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Original Research

Quality analysis of population-based information on cancer stage at diagnosis across Europe, with presentation of stage-specific cancer survival estimates: A EUROCARE-5 study

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Abstract ***Background:*** Cancer registries (CRs) are fundamental for estimating cancer burden, evaluating screening and monitoring health service performance. Stage at diagnosis—an essential information item collected by CRs—has been made available, for the first time, by CRs participating in EUROCARE-5. We analysed the quality of this information and estimated stage-specific survival across Europe for CRs with good data quality.
Data and methods: Sixty-two CRs sent stage (as TNM, condensed TNM or extent of disease) for 15 cancers diagnosed in 2000–2007. We assessed the quality, partly by comparing stage

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according to the three systems. We also developed procedures to reconstruct stage (categories: local, regional, metastatic and unknown) using information from all three systems, thus minimising the amount of missing information.

Results: Moderate-to-excellent stage concordance was found for practically all 24 CRs, for which it was possible to compare at least two staging systems. However, since stage was often incorrectly assigned, and information on the presence/absence of metastases was often lacking, data on only 7/15 cancers from 34/62 CRs (15 countries) were of sufficient quality for further analysis. Cases diagnosed ≥70 years had more advanced (or lacking) stage– and worse stage-specific survival than those <70 years.

Conclusions: Many European CRs collect and record reasonably accurate stage information. Others have difficulties. Both the completeness of primary data and the accuracy of stage coding need to be improved in order for CRs to fulfil their expanding roles in cancer control. We propose our stage reconstruction/checking procedures as a means of fully exploiting the stage information provided by EUROCARE CRs. More advanced (or lacking) stage at diagnosis plus poorer stage-specific survival in the elderly are worrying.

1. Introduction

Cancer registries (CRs) are fundamental sources of population-based information for assessing cancer incidence, survival and prevalence; evaluating mass screening efficacy [1] and monitoring health service quality [2]. It has long been recognised that cancer stage at diagnosis is an essential item of information to be collected by all European CRs [3]. For the first time, many CRs participating in EUROCARE-5 sent in stage at diagnosis information with their records. Thus, new quality control procedures had to be developed to evaluate this information to help decide what data could be used and what had to be discarded. The present study describes these new procedures, and their use to assess the quality, comparability and completeness of the stage information, and presents the first Europe-wide analysis of stage distribution and stage-specific survival for selected cancers and CRs, for which stage information was ascertained to be of sufficient quality.

2. Materials and methods

2.1. Data

The EUROCARE-5 protocol [4] asked CRs to send full data—specifically including information on stage at diagnosis—on adult (aged ≥15 years) patients diagnosed in 2000–2007, and followed up to December 2008, with one of 13 solid cancers. Several CRs also sent stage information on lung and vagina-vulva cancers enabling their inclusion in the data quality analyses. The 15 solid cancers thus investigated were primary malignancies of breast, colon, rectum, stomach, lung, skin melanoma, thyroid, uterine cervix, uterine corpus, ovary, vagina, prostate, testis, urinary bladder and kidney, as defined elsewhere [5].

Ninety-four of the 99 adult EUROCARE-5 CRs collect data on the 15 cancers. However, the following CRs did not send any stage information: national registries of Denmark, Iceland, Sweden, Scotland and Malta; all French registries except the Burgundy registry; 11 of 29 Italian registries and three of nine Spanish registries. These 32 registries (Supplementary Table 1 [Table S1]) are not considered further.

We assessed stage information for the remaining 62 CRs from the following countries: Finland and Norway (northern Europe); England, Wales, Northern Ireland and Ireland (United Kingdom and Ireland); Austria, Belgium, France, Germany, Switzerland and The Netherlands (Central Europe); Croatia, Italy, Portugal, Slovenia and Spain (Southern Europe) and Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Poland and Slovakia (Eastern Europe).

The protocol specified that stage could be provided in one or more of three forms. The preferred and most detailed was the standard tumour-node-metastasis (TNM; according to the fifth/sixth TNM edition [6,7]); the next most detailed was condensed TNM, as specified by the European Network Cancer Registries (ENCR) [8]; the least detailed was summary extent of disease (EoD) [8]. EoD is used by CRs to summarise stage by indicating how far a cancer has spread from its point of origin, using all available information [9]. EoD categories are local, regional, metastatic and unknown, with hybrid categories regional/metastatic (R/M) for cancers that are not local but whose regional versus distant status is unclear; and local/regional (L/R), for cancers without distant spread but whose local versus regional status is unclear. The protocol did not specify clinical versus pathological stage, but if both were available, registries were asked to send pathological stage.

We analysed stage information quality after excluding T0/Tis cancers and cases discovered at autopsy or known only from the death certificate (DCO/autopsy). The following aspects were scrutinised: (a) missing stage information (as defined in Table 1); (b) concordance between TNM, condensed TNM and EoD, when at least two of these were provided; (c) distribution

of EoD categories, for each cancer site, for registries presenting only this information, compared with the distributions of TNM or condensed TNM categories from CRs that provided at least one of these, and which also had ≤30% unknown information (as defined in Table 1) and (d) stage-specific age-standardised 5-year relative survival (RS), according to each staging system.

Before examining concordance between staging systems, their categories were reduced to mutually compatible categories as illustrated in Table 1. First, TNM categories were reclassified to local (TL, NL and ML) or advanced (TA, NA and MA), using the criteria of Table 1 so as to render them directly compatible with condensed TNM categories. Next, hybrid EoD categories were collapsed to unknown. Finally, a new variable, reconstructed stage (again with categories local, regional, metastatic and unknown) was produced by replacing unknown TNM information with information (where available) from condensed TNM, EoD or both, as illustrated in Fig. 2. Thus, reconstructed stage incorporates information available from all three staging systems, minimising the amount of missing information.

Only cancer sites for which ≥10% of all CRs collecting data on that site had the following minimum quality characteristics were considered eligible for further analysis: (i) sufficiently high-quality stage information, as determined by (a)–(d), mentioned previously; (ii) ≤30% cases (for each site) with unknown reconstructed stage and (iii) ≤14% [5] of total registry DCO/autopsy cases.

2.2. Statistical methods

Concordances and discordances between staging systems were expressed as percentages [10]: they do not necessarily sum to 100% because stage data missing/incomplete in one system, but present in another, did not contribute to the percentages.

Age-specific (<70 and ≥70 years) and age-standardised RS by stage was estimated using the

Table 1
Stage information collected by EUROCARE-5.

Stage system	Recorded as	Reduced to
TNM, information as:		
T	T1, T2, T3, T4, Tx, T missing [Tm]	Local: T local[a] (TL) N local[b] (NL) M local[b] (ML)
N	N0, N1, N2, N3, N4, Nx, N missing [Nm]	Regional: any T[f] N advanced[c] (NA) ML; T advanced[d] (TA) any N[e] ML
M	M0, M1, Mx, M missing [Mm]	Metastatic: any T any N M advanced[c] (MA) Incomplete[g]: Tx/Tm NL ML; TL/Tx/Tm Nx/Nm ML; any T NL/NA Mx/Mm; TL/TA Nx/Nm Mx/Mm Missing[g]: Tx/Tm Nx/Nm Mx/Mm
Condensed TNM, information as:		
Condensed T	TL[a], TA[d], Tm	Local: TL NL ML
Condensed N	NL[b], NA[c], Nm	Regional: any T NA ML; TA any N ML
Condensed M	ML[b], MA[c], Mm	Metastatic: any T any N MA Incomplete[g]: Tm NL ML; TL/Tm Nm ML; any T NL/NA Mm; TL/TA Nm Mm Missing[g]: Tm Nm Mm
Summary extent of disease (EoD)		
	Local, confined to the site of origin	Local
	Regional, spread to immediately adjacent tissues and/or regional lymph nodes	Regional
	Metastatic, spread to distant organs	Metastatic
	Hybrid, either tumour not confined to site of origin but not specified whether regional or metastatic (regional/metastatic [R/M]) or tumour without distant metastasis but not specified whether local or regional (local/regional [L/R])	Incomplete[g]: Hybrid
	Missing	Missing[g]

TNM, tumour-node-metastasis.
[a] T local comprises T1-2 cancers in general (except ovary), plus T3 cancers of thyroid, breast, and skin melanoma [3,7].
[b] N and M local are cancers with, respectively, no evidence of regional lymph node involvement or no evidence of distant metastases.
[c] N and M advanced are, respectively, cancers with regional node involvement or distant metastases.
[d] T advanced comprises T2 cancers of ovary and T3-4 cancers of all sites except T3 cancers of thyroid, breast and skin melanoma [3,7].
[e] Any N comprises NL, NA, Nx and Nm.
[f] Any T comprises TL, TA, Tx and Tm.
[g] Further collapsed to unknown category.

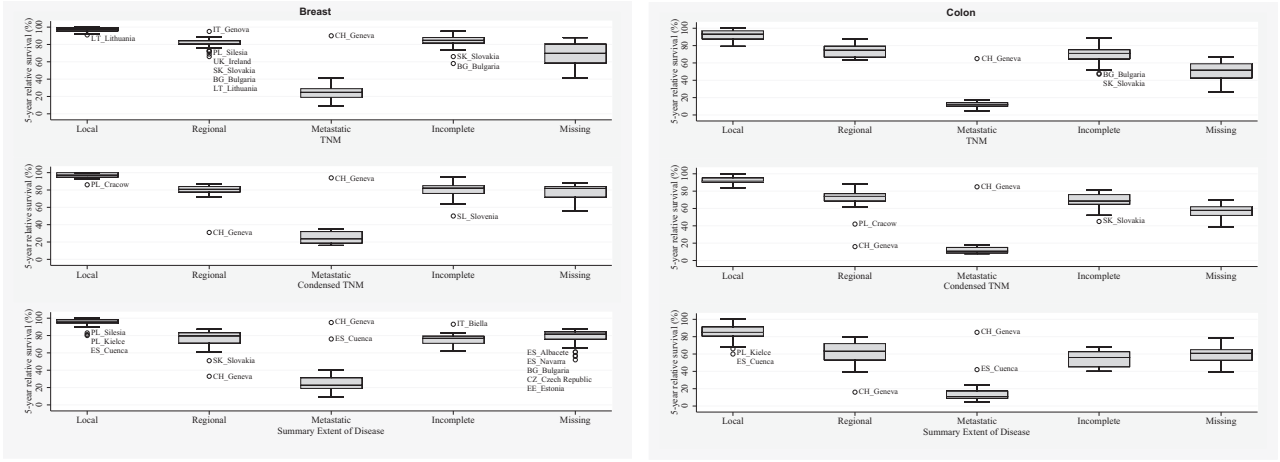

Fig. 1. Stage-specific age-standardised 5-year relative survival for breast and colon cancers* diagnosed in 2000–2007 across Europe, according to each staging system. *See Fig. S1 for the other cancer sites.

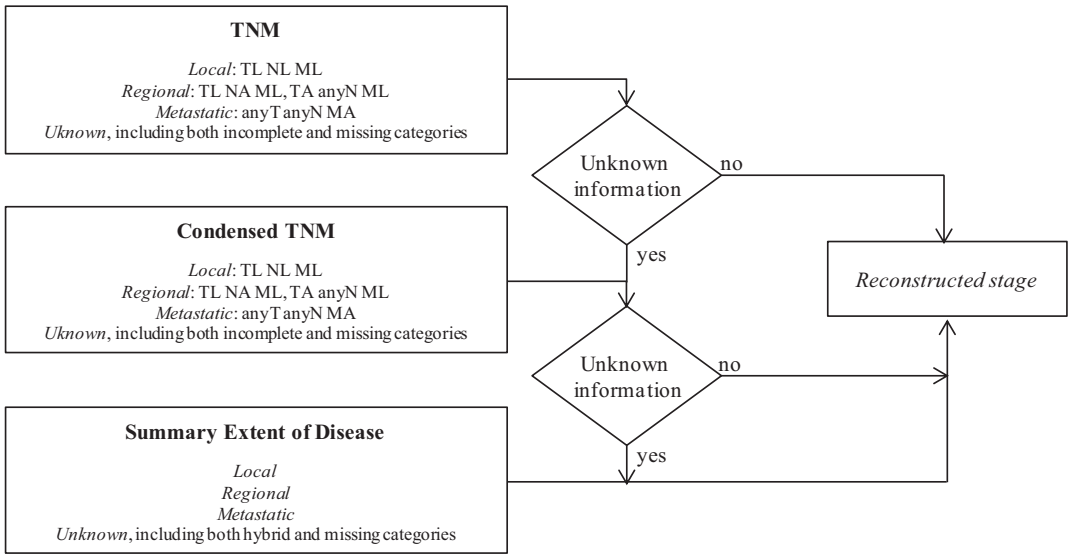

Fig. 2. Flow chart showing procedure for reconstructing stage. TL (T local) comprises T1-2 cancers plus T3 cancers of thyroid, breast and skin melanoma [3,7]. TA (T advanced) comprises T2 cancers of ovary and T3-4 cancers of all sites except T3 cancers of thyroid, breast and skin melanoma [3,7]. NL and ML (N and M local) comprise cancers, respectively, with no evidence of regional lymph node involvement or no evidence of distant metastases. NA and MA (N and M advanced) comprise cancers, respectively, with regional node involvement or distant metastases. Any N includes NL, NA, Nx and N missing. Any T includes TL, TA, Tx and T missing. Hybrid categories are regional/metastatic (R/M), i.e. cancers that are not local but for which it is unclear whether the spread is regional or distant, and local/regional (L/R), cancers without distant spread but with insufficient information to determine whether the disease is local or regional.

complete cohort method [5]. RS is the ratio of observed survival in the patient group to the expected survival in a comparable group of the general population assumed to be free of the cancer of interest. Expected survival was estimated by the Ederer II method [11] from CR-specific life tables stratified by age, sex and year of diagnosis. The analyses were carried out with Stata, version 12 [12].

3. Results

Twenty-two CRs provided TNM only, 15 EoD only and one condensed TNM only (Table 2, Table S1). The remaining 24 CRs provided stage in two or more forms. Variations in the proportions of incomplete and missing information in TNM and condensed TNM were evident across CRs and cancer sites (Table 3, Table S2) justifying merging incomplete and missing to unknown for both stage systems.

For most registries that provided TNM, and for practically all cancers, T and N were more often available than M (Table S3). Exceptions were lung cancer, and the registries of Ticino (Switzerland), Alto Adige, Modena, Palermo-breast and Parma (Italy), Castellón-Valencia-breast (Spain) and Lithuania, for which M was

Table 2
Percentages of cases with not-missing[a] stage information according to TNM (T), condensed TNM (C) and summary extent of disease (S) for 15 solid cancers diagnosed in 2000–2007 in Europe for the cancer registries that provided at least one of the three staging systems.

European region/ cancer registry	Breast	Colon	Rectum	Stomach	Lung	Skin melanoma	Thyroid	Uterine cervix	Uterine corpus	Ovary	Vagina	Prostate	Testis	Urinary bladder	Kidney
	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S
Northern Europe															
FI_Finland	0; 0; 92	0; 0; 82	0; 0; 80	0; 0; 79	0; 0; 81	0; 0; 58	0; 0; 73	0; 0; 79	0; 0; 77	0; 0; 86	0; 0; 72	0; 0; 71	0; 0; 82	0; 0; 74	0; 0; 80
NO_Norway	95; 85; 85	0; 92; 92	0; 86; 86	0; 82; 82	0; 90; 90	0; 63; 63	0; 85; 85	0; 73; 73	0; 86; 86	0; 92; 92	0; 84; 84	0; 60; 60	0; 81; 81	0; 63; 63	0; 76; 76
UK and Ireland															
IE_Ireland	0; 96; 73	0; 94; 69	0; 91; 69	0; 83; 73	0; 86; 75	0; 91; 30	0; 89; 43	0; 92; 59	0; 83; 33	0; 89; 67	0; 76; 39	0; 81; 43	0; 97; 80	0; 74; 40	0; 95; 67
UK_England	0; 0; 47	0; 0; 79	0; 0; 70					0; 0; 56							
UK_Northern Ireland	86; 0; 0	76; 0; 0	63; 0; 0	12; 0; 0	9; 0; 0	44; 0 0				78; 0; 0	56; 0; 0	71; 0; 0	8; 0; 0	53; 0; 0	9; 0; 0
UK_Wales	72; 0; 0	47; 0; 0	36; 0; 0	13; 0; 0	5; 0; 0	50; 0; 0		25; 0; 0	42; 0; 0	28; 0; 0	13; 0; 0	4; 0; 0	24; 0; 0	31; 0; 0	29; 0; 0
Central Europe															
AT_Austria	0; 0; 85	0; 0; 86	0; 0; 83	0; 0; 74	0; 0; 79	0; 0; 66	0; 0; 88	0; 0; 83	0; 0; 86	0; 0; 81	0; 0; 75	0; 0; 78	0; 0; 92	0; 0; 77	0; 0; 88
BE_Flanders	84; 0; 0	76; 0; 0	78; 0; 0	63; 0; 0	70; 0; 0	77; 0; 0	63; 0; 0	59; 0; 0	62; 0; 0	54; 0; 0	53; 0; 0	64; 0; 0	76; 0; 0	77; 0; 0	74; 0; 0
FR_Burgundy (dig).		0; 100; 0	0; 100; 0	0; 100; 0											
DE_Brandeburg	96; 0; 0	94; 0; 0	90; 0; 0	85; 0; 0	88; 0; 0	79; 0; 0	93; 0; 0	92; 0; 0	93; 0; 0	87; 0; 0	85; 0; 0	92; 0; 0	94; 0; 0	94; 0; 0	95; 0; 0
DE_Bremen	96; 97; 76	91; 92; 50	88; 89; 56	74; 77; 45	76; 77; 60	92; 92; 43	92; 94; 18	86; 88; 50	89; 93; 54	95; 97; 51	70; 77; 36	55; 55; 24	93; 93; 40	92; 93; 17	94; 95; 29
DE_Hamburg	89; 0; 84	77; 0; 61	79; 0; 67	66; 0; 60	74; 0; 73	76; 0; 75	74; 0; 45	74; 0; 61	85; 0; 66	75; 0; 59	66; 0; 50	72; 0; 51	82; 0; 68	72; 0; 47	81; 0; 54
DE_Mecklenburg-West Pomerania	95; 0; 0	90; 0; 0	86; 0; 0	73; 0; 0	75; 0; 0	76; 0; 0	95; 0; 0	82; 0; 0	89; 0; 0	82; 0; 0	77; 0; 0	85; 0; 0	94; 0; 0	93; 0; 0	93; 0; 0
DE_Munich	93; 86; 90	91; 88; 92	78; 69; 78	62; 58; 75	0; 0; 81	58; 54; 68	86; 64; 67	80; 61; 66	90; 46; 49	76; 47; 66	3; 2; 57	73; 57; 61	77; 30; 36	54; 31; 35	73; 33; 47
DE_North Rhine-Westphalia	90; 0; 0	83; 0; 0	81; 0; 0	63; 0; 0	62; 0; 0	62; 0; 0	78; 0; 0	73; 0; 0	87; 0; 0	69; 0; 0	65; 0; 0	64; 0; 0	89; 0; 0	82; 0; 0	83; 0; 0
DE_Saarland	0; 88; 79	0; 82; 64	0; 78; 64	0; 64; 56	0; 0; 70	0; 82; 75	0; 85; 49	0; 85; 62	0; 84; 47	0; 79; 39	0; 0; 51	0; 56; 24	0; 83; 44	0; 0; 23	0; 87; 26
DE_Saxony	96; 0; 0	93; 0; 0	88; 0; 0	80; 0; 0	85; 0; 0	89; 0; 0	95; 0; 0	90; 0; 0	94; 0; 0	89; 0; 0	85; 0; 0	87; 0; 0	93; 0; 0	91; 0; 0	92; 0; 0
CH_Basel	97; 0; 0	97; 0; 0	93; 0; 0	85; 0; 0	78; 0; 0	99; 0; 0	95; 0; 0	84; 0; 0	93; 0; 0	96; 0; 0	86; 0; 0	76; 0; 0	98; 0; 0	94; 0; 0	97; 0; 0
CH_Geneva	98; 99; 98	98; 98; 98	79; 98; 98	94; 94; 93	0; 97; 97	99; 99; 99	100; 100; 94	95; 96; 92	97; 98; 97	95; 97; 97	0; 89; 83	93; 95; 94	100; 100; 100	94; 96; 96	79; 97; 97
CH_Grisons	98; 98; 81	96; 96; 94	88; 93; 90	85; 86; 77	0; 90; 84	97; 97; 79	99; 99; 78	95; 95; 87	91; 91; 70	80; 84; 81	0; 86; 64	87; 87; 80	97; 97; 92	95; 95; 76	78; 98; 89
CH_St. Gallen	0; 0; 100	0; 0; 100	0; 0; 99	0; 0; 96	0; 0; 97	0; 0; 99	0; 0; 96	0; 0; 100	0; 0; 98	0; 0; 99	0; 0; 93	0; 0; 96	0; 0; 100	0; 0; 90	0; 0; 98
CH_Ticino	97; 0; 0	98; 0; 0	95; 0; 0	78; 0; 0	79; 0; 0	95; 0; 0	97; 0; 0	91; 0; 0	94; 0; 0	93; 0; 0	76; 0; 0	96; 0; 0	97; 0; 0	94; 0; 0	96; 0; 0
CH_Valais	98; 98; 76	96; 96; 83	86; 95; 86	85; 85; 65	0; 91; 75	99; 99; 17	97; 97; 30	95; 95; 49	94; 94; 42	92; 94; 81	0; 78; 33	94; 94; 54	99; 99; 79	93; 93; 29	77; 93; 49
NL_The Netherlands	100; 0; 0	98; 0; 0	98; 0; 0	93; 0; 0	98; 0; 0	98; 0; 0	98; 0; 0	99; 0; 0	98; 0; 0	97; 0; 0	97; 0; 0	99; 0; 0	100; 0; 0	98; 0; 0	97; 0; 0
Southern Europe															
HR_Croatia	0; 0; 73	0; 0; 64	0; 0; 60	0; 0; 58	0; 0; 66	0; 0; 53	0; 0; 72	0; 0; 63	0; 0; 64	0; 0; 67	0; 0; 59	0; 0; 55	0; 0; 56	0; 0; 56	0; 0; 61
IT_Alto Adige	98; 0; 0	98; 0; 0	94; 0; 0	91; 0; 0	92; 0; 0	82; 0; 0	98; 0; 0	95; 0; 0	99; 0; 0	95; 0; 0	91; 0; 0	93; 0; 0	99; 0; 0	96; 0; 0	95; 0; 0
IT_Biella	95; 95; 84	95; 95; 88	89; 89; 81	79; 79; 72	75; 75; 70	86; 86; 78	71; 71; 36	70; 70; 51	69; 69; 43	85; 85; 76	57; 55; 33	48; 48; 27	73; 73; 54	44; 44; 23	70; 70; 50
IT_Ferrara	88; 0; 0	87; 0; 0	74; 0; 0			57; 0; 0									
IT_Firenze-Prato	91; 83; 84	83; 80; 85	74; 72; 74	0; 61; 68	0; 39; 42	0; 49; 30	0; 45; 28	0; 29; 39	0; 47; 46	0; 46; 41	0; 23; 32	0; 30; 30	0; 43; 11	0; 29; 20	0; 58; 23
IT_Friuli Venezia Giulia	94; 0; 0	9; 0; 0	10; 0; 0					86; 0; 0						1; 0; 0	
IT_Genova	88; 0; 0	78; 0; 0	65; 0; 0	52; 0; 0	15; 0; 0										
IT_Latina	54; 0; 0	26; 0; 0	27; 0; 0	18; 0; 0	12; 0; 0										
IT_Milano	92; 0; 0	94; 0; 0	90; 0; 0	60; 0; 0	43; 0; 0	31; 0; 0	64; 0; 0	34; 0; 0	52; 0; 0	54; 0; 0	26; 0; 0	55; 0; 0	38; 0; 0	47; 0; 0	64; 0; 0
IT_Modena	99; 99; 92	91; 90; 85	83; 83; 74			95; 95; 84	91; 91; 33	86; 86; 35							

(*continued on next page*)

Table 2 (*continued*)

European region/ cancer registry	Breast	Colon	Rectum	Stomach	Lung	Skin melanoma	Thyroid	Uterine cervix	Uterine corpus	Ovary	Vagina	Prostate	Testis	Urinary bladder	Kidney
	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S	T; C; S
IT_Napoli	100; 0; 0	65; 0; 0	53; 0; 0	41; 0; 0	12; 0; 0							16; 0; 0	57; 0; 0		56; 0; 0
IT_Palermo (breast)	97; 0; 0														
IT_Parma	99; 0; 96	87; 0; 87	73; 0; 72	63; 0; 63	9; 6; 45	94; 1; 91	33; 2; 33	97; 0; 96	67; 0; 70	61; 0; 58	22; 6; 40	34; 0; 32	23; 0; 19	43; 1; 40	48; 0; 40
IT_Ragusa	91; 76; 84	82; 56; 39	71; 39; 34		67; 35; 54	74; 15; 19	39; 4; 16					53; 14; 14			
IT_Romagna	83; 83; 0	41; 40; 0	36; 36; 0					69; 69; 0							
IT_Salerno															0; 0; 7
IT_Sondrio	89; 0; 0	86; 0; 0	76; 0; 0	79; 0; 0	68; 0; 0	36; 0; 0		47; 0; 0				49; 0; 0	86; 0; 0	45; 0; 0	62; 0; 0
IT_Torino	69; 0; 0	79; 0; 0	65; 0; 0	50; 0; 0	12; 0; 0							29; 0; 0			67; 0; 0
IT_Veneto	21; 0; 0														
PT_Açores	0; 0; 23	0; 0; 20	0; 0; 25	0; 0; 21	0; 0; 22	0; 0; 32	0; 0; 20	0; 0; 42	0; 0; 56	0; 0; 63	0; 0; 12	0; 0; 3	0; 0; 21	0; 0; 10	0; 0; 25
PT_Northern Portugal	0; 0; 68	0; 0; 50	0; 0; 57	0; 0; 45	0; 0; 48	0; 0; 70	0; 0; 55	0; 0; 68	0; 0; 60	0; 0; 52	0; 0; 57	0; 0; 44	0; 0; 61	0; 0; 43	0; 0; 53
PT_Southern Portugal	0; 0; 66	0; 0; 59	0; 0; 59	0; 0; 53	0; 0; 47	0; 0; 72	0; 0; 64	0; 0; 60	0; 0; 64	0; 0; 56	0; 0; 66	0; 0; 39	0; 0; 53	0; 0; 39	0; 0; 45
SI_Slovenia	0; 99; 99	0; 98; 97	0; 98; 95	0; 94; 92	0; 98; 96	0; 100; 97	0; 100; 99	0; 99; 99	0; 99; 98	0; 98; 97	0; 99; 98	0; 94; 91	0; 100; 99	0; 97; 96	0; 97; 95
ES_Albacete (CLBP)	0; 0; 63	0; 0; 41	0; 0; 45		0; 0; 21							0; 0; 16			
ES_Basque Country	0; 0; 95	0; 0; 93	0; 0; 92	0; 0; 90	0; 0; 94	0; 0; 89	0; 0; 83	0; 0; 95	0; 0; 92	0; 0; 94	0; 0; 92	0; 0; 77	0; 0; 96	0; 0; 80	0; 0; 90
ES_Castellón-Valencia (breast)	93; 98; 97														
ES_Cuenca	0; 0; 90	0; 0; 93	0; 0; 94	0; 0; 91	0; 0; 92	0; 0; 89	0; 0; 90	0; 0; 97	0; 0; 89	0; 0; 94	0; 0; 81	0; 0; 92	0; 0; 92	0; 0; 96	0; 0; 92
ES_Girona	75; 75; 71	56; 56; 31	50; 50; 31	29; 29; 24	35; 35; 36	19; 19; 18	21; 21; 15	22; 22; 18	37; 37; 28	21; 21; 21	29; 29; 21	15; 15; 12	49; 49; 43	29; 29; 26	44; 44; 39
ES_Navarra	0; 96; 96	0; 78; 78	0; 78; 78	0; 62; 62	0; 74; 74	0; 48; 48	0; 14; 14	0; 72; 72	0; 62; 62	0; 46; 46	0; 43; 43	0; 41; 41	0; 53; 53	0; 60; 60	0; 57; 57
Eastern Europe															
BG_Bulgaria	99; 0; 82	97; 0; 72	97; 0; 69	94; 0; 69	96; 0; 60	76; 0; 61	96; 0; 66	98; 0; 59	96; 0; 47	97; 0; 50	95; 0; 50	98; 0; 49	91; 0; 58	97; 0; 55	97; 0; 61
CZ_Czech Republic	0; 0; 93	0; 0; 89	0; 0; 87	0; 0; 77	0; 0; 83	0; 0; 94	0; 0; 86	0; 0; 88	0; 0; 71	0; 0; 85	0; 0; 75	0; 0; 79	0; 0; 92	0; 0; 82	0; 0; 85
EE_Estonia	0; 0; 98	0; 0; 97	0; 0; 97	0; 0; 96	0; 0; 97	0; 0; 97	0; 0; 95	0; 0; 97	0; 0; 97	0; 0; 97	0; 0; 96	0; 0; 91	0; 0; 97	0; 0; 96	0; 0; 97
LV_Latvia	86; 0; 41	71; 0; 30	77; 0; 27	69; 0; 39	60; 0; 39	73; 0; 10	82; 0; 19	76; 0; 14	72; 0; 9	37; 0; 12	78; 0; 30	74; 0; 16	76; 0; 38	72; 0; 9	73; 0; 15
LT_Lithuania	91; 0; 0	86; 0; 0	84; 0; 0	77; 0; 0	76; 0; 0	85; 0; 0	95; 0; 0	87; 0; 0	83; 0; 0	83; 0; 0	89; 0; 0	88; 0; 0	87; 0; 0	85; 0; 0	86; 0; 0
PL_Cracow	51; 100; 100	11; 100; 100	15; 100; 100	0; 100; 100	0; 100; 100	64; 100; 100	0; 100; 100	26; 100; 100	17; 100; 100	3; 100; 100	0; 100; 100	11; 100; 100	3; 100; 100	0; 100; 100	13; 100; 100
PL_Kielce	0; 0; 26	0; 0; 46	0; 0; 44	0; 0; 47	0; 0; 45	0; 0; 44	0; 0; 37	0; 0; 52	0; 0; 50	0; 0; 47	0; 0; 51	0; 0; 24	0; 0; 22	0; 0; 22	0; 0; 28
PL_Lower Silesia	46; 0; 35	27; 0; 52	27; 0; 49	21; 0; 57	46; 0; 36	15; 0; 51	54; 0; 34	4; 0; 67	4; 0; 69	8; 0; 66	6; 0; 60	44; 0; 34	40; 0; 35	67; 0; 20	49; 0; 35
SK_Slovakia	97; 98; 70	93; 97; 88	92; 95; 87	84; 92; 83	89; 95; 88	99; 100; 93	94; 97; 84	95; 97; 91	91; 97; 95	93; 97; 95	85; 96; 86	87; 91; 90	95; 98; 87	93; 96; 95	93; 97; 95

Empty cells indicate the absence of stage information either because specialised registry or registry that did not provide stage information for the specified cancer site to EUROCARE.
The letters preceding the registry name are the international two-digit ISO country codes; UK, United kingdom.
Specialised registries are indicated by parentheses showing the cancer(s) for which they gather data: dig, digestive system cancers only; CLBP, colorectal, lung, breast and prostate cancers only.
[a] Including local, regional, metastatic and incomplete stage categories (Table 1).

Table 3
Percentages of cases with incomplete (in) and missing (mis) stage information according to TNM (T) and condensed TNM (C) systems for 7[a] of 15 solid cancers diagnosed in 2000–2007 in Europe for cancer registries that provided stage information.

European region/cancer registry	Breast		Colon		Rectum		Stomach		Lung		Skin melanoma		Thyroid	
	T	C	T	C	T	C	T	C	T	C	T	C	T	C
	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis	in; mis
Northern Europe														
NO_Norway	30; 5	0; 15		0; 8		0; 14		0; 18		0; 10		0; 37		0; 15
UK and Ireland														
IE_Ireland		38; 4		27; 6		27; 9		25; 17		25; 14		74; 9		64; 11
UK_Northern Ireland	64; 14		48; 24		39; 37		3; 88		1; 91		39; 56			
UK_Wales	71; 28		40; 53		33; 64		10; 87		1; 95		46; 50			
Central Europe														
BE_Flanders	22; 16		29; 24		24; 22		19; 37		9; 30		59; 23		34; 37	
FR_Burgundy (dig.)				7; 0		17; 0		26; 0						
DE_Brandeburg	15; 4		13; 6		14; 10		15; 15		9; 12		26; 21		35; 7	
DE_Bremen	21; 4	21; 3	42; 9	42; 8	33; 12	34; 11	31; 26	33; 23	17; 24	17; 23	50; 8	50; 8	75; 8	77; 6
DE_Hamburg	17; 11		36; 23		27; 21		26; 34		10; 26		19; 24		46; 26	
DE_Mecklenburg-West Pomerania	17; 5		25; 10		21; 14		18; 27		11; 25		32; 24		29; 5	
DE_Munich	31; 7	0; 14	21; 9	0; 12	14; 22	0; 31	14; 38	0; 42			5; 42	0; 46	43; 14	0; 36
DE_North Rhine-Westphalia	21; 10		40; 17		34; 19		26; 37		17; 38		19; 38		51; 22	
DE_Saarland		22; 12		48; 18		34; 22		30; 36				25; 18		49; 15
DE_Saxony	21; 4		19; 7		20; 12		20; 20		11; 15		18; 11		44; 5	
CH_Basel	41; 3		36; 3		36; 7		30; 15		27; 22		85; 1		67; 5	
CH_Geneva	9; 2	10; 1	12; 2	16; 2	5; 21	9; 2	12; 6	20; 6		19; 3	30; 1	30; 1	53; 0	53; 0
CH_Grisons	20; 2	20; 2	13; 4	13; 4	12; 12	13; 7	20; 15	20; 14		13; 10	23; 3	23; 3	24; 1	24; 1
CH_Ticino	13; 3		6; 2		21; 5		10; 22		20; 21		65; 5		59; 3	
CH_Valais	25; 2	25; 2	37; 4	37; 4	24; 14	25; 5	35; 15	35; 15		24; 9	90; 1	90; 1	74; 3	74; 3
NL_The Netherlands	21; <0.5		18; 2		18; 2		19; 7		12; 2		44; 2		35; 2	
Southern Europe														
IT_Alto Adige	11; 2		12; 2		15; 6		12; 9		10; 8		44; 18		55; 2	
IT_Biella	20; 5	20; 5	15; 5	14; 5	16; 11	16; 11	18; 21	18; 21	9; 25	9; 25	40; 14	40; 14	62; 29	62; 29
IT_Ferrara	74; 12		77; 13		67; 26						52; 43			
IT_Firenze-Prato	88; 9	66; 17	68; 17	55; 20	61; 26	48; 28		37; 39		13; 61		43; 51		41; 55
IT_Friuli Venezia Giulia	44; 6		1; 91		2; 90									
IT_Genova	79; 12		72; 22		62; 35		49; 48		15; 85					
IT_Latina	38; 46		22; 74		22; 73		16; 82		10; 88					
IT_Milano	27; 8		20; 6		27; 10		23; 40		18; 57		26; 69		43; 36	
IT_Modena	7; 1	7; 1	5; 9	5; 10	9; 17	9; 17					8; 5	8; 5	58; 9	58; 9
IT_Napoli	54; 0		55; 35		45; 47		36; 59		10; 88					
IT_Palermo (breast)	10; 3													
IT_Parma	14; 1		6; 13		8; 27		9; 37	0; 99	8; 91	4; 94	57; 6	0; 99	27; 67	1; 98
IT_Ragusa	16; 9	4; 24	54; 18	37; 44	52; 29	27; 61			25; 33	9; 65	62; 26	11; 85	34; 61	2; 96
IT_Romagna	71; 17	71; 17	29; 59	29; 60	25; 64	25; 64								
IT_Sondrio	65; 11		60; 14		49; 24		48; 21		30; 32		31; 64			
IT_Torino	68; 31		74; 21		64; 35		47; 50		11; 88					
IT_Veneto	16; 79													
SI_Slovenia		4; 1		5; 2		6; 2		11; 6		10; 2		2; 0		2; 0
ES_Castellón-Valencia (breast)	1; 7	1; 2												
ES_Girona	15; 25	15; 25	42; 44	42; 44	33; 50	33; 50	19; 71	19; 71	3; 65	3; 65	12; 81	11; 81	18; 79	18; 79
ES_Navarra		2; 4		3; 22		2; 22		1; 38		2; 26		1; 52		3; 86
Eastern Europe														
BG_Bulgaria	17; 1		17; 3		17; 3		20; 6		32; 4		14; 24		24; 4	
LV_Latvia	79; 14		54; 29		64; 23		47; 31		42; 40		70; 27		75; 18	
LT_Lithuania	24; 9		10; 14		11; 16		9; 23		18; 24		12; 15		27; 5	
PL_Cracow	4; 49	36; 0	8; 89	50; 0	11; 85	51; 0		36; 0		39; 0	2; 36	80; 0		76; 0
PL_Lower Silesia	17; 54		7; 73		8; 73		6; 79		10; 54		3; 85		12; 46	
SK_Slovakia	12; 3	13; 2	11; 7	15; 3	13; 8	17; 5	14; 16	21; 8	11; 11	17; 5	9; 1	9; 0	20; 6	19; 3

Empty cells indicate the absence of stage information either because a specialised registry or the registry did not provide stage information to EUROCARE for the cancer site or because the registry did not provide stage information according to the specified stage system for that particular cancer site.
The letters preceding the registry name are the international two-digit ISO country codes. UK; United Kingdom.
Specialised registries are indicated by parentheses showing the cancer(s) for which they gather data: dig, digestive system cancers only.
[a] Data on incomplete and missing stage information for the other eight cancer sites are shown in the Supplementary material.

more often available than T or N. The situation was similar for registries presenting condensed TNM: only for Norway, Burgundy (France), Slovenia, Navarra (Spain) and Slovakia was M more often available than T or N (Table S4).

Hybrid stage (L/R, R/M) was provided by 20/38 registries that sent EoD (Table 4, Table S5). For Ireland, Geneva, Grisons and Valais (Switzerland), Biella (Italy), Southern Portugal and Girona (Spain), >10% of cases had hybrid stage (for most cancer sites), and for these, R/M was more often present than L/R, except in Biella (Italy) and Southern Portugal. However, stage information elements included in the L/R and R/M categories varied markedly, indicating the use of varying (and inconsistent) criteria for assigning a case to a hybrid category. For example, both L/R and R/M included

Table 4
Percentages of cases with local/regional (L/R) and regional/metastatic (R/M) hybrid stages, and missing (mis) stage, according to the summary extent of disease for 7[a] of 15 solid cancers diagnosed in 2000–2007 in Europe, for cancer registries that sent in summary extent of disease data.

European region/cancer registry	Breast	Colon	Rectum	Stomach	Lung	Skin melanoma	Thyroid
	L/R; R/M; mis	L/R; R/M; mis	L/R; R/M; mis	L/R; R/M; mis	L/R; R/M; mis	L/R; R/M; mis	L/R; R/M; mis
Northern Europe							
FI_Finland National	0; 1; 8	0; 5; 18	0; 5; 20	0; 8; 21	0; 10; 19	0; 4; 42	0; 3; 27
NO_Norway National	0; 0; 15	0; 0; 8	0; 0; 14	0; 1; 18	0; 1; 10	0; 0; 37	0; 0; 15
UK and Ireland							
IE_Ireland National	2; 13; 27	2; 19; 31	5; 16; 31	7; 14; 27	3; 15; 25	5; 10; 70	4; 16; 57
UK_England National	0; 0; 53	0; 0; 21	0; 0; 30				
Central Europe							
AT_Austria National	0; 0; 15	0; 0; 14	0; 0; 17	0; 0; 26	0; 0; 21	0; 0; 34	0; 0; 12
DE_Bremen	1; 0; 24	0; 0; 50	1; 0; 44	1; 0; 55	1; 0; 40	1; 0; 57	1; 0; 82
DE_Hamburg	0; 0; 16	0; 0; 39	0; 0; 33	0; 0; 40	0; 0; 27	0; 0; 25	0; 0; 55
DE_Munich	0; 0; 10	0; 0; 8	0; 0; 22	0; 0; 25	0; 0; 19	0; 0; 32	0; 0; 33
DE_Saarland	0; 0; 21	0; 0; 36	0; 0; 36	0; 0; 44	0; 0; 30	0; 0; 25	0; 0; 51
CH_Geneva	1; 11; 2	6; 13; 2	3; 8; 2	12; 11; 7	13; 14; 3	1; 33; 1	1; 47; 6
CH_Grisons	2; 3; 19	1; 12; 6	3; 9; 10	6; 11; 23	5; 10; 16	1; 3; 21	0; 4; 22
CH_St. Gallen	0; 3; 0	0; 1; 0	0; 2; 1	0; 2; 4	0; 2; 3	0; 5; 1	0; 8; 4
CH_Valais	1; 2; 24	1; 25; 17	2; 16; 14	2; 15; 35	4; 10; 25	1; 8; 83	4; 6; 70
Southern Europe							
HR_Croatia National	0; 0; 27	0; 0; 36	0; 0; 40	0; 0; 42	0; 0; 34	0; 0; 47	0; 0; 28
IT_Biella	8; 2; 16	7; 1; 12	7; 2; 19	6; 5; 28	3; 2; 30	30; 3; 22	11; 16; 64
IT_Firenze-Prato	0; 0; 16	0; 0; 15	0; 0; 26	0; 0; 32	0; 0; 58	0; 0; 70	0; 0; 72
IT_Modena	0; 0; 8	0; 0; 15	0; 0; 26			0; 0; 16	0; 0; 67
IT_Parma	0; 2; 4	0; 4; 13	1; 4; 28	1; 8; 37	10; 8; 55	2; 3; 9	9; 10; 67
IT_Ragusa	2; 0; 16	1; 0; 61	1; 1; 66		3; 0; 46	1; 1; 81	0; 0; 84
PT_Açores	2; 0; 77	0; 0; 80	5; 0; 75	1; 0; 79	1; 0; 78	0; 0; 68	11; 0; 80
PT_Northern Portugal	2; 9; 32	1; 9; 50	1; 9; 43	1; 11; 55	1; 3; 52	1; 5; 30	0; 4; 45
PT_Southern Portugal	7; 3; 34	5; 5; 41	8; 5; 41	8; 5; 47	11; 2; 53	23; 1; 28	21; 2; 36
SI_Slovenia National	0; 0; 1	0; 0; 3	0; 0; 5	0; 0; 8	0; 0; 4	0; 0; 3	0; 0; 1
ES_Albacete (CLBP)	1; 11; 37	0; 9; 59	0; 11; 55		0; 1; 79		
ES_Basque Country	0; 0; 5	0; 0; 7	0; 0; 8	0; 0; 10	0; 0; 6	0; 0; 11	0; 0; 17
ES_Castellón-Valencia (breast)	0; 0; 3						
ES_Cuenca	1; 0; 10	0; 0; 7	0; 0; 6	0; 0; 9	0; 0; 8	0; 0; 11	0; 0; 10
ES_Girona	2; 9; 29	2; 15; 69	2; 12; 69	2; 10; 76	0; 1; 64	9; 1; 82	8; 4; 85
ES_Navarra	1; 0; 4	0; 0; 22	1; 0; 22	1; 0; 38	1; 1; 26	1; 0; 52	0; 2; 86
Eastern Europe							
BG_Bulgaria National	0; 0; 18	0; 0; 28	0; 0; 31	0; 0; 31	0; 0; 40	0; 0; 39	0; 0; 34
CZ_Czech Republic National	0; 0; 7	0; 0; 11	0; 0; 13	0; 0; 23	0; 0; 17	0; 0; 6	0; 0; 14
EE_Estonia National	0; 2; 2	0; 1; 3	0; 2; 3	0; 3; 4	0; 3; 3	0; 1; 3	0; 1; 5
LV_Latvia National	0; 0; 59	0; 0; 70	0; 0; 73	0; 1; 61	0; 1; 61	0; 0; 90	0; 0; 81
PL_Cracow	0; 0; 0	0; 0; 0	0; 0; 0	0; 0; 0	0; 0; 0	0; 0; 0	0; 0; 0
PL_Kielce	0; 0; 74	0; 0; 54	0; 0; 56	0; 0; 53	0; 0; 55	0; 0; 56	0; 0; 63
PL_Lower Silesia	0; 0; 65	0; 0; 48	0; 0; 51	0; 0; 43	0; 0; 64	0; 0; 49	0; 0; 66
SK_Slovakia National	0; 0; 30	0; 0; 12	0; 0; 13	0; 0; 17	0; 0; 12	0; 0; 7	0; 0; 16

Empty cells indicate the absence of stage information because either specialised registries or registries which did not provide stage information to EUROCARE for the specified cancer site.
The letters preceding the registry name are the international two-digit ISO country codes; UK, United Kingdom.
Specialised registries are indicated by parentheses showing the cancer(s) for which they gather data: CLBP, colorectal, lung, breast and prostate cancers only.
[a] Data on the other eight cancer sites are shown in the Supplementary material.

Table 5
Concordance (c) and discordance (d) (percentages) between staging systems for the 24 cancer registries that sent in stage information in at least two forms (TNM [T], condensed TNM [C] or summary extent of disease [S]) for 7[a] of 15 solid cancers diagnosed in 2000–2007 in Europe.

European region/ cancer registry		Breast		Colon		Rectum		Stomach		Lung		Skin melanoma		Thyroid	
		Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)
Northern Europe															
NO_Norway	c	T; C; S	78; 78; 100	C; S	100	C; S	100	C; S	100	C; S	99	C; S	100	C; S	100
National	d		<0.01; <0.01; 0		0		0		0		0		0		0
UK and Ireland															
IE_Ireland	c	C; S	99	C; S	80	C; S	85	C; S	95	C; S	96	C; S	98	C; S	98
National	d		0		0		0		0		0		0		0
Central Europe															
DE_Bremen	c	T; C; S	100; 100; 100	T; C; S	100; 100; 100	T; C; S	100; 99; 100	T; C; S	99; 99; 100	T; C; S	100S 100; 100	T; C; S	100; 100; 100	T; C; S	99; 100; 99
	d		0; 0; 0		0; 0; 0		0; 0; 0		0; 0; 0		0; 0; 0		0; 0; 0		1; 0; 1
DE_Hamburg	c	T; S	88	T; S	73	T; S	75	T; S	78	T; S	90	T; S	82	T; S	83
	d		0.2		9		10		1		1		1		1
DE_Munich	c	T; C; S	73; 72; 96	T; C; S	80; 56; 67	T; C; S	85; 65; 74	T; C; S	85; 71; 82			T; C; S	99; 82; 83	T; C; S	76; 73; 94
	d		<0.01; 1; 1		0; 22; 29		0; 14; 16		<0.01; 1; 2				0; 3; 3		0; 2; 3
DE_Saarland	c	C; S	84	C; S	62	C; S	67	C; S	77			C; S	70	C; S	76
	d		2		7		10		1				10		6
CH_Geneva	c	T; C; S	95; 94; 98	T; C; S	77; 76; 97	T; C; S	68; 67; 97	T; C; S	66; 64; 95	C; S	92	T; C; S	99; 95; 96	T; C; S	97; 96; 98
	d		4; 4; 0		19; 17; 0		13; 12; 0		26; 23; 0		0		1; 1; 0		3; 2; 0
CH_Grisons	c	T; C; S	100; 99; 99	T; C; S	100; 98; 98	T; C; S	95; 95; 98	T; C; S	100; 95; 95	C; S	94	T; C; S	100; 100; 100	T; C; S	100; 100; 100
	d		0; 0; 0		0; 0; 0		0; 0; 0		0; 0; 0		0		0; 0; 0		0; 0; 0
CH_Valais	c	T; C; S	100; 100; 100	T; C; S	100; 99; 99	T; C; S	92; 90; 98	T; C; S	100; 98; 98	C; S	95	T; C; S	100; 99; 99	T; C; S	100; 98; 98
	d		0; 0; 0		0; 0; 0		0; 0; 0		0; 0; 0		0		0; 0; 0		0; 0; 0
Southern Europe															
IT_Biella	c	T; C; S	100; 100; 100	T; C; S	100; 80; 80	T; C; S	100; 85; 85	T; C; S	100; 99; 99	T; C; S	100; 99; 99	T; C; S	100; 99; 99	T; C; S	100; 100; 100
	d		0; 0; 0		0; 19; 19		0; 14; 14		0; 0.6; 0.6		0; 0.4; 0.4		0; 0; 0		0; 0; 0
IT_Firenze-Prato	c	T; C; S	86; 19; 33	T; C; S	90; 30; 40	T; C; S	90; 39; 49	C; S;	56	C; S	83	C; S	76	C; S	75
	d		0; 0; 0		0; 0; <0.01		0; 0; 0		<0.01		0		0.1		0
IT_Modena	c	T; C; S	100; 99; 99	T; C; S	100; 100; 100	T; C; S	100; 99; 100					T; C; S	100; 97; 97	T; C; S	100; 100; 100
	d		0; 0; 0		0; 0; 0		0; 0; 0						0; 0; 0		0; 0; 0
IT_Parma	c	T; S	91	T; S	99	T; S	98	T; C; S	46; 99; 47	T; C; S	96; 75; 73	T; C; S	62; 49; 14	T; C; S	93; 91; 86
	d		0		0		0		0; 0; 0		0; 0; 0.1		0; 0; 0		0; 0; 0
IT_Ragusa	c	T; C; S	98; 91; 89	T; C; S	91; 85; 77	T; C; S	93; 82; 76			T; C; S	83; 87; 70	T; C; S	92; 95; 88	T; C; S	97; 89; 87
	d		0; 0; 0		0; 0; 0		0; 0; 0				0; 0; 0		0; 0; 0		0; 0; 0
IT_Romagna	c	T; C	100	T; C	100	T; C	100								
	d		0		0		0								
SI_Slovenia	c	C; S	97	C; S	97	C; S	96	C; S	92	C; S	92	C; S	96	C; S	99
National	d		0		0		0		0		0		0		0
ES_Castellón-Valencia (breast)	c	T; C; S	95; 93; 96												
	d		0; 2; 3												
ES_Girona	c	T; C; S	100; 97; 97	T; C; S	100; 96; 96	T; C; S	100; 95; 95	T; C; S	100; 97; 97	T; C; S	100; 94; 94	T; C; S	100; 99; 98	T; C; S	100; 100; 100
	d		0; 1; 1		0; 3; 3		0; 5; 5		0; 0.3; 0.3		0; 3; 3		0; 0.2; 0.2		0; 0; 0
ES_Navarra	c	C; S	96	C; S	73	C; S	76	C; S	96	C; S	94	C; S	88	C; S	99
	d		3		24		22		3		5		11		0.4
Eastern Europe															
BG_Bulgaria	c	T; S	99	T; S	92	T; S	90	T; S	91	T; S	96	T; S	89	T; S	89
National	d		0		0		0.2		3		0		10		4

(*continued on next page*)

Table 5 (*continued*)

European region/ cancer registry		Breast		Colon		Rectum		Stomach		Lung		Skin melanoma		Thyroid	
		Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)	Stage	Concordance/ discordance (%)
LV_Latvia	c	T; S	67	T; S	86	T; S	86	T; S	83	T; S	78	T; S	93	T; S	87
National	d		<0.01		0.2		<0.01		<0.01		<0.01		0		0
PL_Cracow	c	T; C; S	52; 44; 48	T; C; S	49; 2; 49	T; C; S	50; 3; 46	C; S	64	C; S	61	T; C; S	33; 53; 20	C; S	20
	d		11; 3; 16		0; 1; 1		0.2; 2; 3		0.3		0.7		3; 9; 0.4		4
PL_Lower Silesia	c	T; S	35	T; S	28	T; S	32	T; S	27	T; S	28	T; S	37	T; S	25
	d		0		0		0		0		0		0		0
SK_Slovakia	c	T; C; S	98; 63; 64	T; C; S	88; 68; 79	T; C; S	91; 70; 78	T; C; S	97; 71; 74	T; C; S	99; 77; 77	T; C; S	93; 80; 87	T; C; S	94; 0; 73
National	d		1; 1; 0.3		11; 12; 0.2		8; 9; 0.3		2; 3; 0.4		0.4; 1; 0.4		6; 7; 0.1		2; 3; 0.6

An empty cell in the Stage column indicates that the cancer registry provided no stage information or provided stage according to one system only.
If stage information was provided in all three forms, concordance (Concordance/discordance column) is presented as three figures in the following order: concordance between T and C, concordance between T and S and concordance between C and S.
The letters preceding the registry name are the international two-digit ISO country codes; UK, United Kingdom.
Specialised registries are indicated by parentheses showing the cancer(s) for which they gather data.
[a] Data on the other eight cancer sites are shown in the Supplementary material.

N1M0 (which should be regional) and T1-4NxMx (Table S6). Furthermore, some CRs recorded TANxM1 cases as R/M (should be metastatic). The widespread presence of these inconsistencies justified merging L/R and R/M to unknown.

Excellent (>75%) to moderate (40–75%) concordance was obtained for most of the 24 CRs, for which it was possible to compare information from at least two staging systems (Table 5, Table S7). Exceptions were Firenze-Prato (Italy), Cracow (most sites) and Lower Silesia (Poland), which, although they had poor (<40%) concordance, also had low discordance (<5%), implying that for a high proportion of cases information was available from one stage system only. We therefore considered that these registries' data were eligible for further analysis.

For Munich (Germany), Geneva (Switzerland), Biella (Italy), Navarra (Spain), Bulgaria, Cracow (Poland) and Slovakia, discordance was 10–30% due to variation in the assignment of T stage to local versus regional stage categories. It was often possible to discern systematic discordances, for example:

(a) T3 colorectal and ovarian cancers were correctly classified as condensed TA, but T3N0M0 cancers were incorrectly assigned to EoD local (Biella).
(b) T2 ovarian cancers were incorrectly classified as condensed TL, and consequently, T2N0M0 cancers were incorrectly assigned to EoD local (Biella).
(c) T1-4 Nx cancers were classified as condensed Tx instead of condensed TL or TA (depending on the exact site; Munich).
(d) TA NL ML cancers were incorrectly assigned to EoD local, when they should have been regional (Munich, Navarra, Bulgaria, Cracow and, for TNM only, Slovakia).
(e) Although T1 disease was correctly classified as condensed TL, in the presence of N0M1 or N1M0 disease, T1 was often incorrectly classified as condensed TA (Slovakia).

Notwithstanding the misclassification of EoD evident in Munich, Navarra and Bulgaria, these registries were included in further analyses since only in <2% of cases (usually) was stage reconstructed from EoD only. For Munich, 3% of colon, 8% of rectal and 15% of stomach cancers were reconstructed from EoD only; but only in 0.4%, 4.0% and 0.5% of cases, respectively, was local or regional stage reconstructed from EoD (data not shown) justifying the inclusion of Munich.

Although Slovakia often incorrectly classified T1 as condensed TA, this registry's data were also included in further analyses as for only <0.7% of cases overall (4% for thyroid) was stage reconstructed from condensed TNM (data not shown). No stage information was reconstructed from EoD for Biella (Italy; data not shown), justifying its inclusion in further analyses.

Geneva had a high percentage of discordant cases, with the absence of local cases in all three stage systems,

and high proportions of metastatic cases with implausibly high survival (Fig. 1, Fig. S1), mandating exclusion of this registry from subsequent analyses.

Cracow assigned T1-4N0M0 (instead of T1-3N0M0 only) breast cancer and skin melanoma cases to EoD local. A subsequent survey of CRs indicated that Cracow applied this rule to other cancer sites. However, this registry was included in the subsequent analyses on breast, skin melanoma and thyroid, as the proportion of T4M0 cases was generally low (5%, 15% and 10% in our study, respectively).

For registries that provided stage by one system only (condensed TNM or EoD) and with ≤30% of unknown cases, we compared stage distributions with those (TNM or condensed TNM) from other registries with low unknown percentages (Table 6). This comparison allowed Burgundy's inclusion in the definitive analyses. Finland, England, St. Gallen (Switzerland), Basque Country and Cuenca (Spain), the Czech Republic and Estonia (Table 6) had implausible stage distributions for several cancers: our survey showed that incorrect methods had been used to assign stage, mandating their exclusion from subsequent analyses. However, St. Gallen, Basque Country and Estonia, which assigned T1-4N0M0 cancers to EoD local, were included in subsequent analyses for breast, skin melanoma and thyroid (like Cracow), as the distribution of EoD categories was in line with the distributions of other registries (Table 6).

Since <10% of all CRs provided valid information on reconstructed stage for cancers of uterine cervix, uterine corpus, vagina-vulva, prostate, testis, bladder and kidney (Fig. 3), and stage distribution for ovarian cancer varied markedly across CRs (Table S8), further analyses could not be performed for these sites. Thus, 34 CRs (from 15 countries) of the 62 potentially eligible CRs were included in the further analyses (Table 7). These registries covered populations of 76,931,725 for breast cancer (17% of the population of the 29 countries participating in EUROCARE), 44,631,812 (10%) for stomach cancer and 15,759,116 (3%) for urinary bladder.

Of the 34 CRs, 25 provided TNM (with or without condensed TNM or EoD), four provided condensed TNM (with or without EoD) and five provided EoD only (Fig. 3, Table 7). Furthermore, they were representative of the European regions to which they belonged based on age at diagnosis (Table S9) and non-stage-specific survival (Table S10).

As shown in Table 8, local stage predominated in breast (44% overall), thyroid (55%) and skin melanoma (66%). These sites also had the lowest proportions (5–6%) of metastatic cases. By contrast, colon, rectum, stomach and lung were local in <20% of cases and metastatic in 19% (rectum), 22% (colon), 31% (stomach) and 41% (lung) of cases. Elderly (≥70 years) cases were diagnosed at slightly more advanced stage (especially for thyroid cancer) and were more commonly unstaged than cases diagnosed at <70 years.

The 5-year RS was 90% or higher for both young and elderly cases diagnosed with local stage disease, except for local lung cancer (15–69 years: 55% [95% confidence interval: 54%–56%]; ≥70 years: 35% [33%–36%]; Fig. 4 and Table S11) and stomach cancer (74% [72%–76%]; 59% [56%–61%]) and local rectal cancer in the elderly (84% [82%–85%]). As also shown in Fig. 4, in those diagnosed with metastatic breast cancer at 15–69 years, RS decreased from around 70% 1 year after diagnosis to 20% 5 years after diagnosis; for those diagnosed with metastatic colorectal cancer, skin melanoma or thyroid cancer, the decline was from around 50% to 10–20% (30% for thyroid); for metastatic lung and stomach cancers, the decline was from 20% to 3–4%. Similarly, steep declines in RS from 1 year to 5 years after diagnosis were also evident for elderly cases with metastatic cancers; however, the decline started from estimates that were 10–20 percentage points lower than those in 15-69-year-olds.

4. Discussion

This is the first Europe-wide analysis of the quality, comparability and completeness of cancer stage at diagnosis data, although several CRs have documented experience in collecting and analysing stage data, either for all incident cases [14–18] or for random samples of cases contributed to European high-resolution studies [19].

Stage data was provided to EUROCARE-5 for 15 solid cancers diagnosed in 2000–2007—the latest period for which data are available—by 62 of the 94 European CRs that collect information on these 15 cancers. Denmark, Iceland, Sweden, Scotland and Malta, most French registries, half the Italian and about 30% of the Spanish registries did not provide stage information. However, an ENCR survey [13] found that a considerable proportion of CRs have been collecting stage information at least since 2000, including all registries in the so-called North-West region and 50–60% of registries in the South-West region (including France, Italy and Spain). Furthermore, since 2010–2011, when CRs sent their data to EUROCARE, additional registries are likely to have started collecting stage information, and more registries are expected to provide stage for EUROCARE-6 (data submission started in mid-2016).

We developed new quality control procedures to determine what stage data were reliable and what had to be discarded. We found that for only seven cancers (breast, colon, rectum, skin melanoma, thyroid, lung and stomach) and 34 CRs (exact number varies with site) were the data of sufficient quality to justify performing further analyses.

Failure to correctly assign EoD categories was one problem, necessitating the exclusion of the entire data sets of four CRs. One way of overcoming incorrect EoD

Table 6
Stage distribution for 15 cancers, diagnosed 2000–2007, from the 10 cancer registries (CRs) that provided information on summary extent of disease only[a] compared with mean stage distribution for selected CRs[b] that provided acceptable quality information on TNM or condensed TNM.

		TNM[c]	Condensed TNM[d]	FI_Finland	UK_England	AT_Austria	FR_Burgundy (dig.)[a]	CH_St. Gallen	HR_Croatia	ES_Basque Country	ES_Cuenca	CZ_Czech Republic	EE_Estonia
Breast	Local	42	48	50		48		49	31	56	65	72	44
	Regional	31	34	34		30		38	34	34	13	12	44
	Metastatic	6	5	7		7		9	8	5	12	8	8
	Incomplete	19	4	2		0		3	0	0	1	0	2
	Missing	3	10	8		15		0	27	5	10	7	2
Colon	Local	11	16	31	13	19	14	42		41	61	45	41
	Regional	45	52	12	51	48	54	28		29	12	20	26
	Metastatic	22	22	35	15	19	25	30		24	20	24	29
	Incomplete	16	2	5	0	0	7	1		0	0	0	1
	Missing	6	8	18	21	14	0	0		7	7	11	3
Rectum	Local	16	22	34	21	25	22	43		41	62	45	41
	Regional	42	44	12	37	44	38	33		32	12	21	29
	Metastatic	19	20	29	12	15	23	21		18	20	21	25
	Incomplete	16	4	5	0	0	17	2		0	0	0	2
	Missing	6	10	20	30	17	0	1		8	6	13	3
Stomach	Local	7	17	17		22	7	23		27	57	27	24
	Regional	29	31	12		30	32	34		34	11	14	25
	Metastatic	38	34	41		23	35	37		29	23	36	44
	Incomplete	17	8	8		0	26	2		0	0	0	3
	Missing	9	11	21		26	0	4		10	9	23	4
Lung	Local	11	13	14		17		17		18	51	16	18
	Regional	26	29	8		26		29		33	13	26	35
	Metastatic	40	46	49		36		49		44	29	41	40
	Incomplete	13	3	10		0		2		0	0	0	3
	Missing	11	9	19		21		3		6	8	17	3
Skin melanoma	Local	59	74					78		74	77	79	80
	Regional	15	16					11		14	2	9	11
	Metastatic	5	3					5		2	10	5	5
	Incomplete	14	6					5		0	0	0	1
	Missing	8	1					1		11	11	6	3
Thyroid	Local	48	51			58		54	55	55	68	67	61
	Regional	17	30			26		24	14	22	15	10	25
	Metastatic	8	9			5		10	3	6	7	9	9
	Incomplete	22	1			0		8	0	0	0	0	1
	Missing	5	10			12		4	28	17	10	14	5
Uterine cervix[e]	Local	57	53	43		56		63		57	66	61	60
	Regional	11	23	5		21		18		30	11	19	26
	Metastatic	7	7	24		7		12		8	20	8	8
	Incomplete	20	2	7		0		8		0	0	0	3
	Missing	5	16	21		17		0		5	3	12	3
Uterine corpus[f]	Local	–	65	57		71		69		68	68	61	76
	Regional	–	13	2		10		9		14	11	7	11
	Metastatic	–	11	14		5		7		10	11	4	8

	Incomplete		1	3	0	14	0	0	0	2
	Missing	–	10	23	14	2	8	11	29	3
Ovary	Local	13	17	15	28	36	32	53	28	20
	Regional	36	4	1	28	15	31	19	29	47
	Metastatic	24	73	63	26	36	31	23	27	27
	Incomplete		0	8	0	12	0	0	0	4
	Missing	28	6	14	19	1	6	6	15	3
Vagina[f]	Local	–	52		47	59	57	56	49	54
	Regional	–	25		22	13	22	25	16	33
	Metastatic	–	10		6	9	12	0	11	6
	Incomplete		2		0	12	0	0	0	3
	Missing	–	11		25	7	8	19	25	4
Prostate[e]	Local	34	34		61	78	64	75	52	62
	Regional	27	27		13	6	4	7	11	14
	Metastatic	11	11		4	10	9	10	16	13
	Incomplete	15	15		0	2	0	0	0	2
	Missing	13	13		22	4	23	8	21	9
Testis	Local	50	56	61	73	77	67	58	78	44
	Regional	14	19	5	13	13	17	17	12	24
	Metastatic	11	11	14	6	6	12	17	3	29
	Incomplete	21	2	2	0	5	0	0	0	1
	Missing	3	13	18	8	0	4	8	7	3
Urinary bladder	Local	53	49	61	66	63	66	68	70	77
	Regional	10	15	1	8	13	9	12	6	12
	Metastatic	9	7	9	3	7	5	16	7	5
	Incomplete	23	27	3	0	8	0	0	0	2
	Missing	5	3	26	23	10	20	4	18	4
Kidney[e]	Local	45	42	47	60	56	59	61	54	62
	Regional	13	15	1	16	7	11	10	12	11
	Metastatic	17	22	28	11	21	19	22	19	24
	Incomplete	19	4	4	0	14	0	0	0	1
	Missing	6	17	20	12	2	10	8	15	3

Empty cells indicate the absence of stage information or unknown stage exceeded >30%.
The letters preceding the registry name are the international two-digit ISO country codes.
Specialised registries are indicated by parentheses showing the cancer(s) for which they gather data: dig, digestive system cancers only.

[a] Burgundy was the only one of the 10 registries to provide condensed TNM only.

[b] Selected cancer registries had low (≤30%) percentages of unknown stage for condensed TNM (see Table 3, Table S3) or summary extent of disease (Table 4, Table S4).

[c] CRs with ≤30% unknown for TNM (see Table 2, Table S2) excluding Geneva.

[d] CRs with ≤30% unknown for condensed TNM (see Table 3, Table S3; except Geneva and Slovakia).

[e] TNM distributions for uterine cervix and prostate based on one CR only, for kidney based on two CRs.

[f] No CR satisfied the ≤30% unknown selection criterion for uterine corpus (TNM only), vagina (TNM only) cancers.

	Total CRs	CRs providing stage				
		Eligible for analyses		Mean population		
	No.	Total No.	No.	covered	Coverage (%)	Cases analysed
Breast	89	60	30	76931725	16.7	358243
Colon	89	58	21	68880435	14.9	200471
Rectum	89	58	18	60768554	13.2	105158
Skin melanoma	86	49	13	25198775	5.5	21568
Thyroid	87	45	12	40235799	8.7	16806
Lung	87	52	10	37917482	8.2	166554
Stomach	88	52	9	44631812	9.7	50138
Testis	86	47	8	40065560	8.7	12881
Uterine cervix	86	49	8	24541955	5.3	13912
Kidney	86	49	7	39780221	8.6	43287
Uterine corpus	86	44	5	23022402	5.0	22344
Urinary bladder	86	47	4	15759116	3.4	19836
Vagina	86	45	4	20120348	4.4	3325
Prostate	87	50	4	16411006	3.6	56487

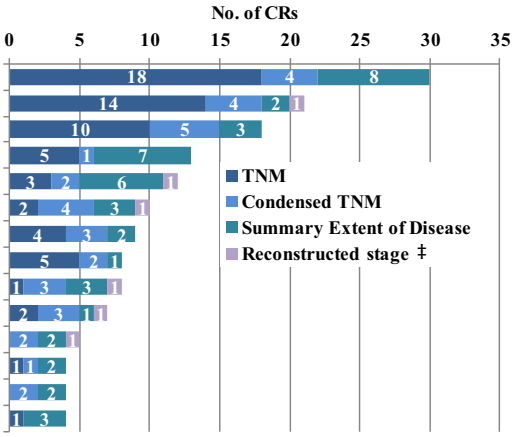

Fig. 3. Numbers of cancer registries (CRs) providing stage information, and numbers eligible for subsequent analyses, together with mean proportions (%) of national populations covered by cancer registration and number of cases analysed, for 14‡ solid cancers diagnosed in 2000–2007 in Europe. ‡15th cancer (ovarian) excluded for between-registry inconsistencies in stage distribution. ‡CRs included in the analysis only after replacing unknown TNM information with information from condensed TNM, summary extent of disease or both.

assignment would be for CRs to collect/provide stage information only as TNM or condensed TNM. If this proved impracticable, eliminating EoD hybrid stages would lead to more consistent coding and improved inter-registry data comparability but would also increase the proportion of unknown stage cases.

An additional 24 CRs had >30% unknown stage cases, mainly due to missing M or condensed M, necessitating their exclusion from subsequent analyses. Unknown stage can be due to the lack of stage information on the primary sources or failure to extract that information. Cancer cases sent to CRs passively (automatically), mainly from cancer hospitals and pathology laboratories, rarely contain complete stage information but instead contain clinical notes from which it is often possible to infer stage. Often it is only possible to infer the more limited EoD stage, so CRs record stage in this form. Often, the notes do not state explicitly that a patient lacked nodal or distant metastases, particularly when pathological staging was not performed. Similarly, negative results of examinations are not always mentioned. Some CRs send personnel to hospitals to extract information from primary sources to complement the information sent passively. This is resource-intensive, and its efficacy depends on the availability and competence of CR staff. In some countries, privacy legislation limits access to cancer case information; budget and bureaucratic constraints can also adversely affect the registration of cases and comparability of data [20,21].

The 7th/8th TNM editions eliminated Mx and recommended assuming Mx cases (coded according to earlier TNM editions) to be M0 [22,23]. We did not follow this practice in line with a previous study [24], even though it considerably reduced the number of CRs included in the subsequent analyses. Not all European CRs have adopted the new procedures for coding Mx, and others have yet to decide how to deal with this problem.

We performed a sensitivity analysis to estimate the error in assuming Mx to be M0. The assumption had a major effect on survival for local and regional cases (Table S12), resulting in stage misclassification for some CRs and cancers that would bias stage-specific survival estimates and comparisons [25]. We therefore feel that Mx should not be changed to M0 (by CRs) when the available clinical data do not specify that a patient lacked distant metastases. The same should hold for nodal metastases. For these cases, methods to impute missing stage can be used to minimise data loss [26].

The fact that only a third of the European CRs provided stage at diagnosis data of acceptable quality, should sent a clear message to CR program owners [1] that they need to improve the quality and standardisation of their stage data collection procedures, with adequate staff training, establishment of clear coding rules and perhaps the use of software that automatically queries unlikely combinations of entries. This of course needs to be done across Europe. It is also essential that CR program owners collaborate with European clinicians to establish a minimal clinical data set that has to be made available to (and easily accessed by) CRs to enable them to accurately record stage, so as to contribute more effectively to cancer surveillance (including monitoring the efficacy of screening), cancer control and research.

As regards stage distribution at diagnosis, we found that 5–6% of cases of cancers of breast, thyroid and skin

Table 7
Mean population, national proportion (%) of population covered by registration and number of cases diagnosed for 14[a] solid cancers in the 34 cancer registries with data quality meriting further analysis.

European region/ registry	Mean population	Cover age	Stage information provided	Breast	Colon	Rectum	Skin melanoma	Thyroid	Lung	Stomach	Testis	Uterine cervix	Kidney	Uterine corpus	Urinary bladder	Vagina	Prostate
Northern Europe				**23,208**	**18,701**	**9586**		**1658**	**18,127**	**4475**	**2061**	**2339**	**4907**	**4812**		**852**	
NO_Norway	4,586,593	100	C, S; breast: T, C, S	23,208	18,701	9586		1658	18,127	4475	2061	2339	4907	4812		852	
Central Europe				**228,401**	**118,170**	**59,117**	**9907**	**5697**	**121,528**	**31,756**	**8498**	**3808**	**31,445**	**7546**	**13,491**	**1426**	**42,936**
AT_Austria	8,150,455	100	S	37,537	23,072	14,032		5353	27,236	10,572	2682	3724	10,083	7546	13,179	1426	41,639
FR_Burgundy (dig.)	1,059,101	1.7	C		3632	2044				1168							
DE_Brandeburg	2,573,201	3.1	T	12,215	8191	5592					955		4586				
DE_Bremen	662,278	0.8	T, C, S	4353													
DE_Hamburg	1,734,369	2.1	T, S	10,297			2475		8744								
DE_Mecklenburg-West Pomerania	1,733,265	2.1	T	8173													
DE_Munich	3,870,016	4.7	T, C, S; lung: S	18,140	10,253	6241				3906							
DE_Saarland	1,058,000	1.3	C, S; lung, vagina, melanoma: S	6628			1248		5973								
DE_Saxony	4,329,470	5.3	T	21,875	15,423		4978										
CH_Grisons	225,361	3.1	T, C, S; lung, vagina: C, S	1250	669	349	386	83	918		99	84	240		312		1297
CH_St. Gallen	524,546	7.2	S	2257			820	261									
CH_Ticino	317,625	4.3	T	2028	1159	536											
CH_Valais	285,339	3.9	T, C, S; lung, vagina: C, S	1690		420					117						
NL_The Netherlands	16,209,421	100	T	101,958	55,771	29,903			78,657	16,110	4645		16536				
Southern Europe				**57,801**	**24,650**	**9796**	**4928**	**4521**	**12,002**	**4455**	**749**	**1731**	**2056**	**2328**	**1985**	**451**	**6197**
HR_Croatia	4,430,233	100	S	17,746				3075									
IT_Alto Adige	470,872	0.8	T	1724	1232	660			1212	835							
IT_Biella	188,077	0.3	T, C, S	1187	776	387											
IT_Firenze-Prato	1,179,368	2.0	C, S; breast, colon, rectum: T, C, S	6115	4403	2179											
IT_Milano	1,278,884	2.2	T		5877												
IT_Modena	651,890	1.1	T, C, S	4490	3432	1207	697										
IT_Palermo (breast)	1,238,995	2.1	T	5193													
IT_Parma	409,530	0.7	T, S; breast, colon, rectum, thyroid, cervix, vagina, bladder, testis, prostate: T, S	3054	2192		542					145					
IT_Ragusa	302,443	0.5	T, C, S	1116													
SI_Slovenia	1,998,138	100	C, S	8475	5346	4475	2628	921	8980	3620	749	1492	2056	2328	1985	451	6197
ES_Basque Country	2,096,083	5.0	S	5553			1061	525									
ES_Castellón-	522,718	1.2	T, C, S	1284													

(*continued on next page*)

Table 7 (*continued*)

European region/ registry	Mean population	Cover age	Stage information provided	Breast	Colon	Rectum	Skin melanoma	Thyroid	Lung	Stomach	Testis	Uterine cervix	Kidney	Uterine corpus	Urinary bladder	Vagina	Prostate
Valencia (breast)																	
ES_Navarra	582,219	1.4	C, S	1864	1392	888			1810			94					
Eastern Europe				**48,833**	**38,950**	**26,659**	**6733**	**4930**	**14,897**	**9452**	**1573**	**6034**	**4879**	**7658**	**4360**	**596**	**7354**
BG_Bulgaria	7,831,973	100	T, S	27,449	16,884	12,996		1797									
EE_Estonia	1,353,303	100	S	4922			1027	554									
LT_Lithuania	3,442,030	100	T		5095	4680	1549										
PL_Cracow	751,898	2.0	T, C, S; stomach, lung, thyroid, vagina, bladder: C, S	2861			494	371									
PL_Lower Silesia	2,902,054	7.6	T, S		5606			746	14,897	3587		2341		2598			
SK_Slovakia	5,385,162	100	T, C, S	13,601	11,365	8983	3663	1462		5865	1573	3693	4879	5060	4360	596	7354

Specialised registries are indicated by parentheses showing the cancer(s) for which they gather data: dig, digestive system cancers only.
[a] 15th cancer (ovarian) excluded for highly variable stage distribution across registries.

melanoma, 19% of rectum, 22% of colon, 31% of stomach, and 41% of lung cancer cases were metastatic at diagnosis. These proportions are similar (4–6% breast, thyroid and skin melanoma, 21% colorectal, 35% stomach and 57% lung) to those of the US National Cancer Institute [27]. Lower proportions of local stage breast (44% versus 61%) and colorectal (<20% versus 39%) cancers in Europe versus the United States (US) have been noted previously and attributed to differences in diagnostic workup [28,29]. Overall, therefore, our stage distributions are compatible with those of the US, suggesting that our quality control and stage reconstruction methods are valid, and that it is feasible to collect and analyse stage at diagnosis information from European CRs.

Importantly, compared with younger patients, elderly patients were diagnosed at a more advanced stage (or more often lacked stage information), and for all cancers at comparable stage, also had worse survival. This finding suggests that elderly patients do not have equitable access to treatment, perhaps for structural reasons or because clinicians are reluctant to apply standard treatments because of comorbidities.

To our knowledge, this is the first time a procedure has been developed to check and render compatible the disparate information on stage collected by European CRs. The procedure includes an algorithm that produces reconstructed stage from the information available from all three staging systems, thereby minimising the amount of missing data. We propose that this procedure be integrated with a newly developed data-checking tool [30]. The resulting potentiated tool could be applied to the EUROCARE-6 data set currently processed: it would not only automatically correct numerous data errors and inconsistencies (like the previous tool) but also provide a list of records with stage inconsistencies to be sent back to CRs for checking and correction.

5. Conclusions

We have shown that although many European CRs are able to collect reasonably accurate and consistent data on stage, many others have difficulties both collecting and coding stage information. Complete and accurate stage information is essential for assessing the efficacy of cancer control measures and for understanding why cancer survival varies across Europe. To improve coding accuracy and the extraction of stage information from primary sources, cancer site-specific courses could be held for CR personnel which should be based on the 7th/8th edition of the TNM, while the obsolete ENCR coding recommendations [8] will need to be updated. An online staging tool [31] and a TNM-to-EoD conversion tool [24] might be useful for this purpose. It is also essential that CRs are able to access primary cancer data

Table 8
Stage distribution for seven cancers diagnosed in Europe[a] in 2000–2007, overall and for young (<70 years) and elderly (≥70 years).

	Number of cases	Stage			
		Local (%)	Regional (%)	Metastatic (%)	Unknown (%)
Breast	**358,243**	**44**	**33**	**6**	**17**
<70 years	249,501	46	34	5	15
≥70 years	108,742	40	29	8	23
Colon	**200,471**	**13**	**48**	**22**	**17**
<70 years	87,430	14	47	24	15
≥70 years	113,041	13	49	21	17
Rectum	**105,158**	**19**	**44**	**19**	**18**
<70 years	55,932	20	45	20	15
≥70 years	49,226	18	43	18	21
Skin melanoma	**21,568**	**66**	**14**	**5**	**15**
<70 years	15,103	70	13	4	13
≥70 years	6465	57	18	6	19
Thyroid	**16,806**	**55**	**23**	**6**	**16**
<70 years	14,090	59	22	4	15
≥70 years	2716	34	30	18	18
Lung	**166,554**	**15**	**27**	**41**	**17**
<70 years	93,310	14	28	43	15
≥70 years	73,244	16	26	39	19
Stomach	**50,138**	**17**	**30**	**31**	**22**
<70 years	21,748	17	33	35	15
≥70 years	28,390	17	29	28	26

[a] Data only from cancer registries with: (i) sufficiently high-quality stage information, as determined by the analyses described in the text; (ii) ≤30% (for each site) with unknown reconstructed stage and (iii) ≤14% of total registry diagnosed at DCO/autopsy.

(with adequate privacy safeguards) and are able to recruit and retain the skilled human resources essential for accurate cancer registration. However, since it is not always possible to convert all stage information from an early TNM edition to later ones, the staging system used must be specified by CRs, and projects comparing stage (like EUROCARE) will need to take account of these incompatibilities.

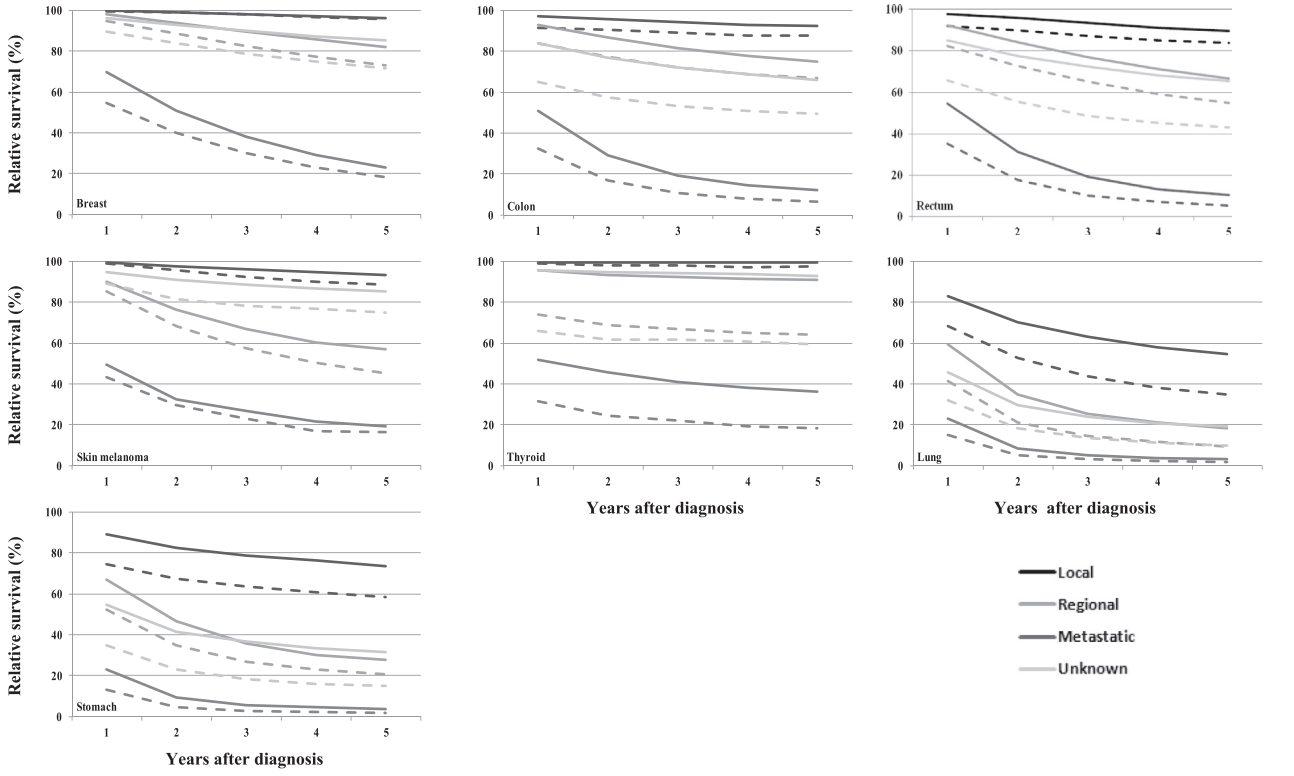

Fig. 4. Relative survival at 1 year through 5 years after diagnosis for cases diagnosed with seven solid cancers in 2000–2007, by reconstructed stage and age at diagnosis (<70 years and ≥70 years). Solid lines refer to cases diagnosed at 15–69 years; dashed lines refer to cases diagnosed at ≥70 years.

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Conflict of interest statement

None declared.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.ejca.2017.07.015.

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