100% in specialised CRs.

The proportion of patients lost or censored before 5 years is an important indicator of data quality for survival estimates. Closing follow-up at 31st December 2003 allowed at least 5-years of follow-up for the cases diagnosed from 1995 to 1998. Considering only the cases diagnosed in this period, the proportion alive but followed up for less than 5 years was slightly above 1% (Table 4, last column). Notable exceptions were CRs with the earlier follow-up closing date of 31st December 2002 (Austria, Saarland and West Bohemia) and CRs with non-negligible numbers of cases censored in 2002 or before (Cote d'Or Haematological, East Anglia and Varese). If only passive follow-up methods are used the proportion of censored cases is null by definition, so this indicator cannot be used to assess the follow-up completeness.

Table 5 shows the proportions of microscopically verified (histological or cytological) cases, by CR, for selected common cancers diagnosed from 1995 to 2002. The extent of microscopic verification depends on the accessibility of the cancer to biopsy, whether surgery was performed, and also the availability of the pathology reports to CRs. The lowest overall proportions of microscopic verification were for rapidly fatal cancers: pancreas (62.7%), brain (78.2%) and lung (83.4%). By contrast, over 95% of skin melanoma, breast and non-Hodgkin's lymphoma cancers were verified. Microscopic verifications were typically 5% to 10% points higher in EUROCARE-4 than in EUROCARE-3 (diagnosed in 1990–1994).[16]

Table 6 shows crude (i.e. non-age-standardised) 5-year relative survival by country for selected poor prognosis cancers (oesophagus, liver, pancreas, lung and pleura) diagnosed in 1990–1994 (EUROCARE-3) compared with those diagnosed in 1995–1999 (EUROCARE-4). Unusually high survival rates for these rapidly fatal cancers suggest an incomplete life status ascertainment (or possibly inaccurate diagnoses). We defined high survival outliers as those countries in which the lower bound of the 99% confidence interval (CI) for survival exceeded the upper bound of the 99% CI for survival of the pool of European CRs. Using this method, implausibly high survival was found in Austria for pancreatic and lung cancers, and in Belgium for oesophageal, pancreatic and lung cancers (Table 6, figures in bold). Exceptionally high survival levels were observed for oesophagus in Germany, for pancreas in Portugal and pleura in Poland. Both exceptionally high survival and exceptionally low survival were observed in Iceland, due to the small population size and correspondingly high random variability. It is encouraging that follow-up problems identified in Spain and Wales in EUROCARE-3 using this method[16] seem to have been overcome in the present EUROCARE round. In Spain, for example, CRs now have access to the Spanish National Death Index, which is likely to have contributed to improving death ascertainment in that country.[17]

5. Methods of survival analysis

The principal indicator provided by EUROCARE is relative survival. Conventionally expressed as a percentage, relative survival is the ratio of the observed survival in a group of patients to the expected survival in a comparable group of individuals from the general population. Relative survival is widely used for international comparisons – in lieu of cause-specific survival – in order to remove the risk of competing mortality (risk of death for causes other than cancer), which varies between CR areas and countries. The standard *cohort* approach was used to estimate the 5-year relative survival for patients diagnosed in 1995–1999.[8] The so-called *period* approach, introduced by Brenner et al.,[18] was used to estimate the relative survival in 2000–2002.[9] The *cohort* and *period* survival estimates were obtained using the SEER*Stat software.[19] Relative survival was estimated using the Hakulinen method[20] from sex-, age- and calendar year-specific life tables for each CR population.

Relative survival can exceed 100%, indicating that the survival in the group of cancer patients is higher than the survival expected in the matched group from the general population. This can happen when information on death is missed by the registry, or by chance in small-size populations. However, it can also occur if patients are cured and subsequently have a healthier lifestyle or are better treated for co-morbidities than the reference population. Standard errors of mean survival estimates were calculated with the Greenwood formula, as incorporated in the SEER*Stat software. To obtain 95% CI the data were logarithmically

Table 3 – The EUROCARE-4 database: total number of cases contributed by each cancer registry with relative diagnosis period. The results of data checking are also shown, together with the proportion (%) of total cases that were malignant tumours.

Country	Registry	Diagnosis period		Total cases	Cases without errors	Cases with minor errors			Cases with major errors	Proportion (%) malignant tumours
						Unlikely behaviour (not malig.)	Unlikely behaviour (malig.)	Other unlikely combinations		
General cancer registries										
Austria	Austria	1983	2002	735,959	729,462	3216	84	2685	512	95
	Tyrol[a]	1988	1999	34,294	34,133	60	0	101	0	99
Belgium	Flanders	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	5332	1425	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'Or digestive	1976	2002	13,032	13,009	0	0	18	5	100
	Cote d'Or haematol.	1980	1999	4415	4386	0	0	19	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
	Hérault	1995	1997	11,214	11,176	0	0	38	0	94
	Isère	1989	1997	35,830	35,520	0	0	176	134	96
	Loire Atlantique	1991	1997	8252	8251	0	0	1	0	100
	Manche	1994	1997	9078	9064	0	0	13	1	91
	Marne & Ardennes	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	1080	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	8806	8766	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

(*continued on next page*)

Table 3 – (*continued*)

Country	Registry	Diagnosis period		Total cases	Cases without errors	Cases with minor errors			Cases with major errors	Proportion (%) malignant tumours
						Unlikely behaviour (not malig.)	Unlikely behaviour (malig.)	Other unlikely combinations		
	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	26,759	0	1	138	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	1181	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	6526	3105	1794	70
Poland	Cracow	1978	2002	60,141	59,075	40	42	174	810	97
	Kielce	1995	2002	34,376	33,844	3	44	146	339	99
	Warsaw	1989	2002	88,664	70,072	37	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	2054	2054	0	0	0	0	94
	Basque Country	1986	1999	111,064	110,326	6	0	242	490	99
	Castellón	1995	2002	1765	1760	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	1,135,034	1,113,095	10,792	14	9597	1536	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	5809	5799	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	2148	2018	0	0	1	129	100
The Netherlands	Amsterdam	1988	2002	174,644	171,687	82	1461	1409	5	97
	Eindhoven	1978	2001	80,964	79,547	168	751	497	1	94
	North Netherlands	1995	2001	62,668	62,029	209	3	424	3	93

UK England	East Anglia	1978	2002	349,264	342,829	294	878	1966	3297	87
	England[b]	1995	2002	1,459,112	1,452,316	0	569	5544	683	100
	Mersey	1978	1999	265,760	261,390	697	1179	1849	645	87
	North Western	1995	1999	121,901	120,609	0	572	648	72	81
	Northern & Yorkshire	1978	2002	631,183	623,839	1368	1796	2139	2041	87
	Oxford	1978	2002	232,230	229,592	15	390	1040	1193	99
	South Western	1978	1999	695,223	687,532	387	160	2784	4360	90
	Thames	1985	1999	958,521	957,427	0	0	910	184	90
	Trent	1979	1999	456,533	451,640	445	1486	1451	1511	89
	West Midlands	1978	2002	610,254	603,462	1060	1275	1980	2477	87
UK N. Ireland	Northern Ireland	1993	2002	113,657	111,605	382	38	1462	170	76
UK Scotland	Scotland	1978	2002	798,898	792,033	524	2143	3913	285	88
UK Wales	Wales	1978	2002	338,366	334,447	12	108	281	3518	99
Total, all ages				13,739,597	13,438,872	171,803	21,364	77,935	29,623	92
Specialised childhood cancer registries										
France	Bretagne	1991	2003	1010	947	0	0	63	0	92
	Lorraine	1983	2002	1272	1221	0	0	51	0	94
Germany	Germany Berlin	1980	2002	1098	1051	0	2	39	6	96
	Germany East	1991	2002	3220	3016	17	42	120	25	92
	Germany West	1980	2002	29288	27,699	0	0	1399	190	93
Italy	Marche	1995	2002	275	266	0	0	9	0	93
	Piedmont	1976	2001	2614	2489	3	0	121	1	90
Spain	Comunitat Valenciana	1983	2002	1437	1388	0	1	48	0	95
	Spain RNTI	1995	1999	569	549	0	0	16	4	96
UK	England and Wales	1978	2002	34193	32,452	7	0	1725	9	84
Total, age 0–14 years				74,976	71,078	27	45	3591	235	89

a Tyrol cancer cases are also included in the Austrian National Registry.

b Refers to the English National database. English regional registries overlap completely with the English National database, except in diagnosis period 2000–2002, because some regional registries did not send data to EUROCARE-4 for 2000–2002 as individual registries, but did send them to the English National database.

Table 4 – Data quality indicators and other characteristics of all malignant cancers (except skin non-melanoma) diagnosed in European adults (age 15+ years) in 1995–2002, by cancer registry.

Country	Registry	Number of malignant cancers	Number of cases excluded for major errors	Cases without major errors	Cases without major errors excluded from survival analyses			Cases included in survival analyses		
					Multiple primaries (%)	Death certificate only (%)	Autopsy (%)	Number of cases	Microscopic verification (%)	Cases 1995–1998 censored before 5 years (%)
Austria	Austria	281,008	367	280,641	5.6	10.2	0.0	237,916	93.1	13.1
	Tyrol	13,721	0	13,721	6.0	3.6	0.1	12,431	94.4	0.0
Belgium	Flanders	143,965	79	143,886	3.0	0.0	0.2	139,364	89.6	0.0
Czech Repub.	West Bohemia	32,196	0	32,196	6.2	3.2	5.7	27,495	87.5	10.0
Denmark	Denmark	110,298	4	110,294	6.1	1.8	0.1	101,547	90.4	0.2
Finland	Finland	168,794	630	168,164	12.9	2.9	1.6	139,813	95.6	0.1
France	Bas Rhin	13,044	0	13,044	7.1	0.0	0.0	12,121	95.8	3.5
	Calvados	5663	0	5663	5.0	0.0	0.0	5382	98.2	6.3
	Calvados digestive	2799	1	2798	2.0	0.0	0.0	2742	86.9	4.4
	Cote d'Or digestive	4375	0	4375	2.3	0.0	0.0	4274	82.6	1.0
	Cote d'Or haematol.	1834	2	1832	0.5	0.0	0.0	1823	100.0	14.9
	Doubs	5701	0	5701	6.2	0.0	0.0	5348	95.6	2.1
	Haut Rhin	9014	26	8988	6.7	0.0	0.0	8389	96.3	5.9
	Hérault	10,425	0	10,425	2.1	0.0	0.0	10,210	n.a.	6.5
	Isère	12,415	22	12,393	5.8	0.0	0.0	11,680	94.1	4.8
	Loire Atlantique	3746	0	3746	0.9	0.0	0.0	3714	100.0	6.8
	Manche	6225	0	6225	3.1	0.0	0.0	6033	96.5	2.8
	Marne & Ardennes	163	0	163	n.a.	0.0	0.0	163	100.0	3.7
	Somme	6443	3	6440	4.9	0.0	0.0	6124	94.0	6.9
	Tarn	4912	0	4912	6.3	0.0	0.0	4601	93.8	2.1
Germany	Saarland	46,374	49	46,325	7.5	4.9	0.0	40,753	95.2	11.6
Iceland	Iceland	8516	3	8513	13.7	0.1	1.0	7266	96.7	0.0
Ireland	Ireland	106,785	4	106,781	3.8	2.9	0.4	99,305	86.3	0.0
Italy	Alto Adige	17,564	0	17,564	4.7	0.8	0.0	16,598	89.5	0.0
	Biella	9884	7	9877	4.5	1.5	0.5	9244	86.3	0.0
	Ferrara	19,264	3	19,261	5.6	1.4	0.0	17,922	86.6	0.8
	Firenze	56,874	80	56,794	6.0	1.2	0.1	52,728	79.6	0.8
	Friuli V.G.	65,087	0	65,087	4.8	0.7	1.9	60,320	89.4	0.6

	Genova	38,238	32	38,206	6.4	2.1	0.0	35,008	81.0	0.0
	Macerata	8513	0	8513	4.9	1.6	0.0	7959	86.3	0.2
	Modena	29,649	1	29,648	5.8	0.6	0.0	27,776	86.8	0.7
	Napoli	7582	24	7558	0.5	4.1	0.0	7204	75.1	3.4
	Palermo	581	0	581	[a]	2.2	0.0	568	94.7	[b]
	Parma	21,532	1	21,531	7.8	1.2	0.0	19,616	85.6	0.6
	Ragusa	8755	0	8755	5.1	2.4	0.9	8037	79.4	0.2
	Reggio Emilia	18,452	4	18,448	2.7	0.3	0.0	17,889	86.0	0.0
	Romagna	51,107	3	51,104	7.6	2.8	0.0	45,862	88.3	0.2
	Salerno	23,768	9	23,759	0.9	2.8	0.0	22,886	77.2	7.4
	Sassari	14,901	0	14,901	4.0	3.5	0.3	13,766	84.2	0.0
	Torino	37,296	9	37,287	6.4	2.4	0.2	33,997	87.3	0.4
	Trento	14,910	21	14,889	3.2	2.5	0.0	14,062	84.4	0.4
	Umbria	39,103	0	39,103	4.9	0.8	0.0	36,887	82.7	0.1
	Varese	21,528	23	21,505	8.4	1.3	0.0	19,459	88.7	14.0
	Veneto	71,290	0	71,290	7.4	1.9	0.2	64,594	86.7	0.2
Malta	Malta	9746	0	9746	2.1	1.9	0.1	9345	89.2	0.0
Norway	Norway	160,212	569	159,643	12.5	1.0	0.4	137,757	92.4	0.2
Poland	Cracow	22,789	69	22,720	7.4	1.3	0.1	20,741	73.7	6.2
	Kielce	31,475	290	31,185	0.8	0.0	0.0	30,928	79.0	0.0
	Warsaw	47,511	114	47,397	4.6	3.4	0.0	43,662	82.2	0.5
Portugal	South Portugal	32,547	156	32,391	2.5	0.0	0.0	31,569	93.8	0.1
Slovenia	Slovenia	56,234	4	56,230	3.6	1.6	1.1	52,714	92.0	0.1
Spain	Albacete	1941	0	1941	2.4	4.7	0.0	1805	93.7	0.7
	Basque Country	44,539	158	44,381	5.5	4.5	0.0	40,068	90.1	0.1
	Castellón	1608	0	1608	9.4	0.0	0.0	1457	99.6	0.0
	Girona	19,774	8	19,766	3.5	4.0	0.1	18,297	91.0	0.1
	Granada	7077	0	7077	4.2	2.2	0.0	6625	91.0	0.0
	Murcia	13,824	0	13,824	2.2	3.6	0.1	13,020	91.0	2.6
	Navarra	11,896	0	11,896	6.3	2.9	0.6	10,761	90.8	1.0
	Tarragona	12,301	46	12,255	5.3	4.8	0.0	11,046	90.7	0.1
Sweden	Sweden	325,466	0	325,466	13.0	0.0	2.2	276,994	98.0	0.2
Switzerland	Basel	13,598	48	13,550	11.8	0.0	2.9	11,598	99.0	7.4
	Geneva	15,622	0	15,622	11.4	0.5	0.8	13,659	93.6	4.0
	Grisons	2739	0	2739	8.1	0.7	0.4	2489	93.0	2.5
	St. Gallen	16,135	0	16,135	8.3	0.7	1.0	14,541	93.9	0.9
	Ticino	10,503	0	10,503	3.5	3.1	0.3	9794	94.0	1.6
	Valais	4376	12	4364	7.1	1.6	0.4	3974	92.6	2.6
	Zurich	777	29	748	6.8	0.3	0.0	695	98.0	3.0
The Netherlands	Amsterdam	90,994	0	90,994	10.1	0.0	0.4	81,552	95.8	0.4
	Eindhoven	27,816	0	27,816	9.8	0.0	0.0	25,099	95.8	0.2
	North Netherlands	58,151	3	58,148	4.6	0.0	1.0	54,927	94.6	0.0

(*continued on next page*)

Table 4 – *continued*

Country	Registry	Number of malignant cancers	Number of cases excluded for major errors	Cases without major errors	Cases without major errors excluded from survival analyses			Cases included in survival analyses		
					Multiple primaries (%)	Death certificate only (%)	Autopsy (%)	Number of cases	Microscopic verification (%)	Cases 1995–1998 censored before 5 years (%)
UK England	East Anglia	102,702	7	102,695	7.6	0.6	1.1	93,251	84.3	15.0
	England	1,455,048	681	1,454,367	n.a.	n.a	n.a	1,454,367	n.a.	0.1
	Mersey	57,454	27	57,427	5.6	5.5	0.0	51,206	81.6	0.0
	North Western	97,885	71	97,814	2.4	1.5	0.0	93,973	79.4	0.0
	Northern & Yorks	211,197	913	210,284	6.1	1.4	0.5	193,914	85.1	0.0
	Oxford	85,046	2	85,044	3.7	0.8	0.4	80,971	89.5	0.0
	South Western	167,521	757	166,764	7.6	7.8	0.1	141,997	76.8	0.0
	Thames	291,642	32	291,610	4.7	14.1	0.6	237,109	84.1	0.1
	Trent	109,074	593	108,481	6.4	7.1	0.0	94,328	79.6	0.0
	West Midlands	189,731	1,048	188,683	6.9	5.1	1.1	164,746	86.9	0.1
UK N. Ireland	Northern Ireland	51,654	60	51,594	5.2	1.6	0.5	47,839	80.3	0.1
UK Scotland	Scotland	211,815	14	211,801	11.1	1.2	0.1	185,879	84.0	0.0
UK Wales	Wales	117,129	791	116,338	8.5	12.5	0.0	93,097	56.9[c]	0.0
Totals		5,761,843	7,909	5,753,934	5.3	2.7	0.4	5,278,670	89.9	1.3

n.a.: not available.

a Palermo only registers breast cancers and did not provide a tumour sequence number (see text) so it was impossible to estimate multiple primaries.

b This registry started in 1999 so cases censored in 1995–1998 could not be estimated.

c Microscopic verifications only partially available to the Wales CR.

Table 5 – Proportions of microscopic verifications, by cancer registry for selected cancer sites diagnosed in 1995–2002 in European adults (age 15+ years).

Country	Registry	Stomach	Colon	Pancreas	Lung	Bone	Skin melanoma	Breast	Prostate	Brain[a]	Non-Hodgkin's lymphoma
Austria	Austria	93.5	94.1	71.2	87.8	96.9	98.2	95.3	95.3	90.6	98.2
	Tyrol	96.9	95.0	64.2	88.0	86.2	99.8	98.0	98.6	91.2	99.7
Belgium	Flanders	90.7	88.5	57.6	85.5	96.0	97.5	93.8	90.2	90.1	99.6
Czech Republic	West Bohemia	89.9	92.2	36.7	82.3	92.1	99.4	93.4	93.1	79.3	99.2
Denmark	Denmark	92.4	91.3	65.6	81.6	84.8	97.4	95.8	84.9	76.4	96.8
Finland	Finland	97.6	97.5	74.2	91.2	96.9	100.0	99.5	99.0	88.7	99.3
France	Bas Rhin	99.5	99.1	70.0	95.4	92.3	100.0	98.9	97.9	70.8	99.5
	Calvados	n.a.	n.a.	n.a.	98.0	100.0	100.0	97.9	98.6	93.4	100.0
	Calvados digestive	94.0	95.5	46.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	100.0
	Cote d'Or digestive	94.0	95.8	48.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Cote d'Or haematol.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	100.0
	Doubs	100.0	97.8	53.3	96.4	100.0	100.0	96.6	97.9	92.6	99.4
	Haut Rhin	98.3	98.6	49.5	96.5	100.0	100.0	98.7	98.4	93.0	100.0
	Hérault	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Isère	97.1	96.7	61.9	93.3	93.1	100.0	98.4	97.2	83.4	99.3
	Loire Atlantique	n.a.	100.0	n.a.	n.a.	n.a.	n.a.	99.9	n.a.	n.a.	n.a.
	Manche	99.0	99.3	58.4	97.4	93.3	100.0	98.1	97.7	88.9	99.4
	Marne & Ardennes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Somme	98.9	95.1	65.9	95.1	100.0	100.0	98.1	95.8	72.6	96.0
	Tarn	95.7	95.4	64.4	95.6	87.5	100.0	98.9	96.3	71.2	98.4
Germany	Saarland	95.8	97.3	72.0	90.3	94.8	99.5	98.5	98.0	92.3	99.3
Iceland	Iceland	99.2	98.6	74.9	93.9	100.0	100.0	99.5	98.5	82.2	100.0
Ireland	Ireland	91.8	89.9	41.3	74.5	93.5	99.7	96.9	86.9	70.3	99.4
Italy	Alto Adige	95.7	94.0	51.5	85.2	88.9	98.9	94.6	93.7	64.6	98.2
	Biella	94.4	94.2	48.9	75.3	66.7	100.0	94.2	97.2	43.0	97.7
	Ferrara	91.6	92.5	49.4	79.1	60.9	100.0	97.4	83.9	56.0	98.6
	Firenze	83.6	86.7	38.5	66.8	79.0	94.0	95.1	81.8	49.6	88.1
	Friuli V.G.	94.1	95.3	48.5	81.7	100.0	100.0	96.9	96.1	59.3	99.6
	Genova	87.2	87.1	43.2	69.4	88.9	94.7	92.8	84.8	53.9	91.2
	Macerata	90.1	88.1	38.8	80.1	80.0	100.0	97.9	89.1	42.4	96.9
	Modena	91.9	93.6	33.7	67.9	97.1	100.0	99.1	96.7	47.3	99.8
	Napoli	82.9	83.4	44.3	65.3	60.7	97.9	93.7	59.1	59.6	88.6
	Palermo	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	94.7	n.a.	n.a.	n.a.
	Parma	89.0	89.8	41.6	76.5	78.6	100.0	98.5	92.3	62.7	99.6
	Ragusa	88.4	87.5	32.7	65.5	75.0	99.2	96.0	80.1	52.3	98.4
	Reggio Emilia	90.5	91.0	37.7	78.3	75.0	99.1	96.4	91.1	35.0	98.4
	Romagna	94.4	92.8	41.6	81.1	87.3	99.8	96.8	89.7	58.9	99.8
	Salerno	82.7	82.0	39.2	66.3	64.4	97.5	83.8	77.9	58.7	95.0
	Sassari	95.3	93.8	45.2	77.0	92.9	100.0	97.3	85.0	47.2	99.4
	Torino	95.3	94.5	43.7	78.4	96.0	99.8	97.4	94.2	40.4	97.0
	Trento	89.9	91.6	35.8	76.8	59.1	99.1	96.5	85.5	1.7	98.3
	Umbria	87.7	87.1	36.8	76.0	64.0	88.1	93.8	84.3	57.9	88.2
	Varese	94.8	94.0	48.0	80.1	76.5	99.5	96.5	92.6	60.5	98.4
	Veneto	92.5	92.6	47.2	75.5	87.2	98.6	96.6	88.7	68.0	97.4

(*continued on next page*)

Table 5 – *continued*

Country	Registry	Stomach	Colon	Pancreas	Lung	Bone	Skin melanoma	Breast	Prostate	Brain [a]	Non-Hodgkin's lymphoma
Malta	Malta	91.4	91.7	33.2	78.3	100.0	99.5	96.2	90.7	71.8	98.6
Norway	Norway	96.5	94.6	58.5	88.3	97.3	99.8	98.7	92.8	75.3	99.1
Poland	Cracow	68.1	68.2	36.8	69.0	75.0	97.2	90.4	62.8	53.0	99.5
	Kielce	74.3	78.4	47.3	81.1	68.2	98.3	90.0	72.4	49.6	92.4
	Warsaw	80.5	79.8	51.3	81.0	79.4	96.8	94.4	88.4	55.9	100.0
Portugal	South Portugal	94.3	95.4	49.8	90.8	97.9	100.0	97.0	94.9	89.8	100.0
Slovenia	Slovenia	93.3	93.9	55.8	92.8	98.1	99.9	96.6	89.3	85.2	100.0
Spain	Albacete	n.a.	n.a.	n.a.	88.4	n.a.	n.a.	98.1	n.a.	n.a.	100.0
	Basque Country	93.9	93.1	51.6	89.0	95.7	99.2	98.4	89.8	69.5	98.1
	Castellón	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	99.6	n.a.	n.a.	n.a.
	Girona	93.9	95.2	39.5	89.2	84.0	100.0	97.7	92.8	61.9	99.6
	Granada	91.5	91.5	n.a.	79.0	n.a.	100.0	98.6	n.a.	n.a.	96.1
	Murcia	94.2	95.0	58.6	87.3	97.4	99.7	98.3	91.6	58.9	97.1
	Navarra	95.4	93.4	63.6	90.6	96.3	99.1	99.3	89.2	49.1	98.8
	Tarragona	95.0	93.6	49.3	88.5	95.8	100.0	97.8	91.1	60.5	100.0
Sweden	Sweden	98.9	98.4	83.2	97.4	99.3	100.0	99.7	99.4	93.5	100.0
Switzerland	Basel	99.4	99.3	91.0	98.6	100.0	99.8	99.4	99.5	98.2	99.3
	Geneva	99.0	95.9	65.4	92.5	96.0	100.0	97.7	94.2	84.2	99.6
	Grisons	93.9	94.3	n.a.	86.9	n.a.	100.0	96.9	89.3	n.a.	n.a.
	St. Gallen	95.6	94.5	75.0	91.2	97.2	100.0	98.1	95.8	77.6	99.4
	Ticino	97.9	97.0	66.5	92.5	100.0	100.0	99.5	93.5	77.2	97.8
	Valais	96.6	96.6	66.1	93.4	100.0	100.0	98.4	89.5	86.0	98.4
	Zurich	n.a.	97.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
The Netherlands	Amsterdam	98.2	97.4	66.0	94.3	98.8	100.0	99.3	97.8	82.4	99.8
	Eindhoven	98.6	98.1	58.3	93.4	100.0	99.9	99.4	98.8	87.5	99.7
	North Netherlands	96.9	96.1	55.8	92.4	98.9	100.0	99.2	97.4	81.3	100.0
UK England	East Anglia	90.0	87.7	39.3	73.2	91.3	99.2	94.8	86.5	71.4	93.9
	England	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Mersey	88.1	86.2	35.8	68.5	88.9	97.8	91.7	89.3	69.3	91.7
	North Western	85.2	84.4	30.1	64.4	87.8	97.8	91.7	86.2	71.5	93.1
	Northern & Yorkshire	92.1	88.3	40.0	72.8	94.8	99.6	96.1	93.8	72.5	95.7
	Oxford	88.3	89.1	51.7	78.3	99.3	100.0	95.3	90.1	90.9	100.0
	South Western	82.9	83.4	37.2	61.7	65.1	94.3	84.8	84.2	66.6	85.5
	Thames	87.9	88.3	47.7	74.6	87.1	97.0	91.7	85.1	76.2	89.6
	Trent	84.5	82.8	34.2	64.6	88.4	97.4	91.7	80.9	62.2	95.9
	West Midlands	91.1	89.9	44.4	75.7	95.9	99.6	96.1	90.5	79.6	93.6
UK N. Ireland	Northern Ireland	88.8	86.4	33.1	66.8	82.9	98.8	96.5	76.2	58.3	89.5
UK Scotland	Scotland	90.4	88.7	45.4	71.9	92.3	99.5	95.2	84.2	68.5	96.1
UK Wales	Wales[b]	56.1	57.8	42.2	47.4	45.1	68.7	55.6	60.8	47.2	61.3
Totals		92.3	92.1	62.7	83.4	89.9	98.4	95.3	92.7	78.2	96.6

n.a.: not applicable.

a Excluding meningiomas.

b Microscopic verifications only partially available to the Wales CR.

Table 6 – Crude 5-year relative survival (5 years RS), with standard errors (SEs), for five poor prognosis cancers diagnosed in adults (age 15+ years) diagnosed in 1990–1994 (EUROCARE-3) and 1995–1999 (EUROCARE-4). High survival outliers are highlighted in bold.

Country	Oesophagus				Liver				Pancreas				Lung				Pleura			
	1990–1994		1995–1999		1990–1994		1995–1999		1990–1994		1995–1999		1990–1994		1995–1999		1990–1994		1995–1999	
	5 years RS	SE	5 years RS	SE	5 years RS	SE	5 years RS	SE	5 years RS	SE	5 years RS	SE	5 years RS	SE	5 years RS	SE	5 years RS	SE	5 years RS	SE
Austria	10.3	1.1	11.4	1.1	7.8	0.7	8.9	0.7	**8.2**	0.5	6.1	0.4	**15.2**	0.4	**15.2**	0.3	10.6	2.4	11.3	2.2
Belgium	n.a.	n.a.	**20.4**	1.4	n.a.	n.a.	10.6	1.5	n.a.	n.a.	**8.8**	0.8	n.a.	n.a.	**16.2**	0.4	n.a.	n.a.	7.6	1.5
Czech	4.8	2.1	5.6	2.2	0.0	n.c.	10.6	4.1	5.2	1.2	5.3	1.2	7.5	0.6	9.6	0.7	18.5	9.9	5.7	5.5
Denmark	5.1	0.7	5.6	0.7	2.5	0.6	3.3	0.7	2.3	0.3	2.3	0.3	6.8	0.2	8.0	0.2	3.2	1.1	5.0	1.2
Finland	7.8	1.0	11.4	1.2	4.4	0.7	5.0	0.8	2.8	0.4	2.5	0.3	9.1	0.3	9.6	0.4	4.9	1.6	5.5	1.5
France	11.8	0.7	13.4	0.9	8.4	0.7	8.5	0.7	5.7	0.6	7.0	0.7	**14.9**	0.4	14.1	0.4	8.2	2.0	4.6	1.6
Germany	10.8	2.1	19.8	2.4	6.8	2.3	8.4	2.1	5.3	1.2	5.0	1.1	12.3	0.7	13.3	0.7	7.9	5.4	8.0	4.0
Iceland	13.6	5.3	8.4	4.1	15.5	8.3	3.6	3.6	3.2	1.8	1.9	1.4	11.2	1.6	14.9	1.8	0.0	n.c.	0.0	n.c.
Ireland	12.6	2.3	12.2	1.0	3.9	2.7	6.4	1.6	6.5	1.6	5.8	0.7	10.2	0.9	8.9	0.4	0.0	n.c.	8.5	3.1
Italy	8.9	0.7	11.6	0.6	7.3	0.4	10.2	0.3	4.4	0.3	5.1	0.2	11.0	0.2	12.5	0.2	4.9	0.9	7.6	0.8
Malta	0.0	n.c.	4.6	3.2	0.0	n.c.	5.5	3.8	4.2	2.9	3.1	1.6	6.8	1.8	8.5	1.3	0.0	n.c.	0.0	n.c.
Netherlands	9.2	1.1	12.3	0.9	4.9	1.5	7.8	1.5	2.7	0.5	3.1	0.4	12.6	0.4	13.9	0.3	2.0	0.8	4.0	0.9
Norway	6.2	1.1	8.0	1.2	3.8	1.0	5.9	1.3	2.7	0.4	3.1	0.4	9.6	0.4	10.6	0.4	2.7	1.2	2.3	1.0
Poland	4.7	1.1	12.9	1.5	2.6	1.1	8.2	2.2	3.3	0.6	7.2	0.7	7.4	0.4	12.9	0.4	4.6	2.6	15.3	4.3
Portugal	n.a.	n.a.	12.9	1.9	n.a.	n.a.	10.1	1.9	n.a.	n.a.	7.5	1.3	n.a.	n.a.	13.4	0.8	n.a.	n.a.	11.0	4.7
Slovenia	6.1	1.4	6.5	1.4	5.5	1.6	3.9	1.3	2.3	0.6	2.1	0.6	9.8	0.5	10.3	0.5	7.7	3.7	1.5	1.5
Spain	10.2	1.0	9.8	0.9	7.6	0.9	10.9	0.8	4.2	0.6	5.3	0.6	11.6	0.4	11.2	0.3	9.3	3.4	6.6	2.0
Sweden	9.4	0.9	12.0	1.0	2.8	0.4	7.5	0.8	2.7	0.3	3.2	0.3	10.6	0.3	12.9	0.3	5.4	1.2	6.3	1.3
Switzerland	13.2	1.9	13.5	1.8	4.7	1.1	10.1	1.3	3.0	0.7	4.4	0.8	10.8	0.6	14.4	0.6	5.9	2.6	11.0	3.1
UK England	8.9	0.2	9.5	0.2	7.2	0.5	7.5	0.4	4.0	0.2	3.8	0.2	7.4	0.1	7.7	0.1	4.7	0.4	4.2	0.3
UK N Ireland	9.1	2.0	12.6	1.4	1.7	1.7	4.8	1.7	2.2	1.0	2.7	0.7	8.2	0.8	9.5	0.5	10.4	5.0	4.7	2.0
UK Scotland	8.2	0.6	10.3	0.6	4.5	0.8	5.7	0.8	3.2	0.4	3.1	0.4	7.0	0.2	7.5	0.2	2.6	0.7	2.3	0.6
UK Wales	7.0	0.8	12.9	1.0	7.0	1.6	6.8	1.5	6.0	0.8	5.2	0.7	7.7	0.4	8.0	0.4	3.6	1.6	2.9	1.3
Pool of European CRs	8.9	0.2	10.6	0.2	6.3	0.2	8.6	0.2	4.0	0.1	4.3	0.1	9.1	0.1	10.2	0.1	4.8	0.3	5.1	0.2

n.a.: data not available for diagnosis period 1990–1994: n.c.: not computed by SEER*Stat software.

transformed, so that the lower bound of the CI was always positive.

5.1. *Registry-specific life tables*

Detailed information on all-causes mortality by age, sex and calendar year for each CR population is essential for estimating the relative survival denominators. Incomplete data on all-causes mortality were provided by the registries participating in EUROCARE. It was therefore necessary to use mathematical interpolation methods to obtain life tables for each year of age between 0 and 99 years and for each calendar year between 1978 and 2004. Several methods were used for these interpolations[21,22]: *the fraction method* to estimate life expectancies for missing calendar years; the polynomial *Elandt-Johnson method* to obtain life tables for each year of age from those for 5-year age classes[23]; the *adult age method* to estimate the probability of death at ages 75 and over using the Gompertz distribution and the *Ewbank adaptive method* to derive regional from national life tables[22] (the latter applied to English CRs). Registry-specific information on life tables data and interpolation methods are given in [10].

5.2. *Age adjustment of survival*

Age is a major determinant of cancer survival, and in international comparisons it is necessary to take account of the different age structures of the populations compared. Relative survival estimates for all ages combined were age-adjusted using the direct method and the international Cancer Survival Standard (ICSS) age distributions proposed by Corazziari et al.,[24] who used multivariate analysis of EUROCARE-2 data to define the smallest possible number of standard cancer patient populations and to provide age-standardised survival values close to the crude ones for the largest possible number of cancer sites. Three different standard age distributions were identified according to the age pattern of incidence of the cancer: one for the cancers mainly of young adults (e.g. testicular cancer or Hodgkin's lymphoma), one for the cancers whose incidence varies little with age (e.g. cervix uteri or thyroid cancers) and one for the cancers whose incidence increases with age (the majority of cancers). The ICSS weightings used, by age class and group of cancer sites, are shown in Table A3 (Appendix). In the previous EUROCARE studies, survival rates were standardised using the empirical cancer site-specific age distributions of European incident cases in the last available period of diagnosis. Compared to the previous system, the ICSS weightings have the advantages of being easier to apply and of remaining constant over time, because they are not dependent on the age distribution of the cases in examination.

The variances of the age-adjusted survival estimates were calculated by directly weighting the corresponding age-specific variances. Ninety-five percent CIs were estimated assuming that age-adjusted survival estimates had normal distributions after logarithmic transformation.

Age-adjusted survival estimates could not be calculated when early censoring or lack of cases resulted in missing values in one or more age classes. This usually occurred with small populations or with relatively rare cancer sites (in all or in some age groups). Occasionally in such circumstances, country-specific age-adjusted survival may be implausibly lower or higher than the crude survival, because small numbers of cases in highly weighted age groups all survive or all die. In such situations the SEER*Stat software does not produce a standard error, and the statistical uncertainty is not accurately reflected in the CIs of age-adjusted estimates. This is noted, when it occurs, in the relevant tables of this monograph.[8]

5.3. *Average European survival*

Although a considerable fraction of Europe is now covered by EUROCARE (35% of the population of the 23 participating countries), the fraction of the population covered in each participating country varies from 1.3% to 100% (Tables 1a and 1b). For this reason, survival estimates obtained by simply pooling the data would be disproportionately influenced by the survival in countries with high coverage and large populations, such as the UK. To provide survival estimates that are more representative of all participating countries *region-weighted* averages were derived. To do this five European regions were defined: Northern Europe (Denmark, Finland, Iceland, Norway, Sweden), UK and Ireland, Central Europe (Austria, Belgium, France, Germany, The Netherlands, Switzerland), Eastern Europe (Czech Republic, Poland) and Southern Europe (Italy, Malta, Portugal, Slovenia, Spain). Pooled region-specific survival was then estimated, assuming the population covered by registration to be representative of the whole region. The European average was obtained after directly weighting the region-specific survival estimates with the mean population of each region over 1995–1999. During 1995–1999 the population of countries participating in EUROCARE was around 426,155,000, and the resulting normalised region-specific percentage weightings were 5.64 for Northern Europe, 14.62 for UK and Ireland, 42.69 for Central Europe, 11.49 for Eastern Europe and 25.56 for Southern Europe.

European mean survival estimates for all ages combined were age-adjusted using the same ICSS standard as used for country-specific estimates. Standard errors of European survival, with 95% CI, were estimated by the same method as used for age-adjusted country-specific survival.

6. Discussion

EUROCARE survival estimates are increasingly used as a reference for comparing with those of national[25] and international studies.[26] This paper provides detailed information on the standardisation and checking procedures used to ensure that the EUROCARE-4 data are as error free as possible. Data quality indicators and statistical methods used are also given to assist the interpretation of EUROCARE-4 results and comparison with survival figures from other studies.

When EUROCARE started in 1990 it obtained data from 30 CRs in 11 European countries. Since then the numbers of participating CRs and countries, and the proportion of the European population represented, have increased steadily with each round. The EUROCARE-4 round now covers 30% of the EU population and 35% of the population of the participating countries.

Estonia and Slovakia, classified within Eastern Europe, did not send in data by the final deadline so they are not included in the current EUROCARE-4 analyses, with the additional consequence that Eastern Europe as a whole is under-represented. Updated datasets from Estonia and Slovakia were received during the preparation of this manuscript.

Germany, the largest EU country, remains under-represented with only a single participating adult CR covering just 1.3% of the national population. However, new CRs are currently being set up in Germany[27] and other countries, and we expect the proportion of the European population covered will further increase in future EUROCARE rounds.

The latest (third) revision of the International Classification of Diseases for Oncology was, for the first time, used to specify cancer topography, morphology and behaviour in the entire EUROCARE-4 dataset. In fact most CRs sent in data already coded (or recoded) in ICD-O-3, so the amount of recoding that had to be done by EUROCARE was limited. ICD-O-3 started being used on a large scale from 2000 on – just after the core period of the present study, so most cases were originally coded according to the previous systems and locally trans-coded into ICD-O-3. The most important changes in ICD-O-3 compared to the previous versions concern the haematological malignancies, whose definition is now more closely linked to the classification used in clinical settings.[28]

The data checking and validation processes used in EUROCARE-4 were simpler than those used in the previous EUROCARE rounds. Firstly, the checking procedures were revised and made consistent with those proposed by IARC.[11] Also most of the EUROCARE specific checks have been incorporated into the IARCcrg software now used by most European CRs; as a consequence a negligible proportion of records was excluded for major errors.

Data quality indicators indicate that the quality of EUROCARE-4 data was satisfactory as a whole and had improved compared to previous rounds. However, the proportion of DCO cases was rather high for some CRs, particularly the Austrian national registry and some UK registries, indicating problems with case detection. The extent to which survival indicators in CRs with a high proportion of DCO cases are biased can only be assessed with more specific analyses based on the local data. A recent study[29] comparing the Thames and Finnish CRs found that the decrease in survival in Thames produced by adjusting for DCO cases was largely offset by an increased survival produced by adjusting for the incompleteness of case ascertainment.

We compared relative survival estimates for selected poor prognosis cancers in EUROCARE-3 and EUROCARE-4 (Table 6) to highlight the potential problems in the completeness of follow-up. Incomplete ascertainment of vital status mainly results in dead patients being misclassified as alive so that the survival is overestimated and the overestimate is likely to be particularly marked for rapidly fatal cancers. We found that follow-up completeness had improved markedly for the Spanish registries and the Welsh national registry compared to EUROCARE-3. However, our outlier analysis indicated that the Austrian and Belgian CRs did not have satisfactorily complete follow-up.

Estimation of overall European survival involved initial grouping of CRs into five European regions (Northern Europe, UK and Ireland, Eastern Europe, Central Europe and Southern Europe), followed by calculating the weighted average of regional survival estimates using the region-specific populations as weightings. Only the populations of countries participating in EUROCARE contributed to the regional weightings. This procedure differs from that used in EUROCARE-3, which weighted country-specific survival estimates by respective country populations so giving excessive weight to countries with large populations and small cancer registration coverage, such as Germany or, to a lesser extent, France. Furthermore, because the error of small samples is large, it also introduces a large error to the overall European estimate.

Weighting region-specific, rather than country-specific, survival estimates limits the problems described above, and in particular reduces the standard error of the European-wide estimates.

The populations of UK/Ireland and Northern Europe were fully represented in EUROCARE-4. The participating countries of Central and Southern European had, respectively, a coverage of 18% and 26% of their populations, and were assumed to adequately represent those populations. Just two countries were included in Eastern Europe, whose population is unlikely to be adequately represented in the study. The Europe-wide survival estimates provided in this monograph are not fully comparable with those of the previous EUROCARE studies,[1–3] not only because the populations covered do not perfectly overlap, but also because country-weighted survival estimates were used.

Effective monitoring of the impact of new diagnostic and therapeutic procedures requires the availability of regularly updated population-based indicators. For this reason, a major effort was made to produce *period* survival estimates for patients diagnosed up to 2002 on the widest available European dataset. We therefore expect the new EUROCARE analyses to be of even more interest to oncologists, clinicians and health planners than the previous EUROCARE studies.

Conflict of interest statement

None declared.

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Appendix

See Tables A1–A3.

Table A1 – Compatibility between ICD-9/10 codes and ICD-O-3 morphology and behaviour codes. These compatibilities were used for trans-coding topography codes.

ICD-9	ICD-10	Compatible ICD-O-3 morphology/behaviour codes
	C222	8970
	C223	9120–9124
	C224	8800–9044
	C227	8000–8790
1552	C229	Behaviour/9
172	C43	8720–8780
	C45	9050–9055
	C46	9140
201	C81	9650–9667
200, 202	C82–C85	9590–9596, 9670–9729
203	C88	9760–9769
	C90	9731–9734
204	C91	9800–9837, 9940, 9948
205–208	C92–C95	9800–9805, 9840–9958
	C96	972, 974–975
210–229	D10–D36	Behaviour/0
235–239	D37–D48	Behaviour/1
230–234	D00–D09	Behaviour/2
2384, 2387	D45–D46	Behaviour/3

Table A2 – Unlikely site–morphology combinations flagged by EUROCARE checking procedures. IARC routines[11] flag other unlikely combinations.

Morphological group number[a]	Morphological group		Unlikely with sites
5	Colorectal tumours	C76.7	Other ill-defined sites
		C76.8	Overlapping lesion of ill-defined sites
		C80	Unknown primary site
7	Gastrointestinal tumours	C76.7	Other ill-defined sites
		C76.8	Overlapping lesion of ill-defined sites
		C80	Unknown primary site
13	Mesotheliomas	C34	Bronchus and lung
20	Skin tumours	C80	Unknown primary site
21	Tumours of skin and subcutaneous tissue	C76.1	Thorax NOS
		C76.2	Abdomen NOS
		C76.3	Pelvis NOS
		C76.7	Other ill-defined sites
		C76.8	Overlapping lesion of ill-defined sites
		C80	Unknown primary site
22	Breast tumours	C76.7	Other ill-defined sites
		C76.8	Overlapping lesion of ill-defined sites
		C80	Unknown primary site
33	Meningeal tumours	C71	Brain
		C72	Spinal chord
56	Transitional cell tumours	C64	Kidney
		C80	Unknown primary site

NOS = not otherwise specified.
a Morphological group number as reported in IARC.[11]

Table A3 – International Cancer Survival Standards (ICSS) used for standardising survival by age according to cancer site. Age classes and weighting for three types of cancer incidence age patterns.[24]

	Age classes	Weightings	Cancer sites
3	15–44, 45–54, 55–64, 65–74, 75–100	60, 10, 10, 10, 10	Testis, Hodgkin's disease, acute lymphatic leukaemia
2	15–44, 45–54, 55–64, 65–74, 75–100	28, 17, 21, 20, 14	Nasopharynx, soft tissues, melanoma, cervix uteri, brain, thyroid gland, bone
1	15–44, 45–54, 55–64, 65–74, 75–100	7, 12, 23, 29, 29	All other sites except prostate
	15–54, 55–64, 65–74, 75–84, 85–100	19, 23, 29, 23, 6	Prostate

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