



PII: S0959-8049(98)00327-X

Original Paper

Survival of Colorectal Cancer Patients in Europe During the Period 1978–1989

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This study concerns the survival of European patients diagnosed between 1978 and 1989 with colorectal cancer. Variations in survival in relation to age, country and period of diagnosis were examined. Data from the EURO CARE study were supplied by population-based cancer registries in 17 countries to a common protocol. Five years after diagnosis, relative survival rates were 47 and 43% for cancers of the colon and rectum, respectively. Survival decreased with increasing age: the relative risk of dying for the oldest patients (75+) was 1.39 for rectum and 1.54 for colon compared with the youngest patients (15–44 years). In 1985–1989 survival from colorectal cancer differed significantly between different European countries: the Nordic countries (Denmark excluded), The Netherlands, Switzerland, France and Austria were characterised by high survival, whilst Eastern European countries, the U.K. and Denmark were characterised by low survival. There was a general improvement in survival over the period 1978–1989: from 40 to 48% for colon cancer and 38 to 46% for rectal cancer. For neither cancer site did between-country survival differences narrow over the study period. Intercountry and time differences in survival differences are probably related to stage at diagnosis and postoperative mortality. © 1998 Elsevier Science Ltd. All rights reserved.

Key words: population-based cancer registries, relative survival, survival trends, colon cancer, rectal cancer, Europe

Eur J Cancer, Vol. 34, No. 14, pp. 2176–2183, 1998

INTRODUCTION

COLORECTAL CANCER is the second most common cancer after lung cancer in men and breast cancer in women [1]. In Europe, population-based data for colorectal cancer show that mortality has declined steadily whilst incidence has increased over the last 20 years [2]. Possible explanations are that both early detection and therapy for these cancers have improved. Several publications have reported on survival from colon cancer among European cancer patients, analysing EURO CARE population-based data [3]. Using multiple regression analysis one study revealed important intercountry differences in survival within Europe. These differences were found to be concentrated in the first six months after diag-

nosis and were, therefore, attributed to differences in stage at presentation, even though detailed staging information was not available [4]. It was also found that the proportion of patients undergoing surgical resection for colorectal cancer varied widely across Europe [5] and that there was a positive correlation between the probability of 5-year survival and the proportion of resected cases. In a more recent study arising from the EURO CARE project, the proportion of patients with colon cancer who were cured of their disease was estimated [6]. Thirty-nine per cent of colon cancer patients diagnosed between 1978 and 1985 were estimated as being cured (i.e. as having the same probability of dying as the general population) and the surviving population achieved this risk around six years after diagnosis. The proportion of cured patients increased over the study period.

The present study is concerned with survival of European colorectal cancer patients over a more recent period, 1985–1989 and is based on combined data collected by 40

*The EURO CARE Working Group for this study is listed in the Appendix.

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Received 20 Aug. 1998; accepted 21 Aug. 1998.

population-based cancer registries. Thus more countries and registries are represented than in previous studies [3–6]. The study focuses on variations in survival in relation to country, age, gender and period of diagnosis (the latter divided into four 3-year intervals) and includes 1978–1985 data in order to provide as complete a picture as possible of survival trends.

PATIENTS AND METHODS

The study considered all the cases of colorectal cancer (ICD-9 153,154), for which complete follow-up data were available (minimum follow-up 5 years), recorded by population-based cancer registries in 17 European countries. Only primary, first occurrence, malignant invasive tumours, as defined by ICD-O behaviour code 3 or higher [7] were considered; *in situ*, uncertain and borderline tumours were excluded. Both microscopically (= histologically or cytologically) verified and non-verified cases were included, but cases known to registries by death certificate only (DCO) or discovered incidentally at autopsy, were excluded. Descriptions of the cancer registries, their data gathering methods and the standardised procedures for ensuring data comparability were published in the first and second EURO CARE monographs [2, 8].

Table 1 shows the 156 634 colorectal cancer cases registered during the 1985–1989 period according to country. The registries of Finland, Denmark, Iceland, Scotland, Estonia, Slovakia and Slovenia cover the entire populations of those countries. English registries cover a large fraction of the whole population. Other countries are represented by one or more local or regional registries. Table 1 also provides information on cancer site, subsite (41% right colon: here defined

as ICD-9 codes 1530-1 and 1534-7), proportions of microscopically verified cases (80% overall), DCOs (4.8%), cases lost to follow-up (0.2%) and the proportion of patients aged more than 74 years. Overall, 38% of cases were over 74 years of age, ranging from 26% in Estonia to 51% in Switzerland. The proportion of microscopically confirmed cases ranged from 58% in Poland to 99% in Switzerland, whilst in most countries more than 80% of cases were histologically confirmed. The number of colon cancer cases in each country was usually slightly higher than the number of rectal cases. Trends in survival over time were analysed for 13 countries for which registries could provide data for the whole period 1978–1989, a total of 250 445 cases were included.

Relative survival rates were calculated as the ratio of the observed survival in a given patient group to the expected survival derived from the mortality rates of the general population, according to the Hakulinen method [9]. Overall (European) relative survival was estimated as the weighted average of the relative survival of the individual countries; weightings were proportional to the number of incident cases yearly diagnosed in each country. Age-standardised survival rates were calculated from age-specific rates for five age classes: 15–44, 45–54, 55–64, 65–74 and 75–99 years. The age distribution of cases in the entire European sample was used, for all periods, both sexes and all geographical areas, as the standard distribution. In order to compare survival trends and differences, the relative risks (RR) of death are given; these were calculated as the ratio of the logarithm of the relative survival for the group or category of interest (e.g. age class or period of diagnosis) to that of a reference category.

Table 1. *Quality of data for colorectal cancer cases by country (EURO CARE II)*

Country	No. of cases	% males	% > 74 years of age	% HV	% Right colon†	% Colon	% Lost to follow-up	% DCO
Northern Europe								
Iceland	373	51	41	95	49 (4)	76	0.0	0.0
Finland	7132	45	36	95	55 (5)	60	0.0	0.4
Sweden*	4256	50	42	98	29 (32)	63	0.0	0.0
Denmark	15 709	41	40	95	46 (6)	60	0.0	0.0
U.K.								
Scotland	13 701	49	36	83	40 (27)	67	0.0	3.3
England	66 460	50	40	68	39 (28)	63	0.0	7.9
Western and Central Europe								
The Netherlands*	3923	51	36	97	54 (3)	63	2.0	1.5
Germany*	3388	47	37	91	31 (33)	66	0.0	5.4
Austria*	555	45	34	83	35 (29)	62	0.0	12.2
Switzerland*	1805	43	51	99	50 (4)	64	1.3	0.7
France*	4586	53	38	97	41 (7)	59	0.2	n.a.
Southern Europe								
Spain*	5282	56	32	87	29 (33)	58	0.5	0.8
Italy*	12 510	50	34	83	38 (14)	64	0.7	2.5
Eastern Europe								
Slovenia	3157	50	36	84	52 (6)	47	0.5	3.8
Slovakia	9692	56	30	77	48 (8)	51	0.0	5.9
Poland*	1857	45	31	58	36 (28)	54	1.1	7.2
Estonia	2248	44	26	83	46 (5)	55	1.2	0.2
Europe	156 634	50	38	80	41 (21)	61	0.2	4.8

* < 20% of the national population covered. † Proportion calculated on colon cancer cases only and in parenthesis proportion of cases with subsite not specified. n.a., not available; DCO, death certificate only; HV, histologically verified.

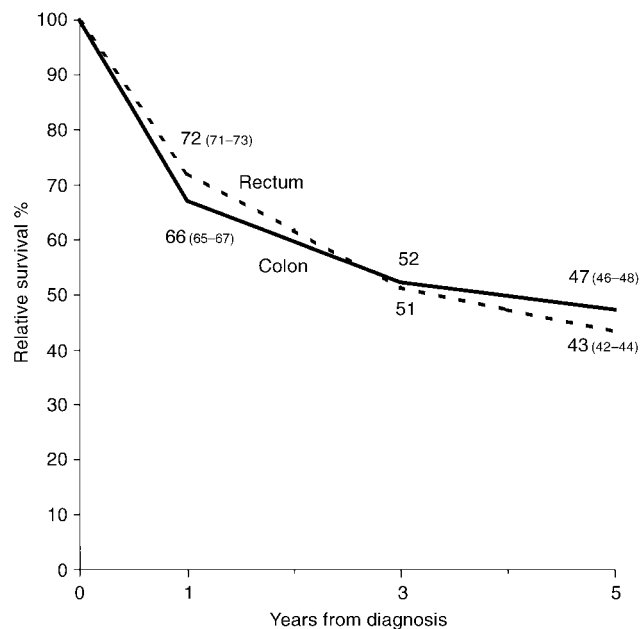


Figure 1. Relative survival (95% confidence intervals in parentheses) for cancers of colon and rectum in Europe, 1985–1989 (EUROCARE II).

RESULTS

The effect of site and age on survival

Figure 1 shows relative survival rates 1, 3 and 5 years after diagnosis for colon and rectal cancer patients. Survival for colon cancer was slightly better than for rectal cancer 5 years after diagnosis (47 versus 43%), but 1 year after diagnosis survival was greater for rectal cancer (72 versus 66%). Survival did not differ between men and women (data not shown).

Figure 2 shows the age effect on survival. Both for colon and rectal cancer, 5-year relative survival decreased with increasing age: from 57% in the youngest age group (15–44

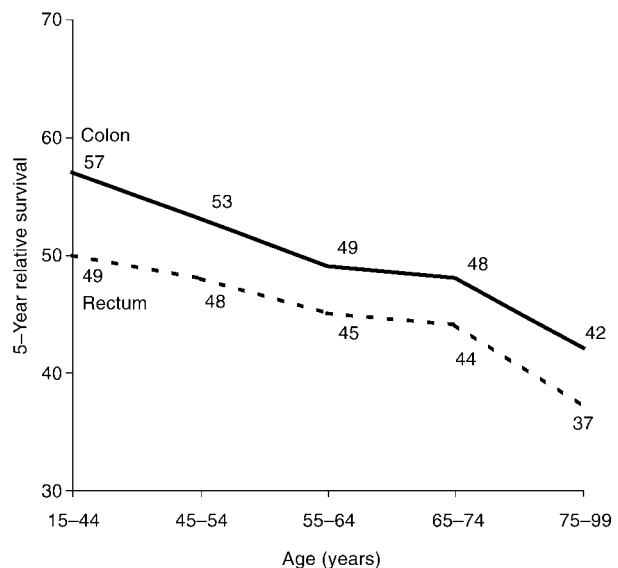


Figure 2. Five-year relative survival by age for colon and rectal cancers in Europe, diagnosed between 1985 and 1989 (EUROCARE II).

years) to 42% in the oldest age group (75+ years) for colon cancer, and from 49 to 37% for rectal cancer. The relative risk of dying for the oldest patients (75+) was 1.54 (1.33–1.69, 95% confidence interval, CI) for colon and 1.39 (1.29–1.55, 95% CI) for rectum, compared with the youngest patients (15–44 years).

Intercountry differences in survival

The effects of country on age-standardised 5-year relative survival are shown for colon (Figure 3) and rectal cancer (Figure 4) in men and women. Countries can be divided into three groups according to survival figures: those with survival close to the European average (RR of dying from 0.9 to 1.1

Table 2. Five-year relative survival (%) by age and period of diagnosis in Europe for colorectal cancers (EUROCARE II)

Colon cancer	1978–1980	1981–1983	1984–1986	1987–1989	RR of dying*
Age					
15–44	50	55	57	62	0.7
45–54	47	51	53	54	0.8
55–64	41	45	48	49	0.8
65–74	40	42	50	48	0.8
75+	33	36	42	43	0.8
Overall	40	42	48	48	0.8
Men	40	42	46	47	0.8
Women	37	40	47	48	0.7
Rectal cancer	1978–1980	1981–1983	1984–1986	1987–1989	RR of dying*
Age					
15–44	46	51	53	51	0.9
45–54	39	46	52	51	0.7
55–64	41	43	42	48	0.8
65–74	39	41	43	48	0.8
75+	29	31	37	38	0.8
Overall	38	40	42	46	0.8
Men	34	38	41	44	0.8
Women	39	39	43	45	0.8

*1987–1989 versus 1978–1980. Note: Rectal cancer survival figures for men in the youngest age group were 46, 48, 45 and 45% (by diagnosis period); the corresponding figures for women in the same age group were 47, 54, 63, and 59%.

versus Europe), those with better survival (RR of dying less than 0.9) and those with poorer survival (RR of dying more than 1.1). The Nordic countries (Denmark excluded), The Netherlands, Switzerland, France and Austria were characterised by high survival, whilst Eastern European countries, the U.K. and Denmark were characterised by low survival.

Time trends in survival

Table 2 shows the effects of period of diagnosis (between 1978 and 1989) on 5-year relative survival according to age. For both colon and rectal cancer the overall RR of dying decreased by 20% over this period; the decrease was marked (approximately 30%) among the youngest patients (15–45 years) of both sexes with colon cancer, and for young women

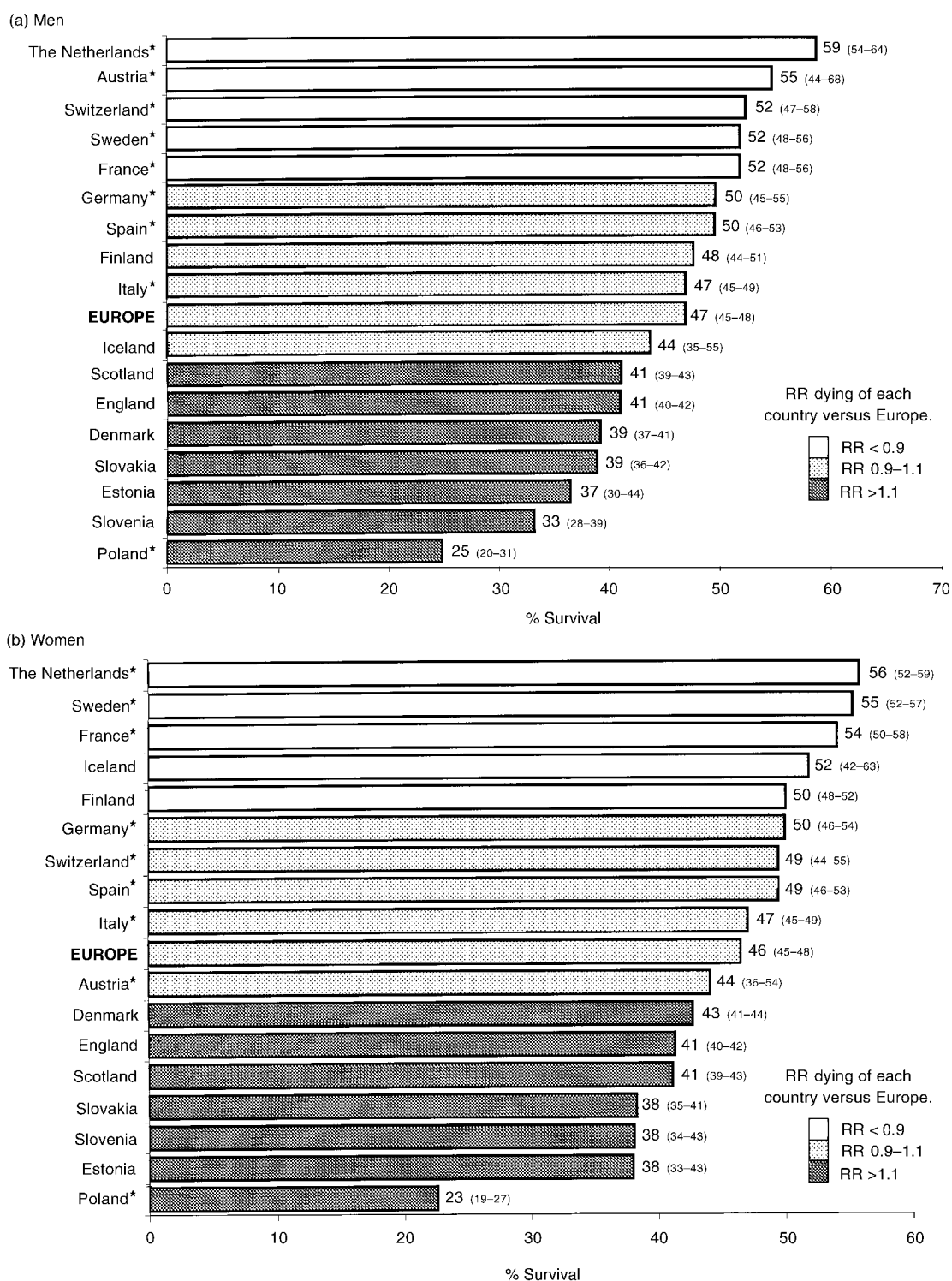


Figure 3. Five-year relative survival (95% confidence interval) for colon cancer in (a) men and (b) women by country, 1985–1989 (EUROCARE II). * < 20% of the national population covered.

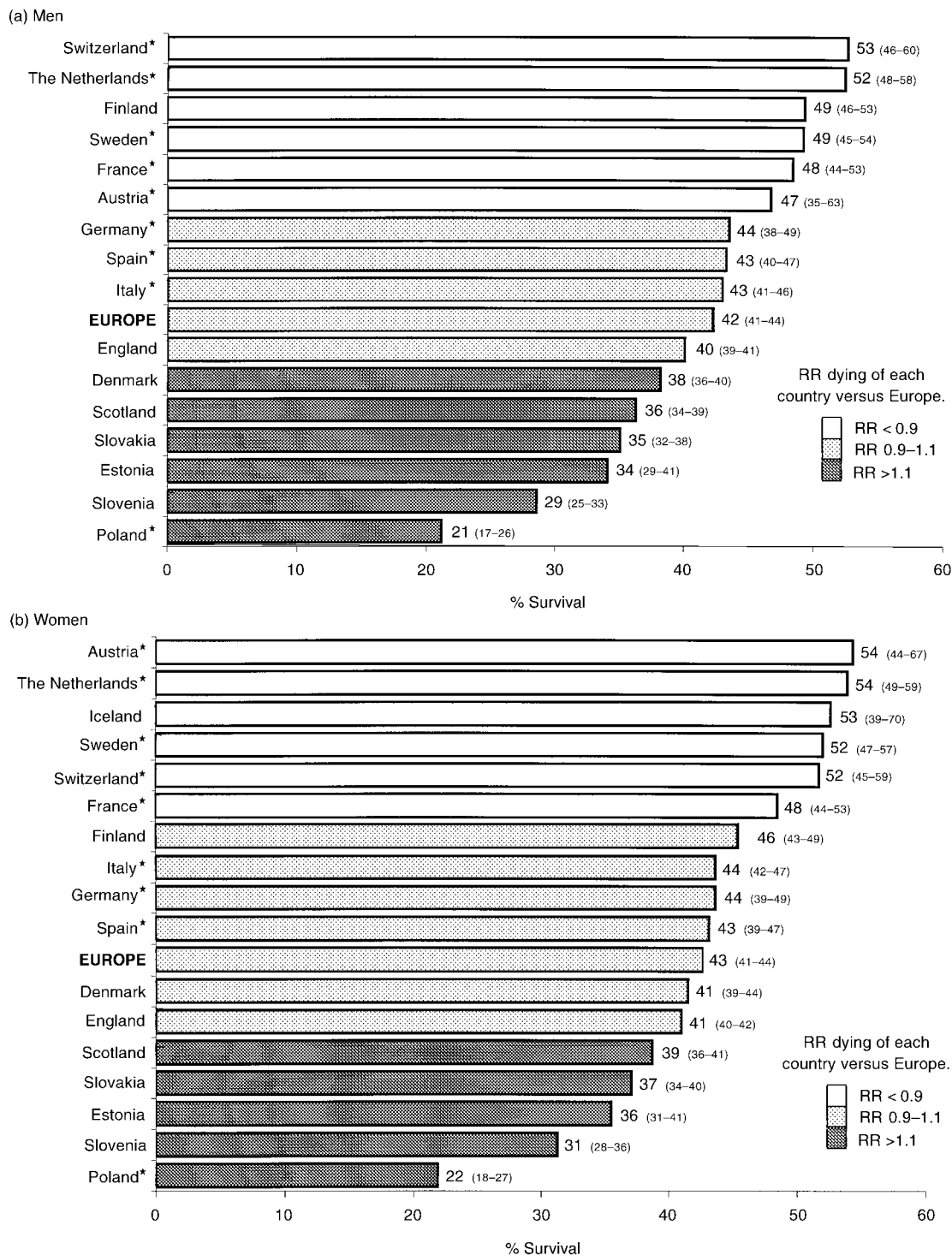


Figure 4. Five-year relative survival (95% confidence interval) for rectal cancer in (a) men and (b) women by country, 1985-1989 (EUROCARE II). * < 20% of the national population covered.

only with rectal cancer (see legend in Table 2). Tables 3 (colon) and 4 (rectal) show the effect of time on 5-year relative survival from 1978 to 1989 and according to gender and country. The 95% CI for relative survival shown in these tables relate to the last diagnosis period only, but since the number of patients diagnosed in each period was similar, the width of the CI did not change substantially for the different periods.

For colon cancer patients in France, Iceland, Italy, Switzerland, England and Estonia, the RR of dying for colon

cancer patients decreased by 20% or more over the study period (10% for women in Iceland and Switzerland). In the latter two countries, survival rates were low and remained below the European average. In Italy survival improved to reach the European average by the end of the study period. Survival improved with time more in women (RR decrease of 25%) than in men, particularly in Estonia, France, Italy and Sweden.

For rectal cancer, countries with a decrease in RR of dying of 20% or more at least in one sex were The Netherlands,

Table 3. Five-year age-standardised relative survival for colon cancer by period of diagnosis and country† (EUROCARE II)

	1978–1980	1981–1983	1984–1986	1987–1989 (95% CI)	RR of dying †
(a) Men					
Northern Europe					
Iceland	35	47	43	46 (33–59)	0.7
Finland	45	50	48	46 (42–50)	1.0
Sweden*	50	47	53	53 (48–58)	0.9
Denmark	37	37	37	40 (38–43)	0.9
U.K.					
Scotland	38	36	38	44 (41–46)	0.9
England	36	38	40	42 (41–43)	0.8
Western and Central Europe					
The Netherlands*	49	46	53	53 (45–60)	0.9
Germany*	41	45	54	46 (39–53)	0.9
Switzerland*	47	46	45	55 (44–66)	0.8
France*	42	48	48	58 (52–64)	0.6
Southern Europe					
Italy*	36	35	43	48 (41–54)	0.7
Eastern Europe					
Poland*	27	5	13	25 (13–41)	1.0
Estonia	23	27	33	39 (31–48)	0.6
Europe	40	42	47	47 (44–49)	0.8
(b) Women					
Northern Europe					
Iceland	54	54	48	57 (43–69)	0.9
Finland	41	45	49	51 (48–54)	0.8
Sweden*	46	54	52	57 (52–61)	0.7
Denmark	38	42	41	44 (42–46)	0.8
U.K.					
Scotland	34	37	40	43 (40–45)	0.8
England	33	38	39	43 (41–44)	0.8
Western and Central Europe					
The Netherlands*	44	47	54	52 (46–59)	0.8
Germany*	37	39	51	47 (42–52)	0.8
Switzerland*	53	51	49	55 (45–65)	0.9
France*	42	44	55	59 (53–64)	0.6
Southern Europe					
Italy*	38	44	51	51 (46–56)	0.7
Eastern Europe					
Poland*	18	19	14	27 (19–36)	0.8
Estonia	30	36	35	40 (34–46)	0.7
Europe	37	40	47	48 (46–50)	0.7

* < 20% of the national population covered. †Relative risk of dying 1987–1989 versus 1978–1980. ‡Only 13 countries contributed data for the whole period 1978–1989. 95%CI, 95% confidence interval for survival in period 1987–1989.

France, Germany, Italy, Poland, Scotland, Switzerland, England and Estonia. In Italy and The Netherlands survival was below the European average at the end of the 1970s but improved significantly to reach the European average (Italy) or surpass it (The Netherlands) by 1987–1989. In contrast, in Eastern European countries and the U.K., survival remained lower than the European average. Among women survival did not improve in The Netherlands or Poland. For neither cancer site did between-country survival differences narrow over the study period.

DISCUSSION

The major findings of this study are that in the late 1980s survival from colorectal cancer differed significantly between different European countries. There was a general improve-

ment in survival over the study period, but intercountry survival differences did not reduce. Survival decreased with increasing age.

During the study period, 5-year relative survival in the European population as a whole was 47 and 43% for colon and rectal cancer, respectively. The overall 1-year relative survival was 66% for colon and 72% for rectal cancer. Between-country variation in 1-year relative survival (ranging from 43–76% for colon, 53–80% for rectum for men; and 43–74% for colon, 53–83% for rectum for women) was more marked than variation in 5-year relative survival. Among patients who survived for 1 year, the conditional probability of surviving for the next 4 years was less variable between countries (55–77% for colon, 40–68% for rectum for men; and 52–77% for colon, 41–67% for rectum for women). The

Table 4. Five-year age-standardised relative survival for rectal cancer by period of diagnosis and country† (EUROCARE II)

	1978–1980	1981–1983	1984–1986	1987–1989 (95% CI)	RR of dying‡
(a) Men					
Northern Europe					
Iceland	41	21	66	n.a.	–
Finland	42	38	50	46 (41–51)	0.9
Sweden*	44	49	47	49 (43–55)	0.9
Denmark	34	36	38	37 (34–40)	0.9
U.K.					
Scotland	29	34	35	37 (34–41)	0.7
England	35	37	40	41 (40–43)	0.8
Western and Central Europe					
The Netherlands*	28	52	43	51 (42–60)	0.6
Germany*	34	40	42	44 (36–51)	0.8
Switzerland*	45	47	45	58 (43–72)	0.7
France*	36	39	42	54 (47–61)	0.6
Southern Europe					
Italy*	25	34	35	44 (36–52)	0.6
Eastern Europe					
Poland*	10	8	19	21 (13–32)	0.7
Estonia	24	23	33	34 (27–43)	0.8
Europe	34	38	41	44 (41–47)	0.8
(a) Women					
Northern Europe					
Iceland	n.a.	n.a.	37	n.a.	–
Finland	45	43	44	48 (44–52)	0.9
Sweden*	44	52	50	53 (47–59)	0.8
Denmark	40	41	40	42 (39–44)	0.9
U.K.					
Scotland	35	33	36	41 (38–45)	0.8
England	35	38	41	42 (41–44)	0.8
Western and Central Europe					
The Netherlands*	50	42	49	49 (41–57)	1.0
Germany*	40	38	45	44 (37–50)	0.9
Switzerland*	58	50	39	62 (49–73)	0.9
France*	42	50	47	55 (48–62)	0.7
Southern Europe					
Italy*	29	30	35	54 (46–62)	0.5
Eastern Europe					
Poland*	30	15	31	16 (10–24)	1.5
Estonia	31	39	32	36 (30–43)	0.9
Europe	39	39	43	45 (42–48)	0.8

* < 20% of the national population covered. †Relative risk of dying 1987–1989 versus 1978–1980. ‡Only 13 countries contributed data for the whole period 1978–1989. 95%CI, 95% confidence interval for survival in period 1987–1989.

important intercountry differences in postoperative mortality and stage at diagnosis, which make their effects felt in the first year after diagnosis, are likely to be the main factors explaining the narrowing of conditional survival variability [4, 10].

From 1978 to 1989, 5-year relative survival from colorectal cancer improved by 20%: a decrease in operative mortality [10–12], increase in the resection rate associated with an improvement in the stage at diagnosis [11, 12] could be the main reasons for this improvement. Radiotherapy was known to be efficacious in rectal cancer, mainly to decrease the risk of local recurrence in Dukes' B and C, which constitute up to 60% of cases. The variation between countries and over time in the survival for rectal cancer may be related to the availability of radiotherapy facilities.

Some studies have reported that the survival of European colorectal patients is worse in lower socio-economic

groups [13–15]. However, it was found that stage at diagnosis could not explain these survival differences and it was suggested that differences in management, which are likely to be important for curable cancers such as those of the colon and rectum, was a likely explanation of this phenomenon. Cancer survival reflects the global impact of the health system on a population. In a previous publication we examined 5-year relative survival for colon cancer in relation to health expenditure in several European countries [16]. It was estimated that approximately 50% of the intercountry variability in cancer survival could be attributed to differences in health spending.

It is interesting to compare our findings on European survival with data for other continents over similar periods. In the US (SEER program, 1983–1987) [17], Japan (Osaka, 1987–1989) [18] and Australia (South Australia, 1977–1990)

[19], 5-year relative survival was between 50 and 60% for both colon and rectal cancer. In Europe, only The Netherlands, Sweden, Switzerland and France (colon only) had 5-year relative survivals greater than 50% in both sexes combined. However, these comparisons are crude and a proper interpretation of the difference would require thorough evaluation of data quality and age-standardisation.

We found that 5-year relative survival was poorer in elderly patients. This is generally attributed to a decline in general health with age, frequently combined with advanced stage at diagnosis. Certainly, these two factors can reduce the efficacy of treatment. The relative survival of colon and rectal cancer patients did not vary appreciably with age among caucasian Americans according to SEER programme data, although it did vary among black patients. For black patients, stage at diagnosis explained more than half the excess mortality compared with caucasian patients [20]. The SEER programme also found that patterns of surgery for colon and rectum cancer patients did not vary substantially with age. This is not the case for the European countries we studied, where the proportion of surgically treated patients declined with advancing age [5]. The considerable age and country-dependent variability in survival in Europe implies that there is room for improvement in low-survival countries and for the elderly.

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Acknowledgements—The EURO-CARE study was financed through the BIOMED programme of the European Union. The authors are grateful to D. Ward for his editorial assistance. They are also indebted to L. Dell'Era and A. Evangelista for their help in preparing the tables and figures.

APPENDIX

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