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Patterns of care for European colorectal cancer patients diagnosed 1996–1998: A EUROCARE High Resolution Study

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Abstract

Objective. To identify disparities in the management of colon and rectal cancer across Europe by assessing population-based information from 12 European cancer registries (CR) participating in EUROCARE, together with additional information obtained from individual clinical records. *Methods and patients.* We considered five indicators: (a) resection with curative intent; (b) post-operative mortality; (c) proportion of stage II/III colon cancer cases given adjuvant chemotherapy; (d) proportion of rectal cancer cases receiving radiotherapy; and (e) proportion of curative intent resections with 12 or more lymph nodes examined. *Results.* A total of 6 871 colorectal cancer patients, diagnosed between 1996–1998, were examined. Overall 71% of patients received resection with curative intent, range 44–86% by CR; 46% of stage III colon cancer cases (range 24–73% by CR) and 22% of stage II cases (not then recommended) received adjuvant chemotherapy; 12% of rectal cancer cases received adjuvant radiotherapy, range ≤2% in five CRs to >51% in two CRs. For only 29% of curative intent resections were 12 or more lymph nodes examined. *Conclusions.* This study reveals that, although most patients received surgery with curative intent, disparities in treatment for colorectal cancer across Europe in the late 1990s were unexpectedly large, with many patients not receiving treatments indicated by published clinical trials. Consensus guidelines for CRC management are now becoming available and should be adopted across Europe. It is hoped that dissemination of guidelines will improve the use of scientifically proven treatments for the disease, but this should be monitored by further population-based studies.

Colorectal cancer (CRC) is a major health problem in Europe, being the second most frequently diagnosed cancer and also the second most important cause of cancer death [1]. In 2006, an estimated 413 000 Europeans were diagnosed with the disease and 207 000 died from it [1]. The EUROCARE studies have shown that the survival of patients with CRC varies considerably across Europe [2]. Five-year relative survival for Europeans diagnosed with the disease between 1995 and 1999 was 54% overall, but survival by country ranged from 39 to 60% [2]. Variation in stage at diagnosis and access to appropriate treatment have been proposed as important reasons for this variation [3]. However, identification of the various factors supposed to be responsible for survival differences across Europe requires analysis

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of standardised information on disease stage at diagnosis, on the diagnostic procedures used for staging, and on the treatments given. Such information is not usually available in population-based cancer registries, and to obtain it special studies [3] are required in which cancer registries (CRs) collect additional clinical and pathological information on a representative sample of incident cancer cases, according to an agreed protocol. Such 'high resolution' population-based studies, carried out as part of the EUROCARE project, are difficult to perform as they require examining and quality checking the clinical records of thousands of patients, but are the only way of assessing the overall performance of health care services in countries and regions, and are to contrast with data on cancer patient management published by specialised (and usually high quality) treatment centres, which are almost always unrepresentative of the situation in the country as a whole.

In the present study we retrieved and analysed data on treatments, stage at diagnosis, and staging procedures applied, to patients diagnosed with CRC between 1996 and 1998, and registered in 12 European population-based CRs. Our aim was to ascertain whether there were major disparities in the management of CRC across Europe and assess the extent to which CRC management followed that indicated by published trials.

Materials and Methods

The following CRs agreed to participate: Genoa and Varese (Italy), Côte-d'Or (France), Granada, Navarra and Tarragona (Spain), Tampere (Finland), Estonia, Slovenia, Slovakia, and Cracow and Kielce (Poland) (Table I). The study protocol specified that at least 500 cases per CR were required and if this minimum was not reached in one year, the study period could be extended to obtain the required number of cases. However, although most CRs provided all cases incident in 1996–1998, for economic reasons – the costs of obtaining detailed clinical information are high – less than 500 cases were provided by Kielce. Only cases with a first primary, carcinoma of the colon or rectum, defined by codes 153.0 to 154.1, 154.8 of the International Classification of Diseases for Oncology, 9th edition [4] were considered. Cases known to CRs through death certificate only or discovered incidentally at autopsy were excluded, as were non-epithelial tumours [5]. Both histologically verified and non-verified cases were included.

Each CR was asked to provide detailed information on diagnostic and treatment procedures, obtained from clinical records and abstracted onto a standard form. Details of the information abstracted given elsewhere [6]. A total of 6 871 patients were included in the analysis.

Surgery was categorised as: resection with curative intent, resection for palliation, by-pass surgery plus exploratory laparotomy, and unknown. Resection with curative intent was defined as resection of all macroscopically evident malignant tissue with no microscopic evidence of surgical margin involvement, and excludes polypectomy and transanal excision. Disease stage at diagnosis was defined according to the 4th TNM revision [7] except that non-resected and metastatic cases were grouped as advanced cancers.

We derived the following indicators of treatment: (a) Proportion of patients resected with curative intent; (b) Perioperative mortality (death within 30 days of surgery) in cases treated with curative intent; (c) Proportion of stage II/III colon cancer cases, treated with curative intent, receiving adjuvant chemotherapy (administered within six months of surgery); (d) Proportion of stage I-III rectal cancer cases, treated with curative intent, receiving neoadjuvant/adjuvant radiotherapy; and (e) Proportion of patients, treated with curative intent, in whom with 12 or more lymph nodes examined. We erected four categories (0, 1–11, ≥12 and NA) where NA (not available) includes cased with number of nodes missing even though nodes were examined, and cases with no information on whether or not lymph nodes were examined.

For the analyses of primary treatment, adjuvant treatment, peri-operative mortality, number of examined nodes and advanced cases, cases were categorised according to age (up to 64, 65–74, 75 and over), sex, site (colon and rectum) and CR.

When calculating the proportion receiving radiotherapy we excluded cancers of the rectosigmoid junction (ICD9 code: 154.0) and cases treated by polypectomy or transanal resection.

Statistical methods

Generalised linear models assuming a binomial distribution and logit link [8] were used to estimate odds ratios (ORs) with 95% confidence intervals (CI) of receiving resection with curative intent, adjuvant chemotherapy for stage II or III colon cancer, and adjuvant radiotherapy for rectal cancer, according to age, sex, and CR. Models were adjusted for age, sex and CR as appropriate. The CR of Slovenia, which provided the greatest number of cases, was reference (OR=1) for the analysis of CR as risk factor. We also estimated p-values for treatment differences according to age, sex and CR [9].

The analyses were performed with the Stata statistical package, release 9.2. (Stata Corporation, College Station, TX, USA) [10].

Table I. Colorectal cancer cases diagnosed in selected European cancers registries from 1996–1998.

Country	Cancer registry	No. of cases	Period of diagnosis	Men (%)	Age ≥75 (%)	Colon (%)	MV* (%)	No stage information*(%)	
								Colon	Rectum
All		**6871**	**1996–1998**	**53.2**	**33.6**	**59.3**	**92.7**	**4.5**	**4.6**
Finland	Tampere	523	1996–1998	47.2	38.8	56.2	91.4	15.8	9.6
France	Côte-d'Or	561	1996–1997	53.8	44.7	68.0	97.0	0.0	0.8
Italy	Genoa	597	1996	55.6	39.9	63.5	90.0	5.4	6.1
	Varese	503	1997	53.3	34.0	66.6	87.2	0.0	4.0
Spain	Granada	579	1996–1997	55.1	33.2	63.6	92.4	12.5	16.2
	Navarra	588	1996–1997	60.2	41.8	57.0	94.9	1.5	1.6
	Tarragona	653	1996–1997	52.8	39.7	66.2	94.8	1.8	3.9
Estonia	Estonia	560	1997	44.6	28.6	60.2	87.7	1.5	0.8
Slovenia	Slovenia	940	1997	52.2	25.9	50.6	93.0	4.5	2.8
Slovakia	Slovakia	581	1996	60.4	23.2	54.2	92.1	0.9	1.3
Poland	Cracow	512	1997–1998	49.2	25.8	55.7	90.4	7.1	4.1
	Kielce	274	1996	54.1	29.2	48.9	NA	0.0	3.2

MV=microscopically verified; NA=not available. *Among cases resected with curative intent: 131/2944 colon cancer cases and 85/1871 rectal cancer cases.

Results

We examined 4 073 colon and 2 798 rectal cancer cases diagnosed between 1996 and 1998. The proportion of men in each CR varied from 45% in Estonia to 60% in Slovakia and Navarra, Spain. The proportion of patients aged 75 years and over varied from 23% (Slovakia) to 45% (Côte-d'Or, France). The proportion of colon cancers ranged from 49% in Kielce, Poland to 68% in Côte-d'Or. Overall 93% of cancers were microscopically verified, range 87% (Varese) to 97% (Côte-d'Or), excluding Kielce for which microscopic verification data were not available (Table I). The proportion of resected cases with stage not available is also given in Table I as an indicator of data quality.

Surgical treatment

Table II shows the proportions of patients resected with curative intent, by age sex and CR, with multivariable estimates of odds ratios (ORs) of receiving resection with curative intent, according to age, sex, site and cancer registry. Overall 71% of patients were treated with curative intent, range 44% (Kielce) to 86% (Genoa) but this proportion decreased with advancing age at diagnosis from 76% in patients under 65 years, to 63% in patients of 75 and over ($p<0.001$). Curative intent surgery did not vary between the sexes but was significantly higher ($p<0.001$) for colon cancer (73%) than rectal cancer (68%).

Overall 5% of resected patients died within 30 days of surgery, varying from 2% in Varese and Cracow to 7% in Genoa, Granada and Slovenia, and from 2% in patients under 65 years to 9% in patients of 75 years and over. Peri-operative mortality did not vary between the sexes but was significantly higher ($p=0.02$) for colon than rectal cancer.

Lymph nodes examined and advanced cases

Among patients treated with curative intent, 29% had 12 or more lymph nodes examined, 31% of colon cancer cases, and 25% of rectal cases (Table III); differences in relation to age and sex were small. Tarragona (54%) and Slovenia (52%) had the highest proportions of cases with 12 or more nodes examined. For many CRs this information was not available for high proportions of cases: 35% in Finland, 50% in Estonia, 54% in Slovakia and 78% in Kielce.

Overall 30% of patients had advanced disease (non-resected and metastatic cases), varying from more than 35% in Kielce and Cracow to 25% in Côte-d'Or and Genoa, and from 36% in patients of 75 years and over to 26% in patients under 65 years ($p<0.01$). The proportion of advanced cases varied little with sex and site.

Adjuvant chemotherapy in colon cancer

Table IV shows the proportions of stage II and III colon cancer cases, treated with curative intent, that received adjuvant chemotherapy by age, sex and CR. With regard to stage II cancers, 22% overall received adjuvant chemotherapy, with marked variations by age at diagnosis (38% for under 65 years; 5% for 75 and above) and CR (5% in Estonia; 61% in Slovakia). There was also some difference between the sexes (24% for men; 19% for women; $p=0.05$).

With regard to stage III colon cancers, 46% overall received adjuvant chemotherapy, with wide variation by age at diagnosis (69% in under 65 years; 16% in those 75 and above) and CR (24% in Cracow; 73% in Slovakia) but not for sex. Multivariable analysis of stage III cases indicated that the risk of receiving adjuvant chemotherapy varied even more markedly with age than suggested by the

Table II. Proportions of colorectal cancers resected with curative intent, with multivariable estimates of odds ratios (OR) of curative intent resection according to age, sex, site and cancer registry. Peri-operative mortality is also shown.

			Resection with curative intent*	Multivariable estimates odds ratio of resection with curative intent			Peri-operative mortality**	
		No. of cases	%	OR	95% C.I.		N	%
	All	**6 871**	**70.8**				**248**	**5.1**
Age (years)	<65	2 197	76.2	**1**			31	1.9
	65–74	2 364	73.4	**0.83**	0.72	0.95	81	4.7
	75+	2 310	63.1	**0.43**	0.37	0.49	136	9.3
Sex	Men	3 659	71.1	**1**			135	5.2
	Women	3 212	70.6	**1.08**	0.97	1.21	113	5.0
Site	Colon	4 073	72.9	**1**			170	5.7
	Rectum	2 798	67.9	**0.79**	0.71	0.89	78	4.1
Country	**Registry**							
Finland	Tampere	523	73.6	**1.29**	1.01	1.65	17	4.4
France	Côte-d'Or	561	76.8	**1.58**	1.24	2.03	27	6.3
Italy	Genoa	597	85.6	**2.92**	2.21	3.85	37	7.2
	Varese	503	78.9	**1.66**	1.28	2.16	8	2.0
Spain	Granada	579	77.7	**1.75**	1.36	2.26	33	7.3
	Navarra	588	76.9	**1.67**	1.31	2.14	17	3.8
	Tarragona	653	74.0	**1.54**	1.21	1.95	20	4.1
Estonia	Estonia	560	56.1	**0.53**	0.42	0.66	10	3.2
Slovenia	Slovenia	940	69.6	**1**			46	7.0
Slovakia	Slovakia	581	63.2	**0.70**	0.56	0.87	19	5.2
Poland	Cracow	512	59.2	**0.60**	0.48	0.75	6	2.0
	Kielce	274	43.8	**0.33**	0.25	0.44	8	6.7

*66 cases with resection information missing. **Within 30 days of surgery with curative intent.

percentages, and the oldest patients had extremely low probability of receiving such treatment. In five registries (Côte-d'Or, Genoa, Navarra, Tarragona and Slovakia) stage III cases were significantly more likely to receive adjuvant chemotherapy than Slovenia (reference) and only Cracow stage III cases were significantly less likely to receive adjuvant chemotherapy than reference (OR 0.3, 95% CI 0.1–0.8).

Radiotherapy (neoadjuvant or adjuvant) in rectal cancer

Table V shows the proportions of stage I–III rectal cancers treated with curative intent that received neoadjuvant/adjuvant radiotherapy by age, sex and cancer registry. Overall, only 12% received radiotherapy. The variation by CR was more conspicuous than the variation in colon cancer cases receiving adjuvant chemotherapy: from 0% in Granada and Kielce to 51% in Navarra and Côte-d'Or. The multivariable analysis showed that rectal cancer patients in Navarra, Côte-d'Or, Estonia and Tampere had significantly greater risk of receiving radiotherapy than those in Slovenia (reference), and that those of 75 years or over were very much less likely to receive radiotherapy treated than reference (<65 years). Sex has no influence on the probability of receiving radiotherapy.

Discussion

The main findings of this study are that management practices for CRC vary strikingly across European countries and also with patient age.

On the positive side, a relatively high proportion (over 70%) of cases received radical surgical resection – the only treatment that offers a chance of curing the disease. Nevertheless, for the Eastern European countries of Poland, Slovakia and Estonia, the percentages were considerably lower (Table II). However, this proportion decreased to 63% in patients aged 75 years or more. Such figures had already been reported in other population-based studies [11,12]. There are several possible reasons why older patients were treated less often with potential curative surgery, including late diagnosis, poor performance status, comorbidity, or because clinicians tend not to apply 'overly aggressive' treatments to the elderly. Post-operative mortality remains relatively high, 5% on average. Similar figures have been reported [13]. However, lower post-operative mortality rate (2.4%) have been reported in Sweden where surgery was centralised, standardised and quality assured [14].

As regards late diagnosis, we found that between 25% and 37% of CRCs were diagnosed in advanced stage, with high percentages in Eastern European countries and Spain. For Eastern Europe the high percentage with advanced stage may partly explain

Table III. Proportions of colorectal cancer cases resected with curative intent by age, sex, site and cancer registry, in relation to number of lymph nodes examined (0, 1–11 and ≥12) and proportions of advanced cases.

		No. of lymph nodes examined*				Advanced disease**	
		0	1–11	≥12	NA	N	%
	All	**2.3**	**48.7**	**28.8**	**20.2**	**2 081**	**30.2**
Age (years)	<65	2.1	46.4	32.1	19.3	579	26.4
	65–74	1.9	48.4	28.0	21.7	672	28.4
	≥75	3.0	51.9	25.7	19.4	830	35.9
Sex	Males	2.2	49.1	28.2	20.5	1 119	30.6
	Females	2.4	48.4	29.4	19.9	962	30.0
Site	Colon	2.2	47.4	31.0	19.4	1 249	30.7
	Rectum	2.4	51.1	24.9	21.6	832	29.7
Country	**Registry**						
Finland	Tampere	8.7	50.6	5.5	35.3	134	25.6
France	Côte-d'Or	6.9	64.5	28.7	0.0	141	25.1
Italy	Genoa	0.5	46.0	35.9	17.7	151	25.3
	Varese	2.4	52.7	40.7	4.2	133	26.4
Spain	Granada	1.2	55.4	30.7	12.7	190	32.8
	Navarra	0.0	48.5	32.2	19.3	172	29.3
	Tarragona	0.0	39.1	53.8	7.0	206	31.5
Estonia	Estonia	0.0	48.5	1.6	49.8	186	33.2
Slovenia	Slovenia	2.9	38.0	51.9	7.2	286	30.4
Slovakia	Slovakia	2.0	43.6	0.3	54.1	196	33.7
Poland	Cracow	2.0	69.2	8.3	20.5	185	36.1
	Kielce	0.0	20.8	1.7	77.5	101	36.9

*Based on 4538 cases; cases treated for polypectomy and by transanal excision excluded.
**Advanced disease defined as metastatic cases or unresected cases with stage not available; based on 6871 cases.
NA = information not available.

why curative surgery was performed less often. Earlier diagnosis by testing for occult faecal blood has been shown to be effective at identifying early CRC and may be a potential important way of reducing CRC mortality [15]. We suggest that this relatively inexpensive measure should be adopted particularly in Eastern Europe.

It has been shown that the number operations performed by a hospital predicts both short- and long-term survival following surgery for CRC [16,17], indicating that CRC surgery should always be performed in specialist centres. We found that peri-operative mortality was 5% overall but 7% or more in Slovenia, Genoa and Granada where perhaps too many patients were being treated in non-specialist hospitals with low volumes of CRC operations.

Trials published in 1989 [18] and 1990 [19] showed that adjuvant chemotherapy for stage III colon cancer was effective. In one study the death rate over a median follow-up of three years was reduced by a remarkable 33% [19]. It is striking therefore that, during the period of the present study (cases diagnosed 1996–1999), only in four of the 12 CRs was chemotherapy given to more than 50% of stage III colon cancer cases. This finding is also in stark contrast with the situation in the US, where, following the publication of these studies [18,19], use of adjuvant chemotherapy increased markedly [20,21]. However, it must be underlined that the results of the two US trials were reluctantly accepted in Northern European countries. It was felt that more evidence were needed and confirmatory randomised studies were set-up [22–24].

By contrast, 22% of stage II colon cancer patients received adjuvant chemotherapy despite its uncertain benefit [19]. The inter-CR variation was also marked (5–61%): in Slovakia, Navarra and Granada adjuvant chemotherapy was administered to over 30% of stage II cases, while in Côte-d'Or, Tarragona, Estonia and Slovenia, adjuvant chemotherapy seems to have been given more appropriately – to around 50% of stage III cases and in less than 15% of stage II cases.

Another disturbing finding of the present study is that low proportions of patients aged 75 and over received adjuvant chemotherapy: only 16% of stage III cases compared to 40–50% in the US [25]. Elderly patients are generally considered more prone to the side effects of chemotherapy than younger patients [26] which might severely worsen quality of life. It is probably for this reason that chemotherapy was rarely given. However, it has been shown that elderly colon cancer patients, as far as 5 FU and folic acid is concerned, benefited from chemotherapy just as much

Table IV. Proportions stage II and III colon cancer cases, treated with surgery of curative intent, that received adjuvant chemotherapy by age, sex and cancer registry, with odds ratios (OR) of stage III cases receiving adjuvant chemotherapy (yes vs. no) in relation to age, sex and cancer registry.

		Stage II cases N	Adjuvant chemotherapyin stage II* %	Stage III cases N	Adjuvant chemotherapyin stage III* %	Multivariable analysis ofadjuvant treatment in stage III		
						OR	95% CI	
	Totals	**1 163**	**21.8**	**719**	**46.2**			
Age (years)	<65	349	37.8	240	69.2	**1**		
	65–74	403	24.6	261	50.2	**0.36**	0.24	0.55
	≥75	411	5.4	218	16.1	**0.05**	0.03	0.09
Sex	Men	575	24.4	339	45.7	**1**		
	Women	588	19.2	380	46.6	**1.10**	0.77	1.59
Country	**Registry**							
Finland	Tampere	109	7.3	45	42.2	**1.70**	0.76	3.78
France	Côte-d'Or	168	12.5	62	51.6	**2.89**	1.40	5.93
Italy	Genoa	117	29.1	92	39.1	**3.46**	1.62	7.38
	Varese	102	25.5	61	42.6	**1.27**	0.62	2.58
Spain	Granada	105	36.2	61	50.8	**1.67**	0.82	3.41
	Navarra	109	32.1	63	50.8	**3.68**	1.70	7.96
	Tarragona	121	14.1	104	49.0	**2.18**	1.17	4.08
Estonia	Estonia	76	5.3	37	46.0	**1.18**	0.51	2.76
Slovenia	Slovenia	130	8.5	115	45.2	**1**		
Slovakia	Slovakia	71	60.6	33	72.7	**5.16**	1.93	13.8
Poland	Cracow	40	37.5	33	24.2	**0.32**	0.13	0.80
	Kielce	15	6.7	13	30.8	**0.59**	0.15	2.31

*48 and 63 cases with unknown information regarding adjuvant chemotherapy in stage III and II respectively.

as younger patients without significant additional side effects [27,28]. It is likely that large proportion of patients over 75 who were healthy enough to undergo surgery with curative intent, would have benefited from adjuvant chemotherapy.

Good evidence that neoadjuvant or adjuvant radiotherapy reduces local recurrence in rectal cancer has been available [29]. Nevertheless, a low proportion of the rectal cancer patients resected with curative intent in this study received radiotherapy: less than 5% in eight of the 12 CR areas studies. It is now known that preoperative radiotherapy is more effective than postoperative radiotherapy since the early 1990s [30]. However, we were unable to distinguish between pre and post operative radiotherapy because this information was not systematically available. Our results indicate that radiotherapy has not yet reached its full development in elderly patients. Similar data were reported in a population-based study [31].

According to the World Congress of Gastroenterology [32], a minimum of 12 lymph nodes should be examined to accurately stage CRC. We found that 12 or more lymph nodes were examined in only 29% of cases overall while for a further 20% of cases this information was not available. Similar disappointing results were reported in two recent studies from Sweden [12,33]. Since adjuvant chemotherapy is recommended in stage III colon cancer as it markedly reduces recurrence, it is essential that sufficient numbers of lymph nodes are examined to accurately determine stage and hence guide appropriate treatment.

A strength of this study is that it is population-based, analysing all CRC cases archived by 12 population-based CRs of over a given period. Untreated cancers and those not verified histologically were included. The study therefore avoided the referral biases that often occur in hospital-based series. A limitation of the study is clinical data were often missing. For example stage at diagnosis was missing in about 4.5% of cases overall, and in over 9% of cases in several CRs. Similarly the number of lymph nodes examined was not recorded in 20% of cases overall in over 35% of cases in several CRs. The use of prospective population-based cohort studies, such as the Swedish rectal cancer registry [14] allows a more complete coverage of all newly diagnosed cases. However, they need special funding which is rarely available on a routine basis to cancer registries. This is why punctual retrospective studies although of lower quality were performed within the EUROCARE study.

Conclusions

Although a large proportion of the CRC patients investigated in this study received surgical resection

Table V. Proportions of stage I–III rectal cancer cases, treated with surgery of curative intent, that received adjuvant radiotherapy, by age, sex and cancer registry, with odds ratios (OR) of stage I–III rectal cancer cases receiving adjuvant radiotherapy (yes vs. no) by age, sex and cancer registry.

		Stage I–III*	Adjuvant radiotherapy**	Multivariable analysis for radiotherapy		
		N	%	OR	95% CI	
	Total	**1 134**	**11.7**			
Age (years)	<65	465	**11.2**	**1**		
	65–74	409	**13.9**	**1.29**	**0.79**	**2.09**
	≥75	260	**9.2**	**0.41**	**0.22**	**0.75**
Sex	Men	666	**13.1**	**1**		
	Women	468	**9.8**	**0.88**	**0.56**	**1.39**
Country	**Registry**					
Finland	Tampere	101	**15.8**	**4.20**	**1.82**	**9.68**
France	Côte-d'Or	47	**51.1**	**28.74**	**11.83**	**69.83**
Italy	Genoa	74	**1.4**	**0.37**	**0.05**	**2.92**
	Varese	72	**2.8**	**0.69**	**0.15**	**3.25**
Spain	Granada	62	**0**	**NA**	**NA**	**NA**
	Navarra	106	**50.9**	**26.4**	**12.32**	**56.62**
	Tarragona	110	**1.8**	**0.41**	**0.09**	**1.93**
Estonia	Estonia	90	**21.1**	**5.55**	**2.45**	**12.56**
Slovenia	Slovenia	216	**4.6**	**1**		
Slovakia	Slovakia	79	**1.3**	**0.26**	**0.03**	**2.10**
Poland	Cracow	123	**3.3**	**0.68**	**0.21**	**2.23**
	Kielce	54	**0**	**NA**	**NA**	**NA**

*Excluding cancers of rectosigmoid junction (ICD9 154.0), and cases treated by polypectomy or transanal excision.
**31 stage I–III cases with unknown information on adjuvant chemotherapy.
NA=not applicable.

with curative intent, adherence to other aspects of treatment (validated by clinical trials and published before the study period) was less than satisfactory in many of the CR areas studied. Our most worrying findings were the unacceptably low use of adjuvant chemotherapy for stage III colon cancer and of radiotherapy (preferably preoperative) in rectal cancer, which may be explained in Finland by the need of more evidence. Furthermore, among elderly patients fit enough to receive curative intent surgery, appropriate adjuvant treatments were given even more rarely.

These results should sound as a warning to health authorities and to oncologists: today consensus guidelines for CRC management are available and should be followed, for instance the ESMO Minimal Guidelines [34] which are updated every year. It has emerged since the turn of the millennium, that CRC outcomes can be improved by treating patients in specialist centres, where management is in the hands of multidisciplinary teams and where surgeons perform relatively large numbers of operations. Efforts should be made therefore to centralise the treatment. Finally the dissemination of consensus guidelines can improve the use of scientifically proven treatments for this disease, but this should be monitored by further population-based studies.

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