

# Patterns of Colorectal Cancer Care in Europe, Australia, and New Zealand

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Colorectal cancer is the second most common cancer in women and the third most common in men worldwide. In this study, we used MEDLINE to conduct a systematic review of existing literature published in English between 2000 and 2010 on patterns of colorectal cancer care. Specifically, this review examined 66 studies conducted in Europe, Australia, and New Zealand to assess patterns of initial care, post-diagnostic surveillance, and end-of-life care for colorectal cancer. The majority of studies in this review reported rates of initial care, and limited research examined either post-diagnostic surveillance or end-of-life care for colorectal cancer. Older colorectal cancer patients and individuals with comorbidities generally received less surgery, chemotherapy, or radiotherapy. Patients with lower socioeconomic status were less likely to receive treatment, and variations in patterns of care were observed by patient demographic and clinical characteristics, geographical location, and hospital setting. However, there was wide variability in data collection and measures, health-care systems, patient populations, and population representativeness, making direct comparisons challenging. Future research and policy efforts should emphasize increased comparability of data systems, promote data standardization, and encourage collaboration between and within European cancer registries and administrative databases.

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In 2008, an estimated 2.1 million individuals were diagnosed with colorectal cancer worldwide, with nearly 60% residing in developed regions (1,2). Globally, colorectal cancer is the second most common cancer in women and third in men (1,2). Although rates vary significantly by regions of the world, Australia/New Zealand and Western Europe have among the highest estimated incidence rates of colorectal cancer (1,2). For both genders, Central and Eastern Europe have the highest mortality rates because of colorectal cancer worldwide (1,2). Given that the likelihood of developing colorectal cancer increases with older age, global prevalence is rising over time because of growing proportions of elderly (1,2). Better methods of screening and early detection and advances in treatment are also improving survival, further contributing to increasing prevalence (1,2). Undoubtedly, these increases have significant implications for health-care costs, delivery, and service utilization associated with this disease.

Given high rates of mortality and incidence for colorectal cancer in certain parts of Europe, this region of the world is an important area of international focus. Available comparative research on cancer in European countries has primarily come from studies conducted by EURO-CARE, a research collaboration between several European population-based cancer registries that began in 1990 (3). EURO-CARE was designed to develop standardized measures for improved comparability of cancer data between European countries and explore trends in patterns of cancer treatment and survival (3). Findings from these studies have demonstrated considerable variation in age-adjusted 5-year survival by country and region, with the highest colorectal cancer survival rates in northern European countries and the lowest in Eastern European countries (4–9).

A study comparing colorectal cancer survival in Europe to the United States during the period of 1985–1989 found that 5-year survival ranged from 13% to 22% higher in the United States depending upon tumor subsite (10). Verdecchia et al. compared data from 47 European registries to data from Surveillance, Epidemiology, and End Results (SEER) and noted higher mean survival in the United States compared with Europe for multiple cancers, including colorectal cancer, for patients diagnosed in 1995–1999 and followed up to December 2003 (7). Although limited, existing studies have suggested that differences in stage at diagnosis, postoperative mortality, and access to care may be factors that partially explain variations in outcomes between European nations (11–13).

With the larger goal of improving delivery of population-based care for colorectal cancer, assessment of current practices is a necessary first step. Therefore, we conducted this systematic review of published studies to evaluate patterns of initial care following diagnosis, post-diagnostic surveillance, and end-of-life care for colorectal cancer in Europe, Australia, and New Zealand. Examination of this literature will provide a deeper understanding of care patterns and trends over time and may identify disparities in treatment. Assessment of data comparability between nations can also inform data collection and in combination with patient outcomes and cost data, assist resource allocation, health-care delivery, and research and policy efforts targeting colorectal cancer treatment.

## Methods

### Study Selection and Criteria

The MEDLINE database was used to identify articles on colorectal cancer care published in English between January 2000 and

December 2010. The Medical Subject Heading (MeSH) term “Colorectal Neoplasms” was combined with additional headings or text strings related to patterns of care, such as “physician’s practice patterns,” “guideline adherence,” “chemotherapy,” and “radiotherapy” (see Appendix). In total, this search strategy yielded 717 articles.

Articles were hierarchically excluded according to the following criteria: 1) article was an editorial, letter, essay, commentary, conference paper, note, published guideline, highlight, or review; 2) study was based on biological specimens, nonhuman population, simulation model, or hypothetical cohort; 3) study did not report receipt of initial, post-diagnostic surveillance, or end-of-life colorectal cancer care; 4) study reported results from a clinical study or controlled trial evaluating a specific treatment; 5) study included only outcome measures, such as survival; 6) study had sample size of less than 200 cancer patients; and 7) study did not report data for colorectal cancer care separately from other cancer sites.

### Data Abstraction

After applying the exclusion criteria to the 717 identified articles, a total of 105 studies were retained and abstracted by four individuals. Additionally, because electronic searches may not include all relevant studies, we reviewed the reference lists of these 105 articles and published reviews of colorectal cancer treatment (14–25) to identify additional studies for possible inclusion. Through this process, the study team identified 34 additional articles that were also included and abstracted. In total 139 studies were abstracted and a subset of 66 articles reporting patterns of colorectal cancer care in countries outside of North America were included in this systematic review (25–90).

The countries represented in this review include Australia, France, Germany, Italy, Spain, the Netherlands, New Zealand, Norway, Sweden, and the United Kingdom. Additionally, one study included in the review compared data from cancer registries in multiple European countries: Genoa and Varese, Italy; Côte-d’Or, France; Granada, Navarra, and Tarragona, Spain; Tampere, Finland; Estonia; Slovenia; Slovakia; and Krakow and Kielce, Poland. The remaining 73 articles were included in the companion review conducted by Butler et al., which examines patterns of colorectal cancer care in the United States and Canada (91).

A standardized abstraction form was used to record information on study characteristics and principal findings, including initial care and treatment (eg, surgery, radiotherapy [RT], chemotherapy), post-diagnostic surveillance, and end-of-life care. We also abstracted several study characteristics, including reporting of stage, year of diagnosis or treatment, sample size, patient age, health delivery setting, and data sources. In order to ensure comparability between reviewers, three quality control reviews were conducted and compared for uniformity in abstraction procedures. After each quality control review, adjustments were made to increase consistency in data abstraction. By the last quality review, it was determined that comparability among the four reviewers had been achieved, and studies that were abstracted prior to this point were revisited for secondary abstraction.

### Data Analyses

Data are presented for initial care following colorectal cancer diagnosis, post-diagnostic surveillance, and end-of-life care. We

abstracted “chemoradiation” or “any adjuvant therapy” as reported in the underlying studies and classified treatment as “multicomponent care” when one particular form of treatment could not be separately abstracted from other treatment types.

Several studies reported multiple types of care, such as rates of surgery as well as chemotherapy. These studies were reported in both tables on surgery and chemotherapy. As a result, some studies may appear in the data tables more than once. Tables presenting studies with findings on receipt of initial care are organized by cancer site and then by year of publication, beginning with the most recent year of publication. Given the limited number of studies focusing on either post-diagnostic surveillance ( $n = 7$ ) or end-of-life care ( $n = 1$ ), findings from these studies are described in the text only.

## Results

### Study Characteristics

Out of the total 66 papers included in the review, the vast majority focused on initial treatment for colorectal cancer (Table 1). Limited research examined either post-diagnostic surveillance or end-of-life care. With respect to distribution by country, the majority of studies were conducted in France (22.7%), the Netherlands (18.2%), the United Kingdom (16.7%), and Australia (12.1%) (Figure 1). Categories for components of care were not mutually exclusive. Nearly three-quarters of studies reported rates of surgery (69.7%), whereas approximately half of studies reported rates of radiation treatment (48.5%) and chemotherapy (51.5%).

As shown in Table 2, the data sources for measuring patterns of care varied significantly in terms of population coverage (eg, single institution vs national) and availability of information about cancer diagnosis, stage at diagnosis, and health services reported. Studies from certain countries, such as France and the Netherlands, relied more heavily on registry data, with several studies using the French network of cancer registries (FRANCIM) or the Eindhoven registry as the data source. By contrast, studies conducted in countries such as Italy, New Zealand, and the United Kingdom relied more heavily on hospital data sources that were comprised of either single or multiple institutions. Studies from other countries had mixed data sources that ranged from national health insurance commissions for pharmaceuticals to single institutions to registries in a particular geographic region or area.

### Initial Treatment

**Surgery.** Forty-six articles included in the review reported rates of surgical treatment and spanned several countries (Table 3), including France (19.6%), the United Kingdom (19.6%), Australia (15.2%), and the Netherlands (15.2%). Among studies that were not exclusively limited to patients undergoing surgery, rates of resection varied from 54% to 85% (36,57) depending upon cancer site, stage, patient age, disease stage, and study time period. One study was conducted as a European collaboration comparing rates of resection with curative intent across eight European countries (28) and found significant variation of resection rates by country, ranging from 44% in Kielce (Poland) to 86% in Genoa (Italy).

**Table 1.** Characteristics of colorectal cancer care studies from Europe, Australia, and New Zealand (n = 66)

Characteristics	No. of studies	Percentage of studies
Study publication year		
2000–2003	16	24.2
2004–2007	35	53.0
2008–2010	15	22.7
Tumor site reported (not mutually exclusive)*		
Colon	29	43.9
Rectum	45	68.2
Colorectal (combined)	11	16.7
Type of care measured		
Initial treatment only	58	87.9
Initial treatment + post-diagnostic surveillance	5	7.6
Post-diagnostic surveillance only	2	3.0
End of life	1	1.5
Component(s) of care reported (not mutually exclusive)*		
Initial care		
Surgery	46	69.7
Radiation	32	48.5
Chemotherapy	34	51.5
Multicomponent	11	16.7
Post-diagnostic surveillance	7	10.6
End-of-life care	1	1.5
Cancer patient identification/data source		
Registry	20	30.3
Medical records/hospital data	21	31.8
Registry + medical records/hospital data	9	13.6
Registry + physician survey	8	12.1
Other	5	7.6
Not reported	3	4.5
Study design		
Retrospective cohort	54	81.8
Prospective cohort	10	15.2
Cross-sectional	2	3.0
Lower-bound year of diagnosis		
Prior to 1990	11	16.7
1990–1999	28	42.4
2000 and later	8	12.1
Not reported	19	28.8
Age distribution		
Mean/median age <65	9	13.6
Mean/median age >65+	49	74.2
Not reported	8	12.1
Number of cancer patients		
<500	16	24.2
500–999	15	22.7
1000–4999	20	30.3
5000–9999	5	7.6
10 000+	10	15.2

\* Exceeds 100% because some studies counted in more than one category; percentages for components of care and cancer site were derived by dividing reported number of studies by total number of studies (n = 66); several articles examined both colon and rectal cancers separately; therefore, these studies were counted twice when reporting site of cancer.

Most studies reported trends in rates of surgery over time and described variation in rates by patient characteristics (ie, age, gender, socioeconomic status, disease severity, comorbidities), hospital setting or volume, and geographical location. Several studies reported increasing or stable rates of surgery for both colon and rectal cancers over time (27,30,32,36,66,68,79). However, three studies contrasted decreasing trends for abdominoperineal resection (APR) with increasing trends sphincter-sparing surgery (27,83,86). Additionally, a small number of studies compared trends over time to the implementation of guidelines or national consensus statements (32,46,49,52,66,74).

With respect to patient characteristics, several studies found that younger patients were more likely to receive resections (28,30,37,45,55,66,72,78,79). However, other studies indicated mixed findings for rates of surgical treatment by patient age depending upon type of surgery, time period, and disease severity (26,31,79). Studies also reported mixed findings regarding the association of female gender with the likelihood of receiving surgical treatment (31,38,55,84). Although many studies did not report information on patient socioeconomic status, two UK studies found that patients with lower socioeconomic status were less likely to receive surgical treatment (31,38). Additionally, several studies noted that patients

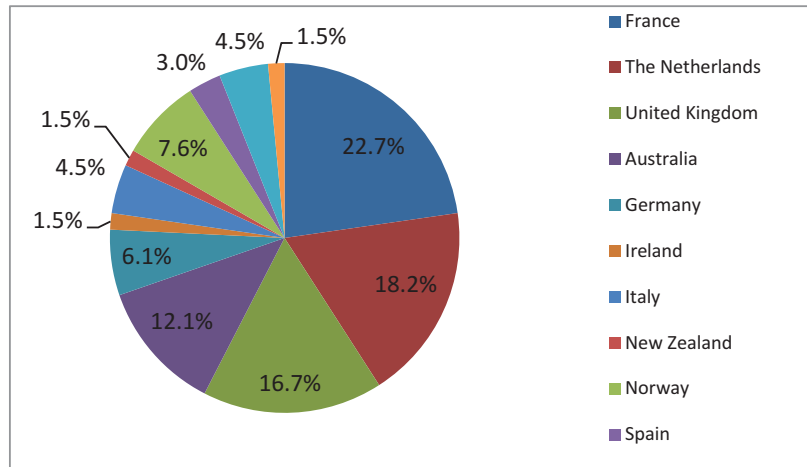


Figure 1. Percentage of studies by country.

with metastatic tumors and comorbidities were often less likely to receive surgical treatment for colorectal cancer (45,55,66,79).

Variation in rates of surgical treatment was also observed by hospital setting and patient volume for several studies. Presentation to the emergency room was associated with a lower likelihood of receiving resections (31,38,45,84). Hospital type, such as private vs public hospital, was associated with variations in surgical treatment patterns (55,59,76). Additionally, higher hospital volume was associated with lower rates of APR in two studies (42,85). A number of studies also highlighted regional variation in rates of surgery for both colon and rectal cancers (57,63,69,79). Although the majority of studies did not report urban/rural residence, two studies found that individuals living in urban areas were more likely to receive surgery (57,79).

**Radiation treatment.** The majority of the 32 total studies reporting on patterns of RT were conducted in the Netherlands (25.0%), France (21.9%), Australia (12.5%), Norway (9.4%), and the United Kingdom (9.4%) (Table 4). Rates of overall RT use varied widely, ranging from 1% to 75% in studies reviewed, depending upon patient age, stage of disease, and study time period (57,81). Studies typically reported increasing or stable rates of RT over time; for instance, one study conducted in the Netherlands found a 16% increase over the study period, with 47% receiving RT in 1998–2002 and 63% receiving RT in 2003–2006 (34). Several studies noted the declining rates of postoperative RT balanced by increasing rates of preoperative RT as a general trend over time (27,30,34,43,57,68,73,83,88). This trend was seen for patients of all age groups, although multiple studies indicated that older patients were less likely to receive either pre- or postoperative RT overall (26,28,30,34,48,78,88).

Some studies indicated that later stage of diagnosis and tumor status were significant predictors of RT use, with sicker patients being more likely to have RT administered (26,48,60,78,88). Two studies found that female patients were less likely to receive preoperative RT (26,35). Variation in RT use by hospital setting, hospital volume, and surgery type was also reported by several studies (26,34,48,51,72,88). Lastly, some studies reported regional variation in RT rates (26,28).

**Chemotherapy.** Thirty-four studies reported patterns of chemotherapy use for colorectal cancer, and these were most commonly conducted in France (35.3%), Australia (17.6%), the Netherlands (17.6%), and the United Kingdom (8.8%) (Table 5). Overall, chemotherapy use varied substantially between studies, ranging from 0% to 95%, depending upon stage, patient age, and study time period (52,73). The single study making national comparisons between European countries found wide variation by cancer registry, ranging from 24% in Krakow to 73% in Slovakia (28).

Many studies noted increasing trends of chemotherapy use over time, particularly toward the later part of the 1990s (30,44,54,64,66,68,73,79,82). Several studies also indicated that younger patients were more likely to receive chemotherapy compared with older patients, though some highlighted rising rates of chemotherapy use among the elderly over time (28–30,40,46,47,60,61,66,68,69,78,79). Additionally, more advanced tumor stage greatly increased the likelihood of chemotherapy receipt (30,40,49,50,54,61,63–66,68,73,78,79).

Although studies exhibited inconsistent reporting of comorbidities, two studies found that patients with previous malignancies or chronic obstructive pulmonary disease were less likely to receive chemotherapy (60,61). Chemotherapy receipt was less likely among both women and patients with lower socioeconomic status in one study (61). Several studies also highlighted variation in chemotherapy rates by hospital setting (eg, general vs university; private vs public), hospital volume, and emergency room admissions (29,40,54,61,68,77).

**Multicomponent care.** Out of the 11 studies reporting on patterns of multicomponent care, four were conducted in the Netherlands, three in Germany, and the remaining in Australia, Italy, the United Kingdom, and Norway (Table 6). Studies exhibited variation in stage, patient age, and date of diagnosis. Sources of data varied, though data were most commonly from registries (63.6%) (26,30,37,60,65,73,81). Most studies reported on treatment that combined chemotherapy and radiation, such as chemoradiation or neoadjuvant RT combined with chemotherapy. Predominant findings included higher rates of therapy use over

**Table 2.** Characteristics of selected data sources for measuring patterns of colorectal cancer care in Europe, Australia, and New Zealand\*

Country	Data source	Type of data	Population coverage	Information about cancer patients			Health services reported		
				Date of diagnosis	Stage at diagnosis	Surgery	Chemotherapy	Radiation	
Australia	Multiple hospitals	Hospital records	Four hospitals in Western Australia; 1.8–2 million	✓	✓	✓			
	Victoria Cancer Registry	Registry	State in southeast Australia	✓		✓			
	Health Insurance Commission through PBS	Insurance claims for pharmaceuticals	National				✓		
France	Burgundy Registry of Digestive Cancers	Registry, physician survey	Region	✓	✓	✓	✓	✓	
	Calvados Registry of Gastrointestinal Tumors	Registry	Administrative district in north of France	✓	✓	✓	✓	✓	
	FRANCIM	Registry, hospital data, physician survey	10% of French population in eight administrative areas	✓		✓	✓	✓	
	Multiple hospitals	Medical records	81 hospitals			✓	✓	✓	
Germany	Multiple hospitals	Hospital databases/medical records	75 hospitals in five states: Brandenburg, Saxony, Saxony-Anhalt, Thuringia, Mecklenberg-West Pomerania	Date of surgery	✓	✓	✓	✓	
			Individuals residing in Munich region, approximately 2.3 million	Hospital admission date	✓	✓		✓	
Ireland	Munich Cancer Registry	Registry	NCR records all cancers diagnosed in Ireland and has 98% completeness of registration	✓	✓	✓	✓	✓	
	National Cancer Registry	Registry	Single hospital in Milan	✓					
Italy	University of Milan, San Raffaele Hospital	Hospital data	86 Italian oncology centers	Date of treatment	✓			✓	
	Oncology centers	Forms completed by treating oncologist	All malignancies in the Netherlands	NR			✓	✓	
The Netherlands	Netherlands Cancer Registry–National Registry of Hospital Discharges	Cancer registry, national registry of hospital discharge diagnoses, hematology departments and radiotherapy institutions	All malignancies in southern part of the Netherlands, approximately 2.4 million	✓	✓	✓	✓	✓	
	Eindhoven Cancer Registry	Cancer registry notified by pathology departments, hospital records, and radiotherapy institutes	All hospitalized patients in the Netherlands	✓	✓	✓	✓	✓	
	Dutch National Medical Registry	Hospital discharge	Single hospital in Canterbury region	Date of surgery	✓	✓	✓	✓	
New Zealand	Christchurch Hospital	Hospital patient notes		✓	✓	✓	✓	✓	

(Table continues)

**Table 2 (Continued).**

Country	Data source	Type of data	Population coverage	Information about cancer patients			Health services reported		
				Date of diagnosis	Stage at diagnosis	Surgery	Chemotherapy	Radiation	
Norway	Aker Hospital linked to registry Norwegian Rectal Cancer Project	Hospital data, registry Registry, medical records, patient administrative data	Single hospital in Oslo catchment of 180 000 Rectal cancer treated with curative intent in one of 47 hospitals	Hospital admission ✓	✓	✓	✓	✓	
Spain	Clinico Universitario of Valencia	Registry	Valencia hospital catchment of 275 000	✓	✓	✓			
Sweden	National Quality Registry for Rectal Adenocarcinoma Uppsala/Orebro registries Multiple hospitals	Registry Registry Medical records	97% of all rectal patients in Sweden since 1995 Uppsala/Orebro County of Vastmanland, five hospitals	✓	✓	✓	✓	✓	
United Kingdom	NHS HES dataset NORCCAG; Newcastle and North Tyneside, Northumberland, Gateshead, South Shields, Sunderland, Teesside, County Durham, Cumbria, and part of North Yorkshire Hospital	Hospital discharge Hospital data Hospital data	All NHS hospitals All hospitals in northern region of England, population 3.1 million	Date of surgery Date of surgery	✓	✓	✓	✓	
European collaboration	Scottish registry linked to hospital data Cancer registries from the following regions: Genoa and Varese (Italy); Côte-d'Or (France); Granada, Navarra, and Tarragona (Spain); Tampere (Finland); Estonia; Slovenia; Slovakia; and Krakow and Kielce (Poland)	Registry, hospital inpatient and day case form data Registry data	Single hospital, Leeds, England All hospitals in Scotland Each cancer registry provides detailed information on diagnostic and treatment procedures, obtained from clinical records	Date of surgery ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	

\* FRANCIM = French network of cancer registries; NCR = National Cancer Registry; NHS HES = National Health Service Hospital Episode Statistics; NORCCAG = Northern Region Colorectal Cancer Audit Group; NR = not reported; PBS = Pharmaceutical Benefits Scheme.



**Table 3.** Patterns of care for the initial surgical treatment of colorectal cancer (CRC) in Europe, Australia, and New Zealand by cancer site, publication year, and country (n = 46)\*

	<b>First author, y (ref.)</b>	<b>Country</b>	<b>Stage</b>	<b>Year of diagnosis</b>	<b>N</b>	<b>Age (y)</b>	<b>Health delivery setting and data sources</b>	<b>Findings related to initial surgical treatment</b>
Colon	Lepage, 2006 (49)	France	All stages	2000	567	Mean at diagnosis 70	Burgundy Registry of Digestive Cancers	74.4% curative resection, 15% palliative resection; 3.9% exploratory laparotomy or bypass
	Morris, 2007 (44)	Australia	Stage II	1993–2003	812	Mean 64.9	Four hospitals in Western Australia covering 1.8–2 mil- lion people; pathology reports	82% of the sample received surgery alone
	Silvera, 2006 (50)	France	All stages	Hospitalized or surgery 2001–2002	1842	18+, mean 68.7	French health insurance database; patients in Paris metropolitan area; surveys of medical advisers	96.6% had surgery; 89.7% lapa- rotomy; LAP used for 5.9% of operated patients, with conversion to laparotomy for 34%
	Phelip, 2005 (63)	France	All stages	1995	1605	75+	FRANCIM and survey given to specialists	Primary tumor resection in 89.6%, ranging from 87.9% to 92.9% by region
	Faivre-Finn, 2002 (79)	France	All stages	1976–1998	3389	NR	Côte d' Or, Burgundy registry; hospital data, physician surveys among specialists and GPs	85.2% had resection, rising from 69.3% (1976–1979) to 91.9% (1988–1991) then stable; rates increased among elderly over time (56.4% vs 90.5%); curative resec- tions rose from 56.6% to 81.0%; in multivariate results, younger age, urban residence, non-MET tumor status, and later diagnosis associated with resection
Rectum	Eiferink, 2010 (26)	The Netherlands	Non-MET 77.8%; MET 17.4%; NR 4.8%	2001–2006	16 039	<60: 26.2%; 60–74: 43.4%; 75+: 30.3%	Netherlands Cancer Registry	Patients <75 y and diagnosed with T1–M0 tumors who underwent POL or TEM was 34% vs 43% in 75+; more patients <75 y with an M1 tumor had surgical resection of primary tumor vs 75+ (44% vs 31%)
	Eiferink, 2010 (30)	The Netherlands	All stages	1989–2006	40 888	≤44: 4%; 45–59: 22%; 60–74: 43%; ≥75: 32%	Netherlands Cancer Registry	Among patients <75 y with stages I–III, resections remained stable from 1989 to 2006, but decreased in elderly from 91% (1989–1993) to 81% (2004–2006); among stage IV patients, younger patients had metastectomy more frequently
	Khani, 2010 (27)	Sweden	All stages	Surgery 1993–1996; 1996–1999	277	Period 1 median 70; period 2 median 69	County of Vastmanland; four district hospitals' (period 1) or central county hospital's (period 2) medical records	In period 1, 38% of patients had AR, 8% LAR, 38% APR, and 16% other surgical procedures; in period 2, 3% had AR, 55% LAR, 18% APR, and 24% other procedures
	Marwan, 2010 (25)	Australia	All stages	2005	582	<59: 32.3%; 60–69: 27.3%; 70+:	Victorian Cancer Registry	23.4% had APR; 53.2% AR; 1.2% total proctocolectomy; 0.2% TEM; and 23% ULAR

(Table continues)

**Table 3 (Continued).**

First author, Y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to initial surgical treatment
Raine, 2010 (31)	United Kingdom	NR	Admitted 1998–2006	29 214	≥50	Inpatient treatment HES dataset	71.9% of patients with surgery had AR; in adjusted analyses, AR more common in women, elderly, higher SES, ER admissions, and in more recent years LAR in 69% and APR in 31%
Ferenschild, 2009 (33)	The Netherlands	All stages	1996–2003	210	Mean 69	Medical charts, including hospital notes, radiotherapy plans, and pathology reports	
Martling, 2009 (35)	Sweden	All stages	1995–2002	11 774	Median women 73; men 71	National Quality Registry included patient data, adjuvant treatment, surgery	86.4% had surgical resection; 52.7% AR; 26.9% APR; 10.3% HP; 10.1% other procedures
Sigurdsson, 2009 (37)	Norway	NR	1997–2002	297	Median 77; range 67–84	Norwegian Colorectal Cancer Registry	64% had noncurative surgery, younger patients more likely; in resected patients, 48% major resections, 48% stomas, and 4% local procedures or surgical explorations
Tilney, 2008 (38)	United Kingdom	NR	Admitted 1996–2004	52 643	NR	England; inpatient treatment in HES dataset	24.9% had APR, which decreased from 29.4% to 21.2% over time; in adjusted analyses, APR less likely among older age, female, higher SES, and ER presentation patients
Ptok, 2007 (42)	Germany	Stages I–III	Entered study 2000–2001	1557	Median 66; range 26–92	Multisite observational study, data collected from patients, hospital data	APR rate significantly associated with hospital volume
Phelip, 2004 (66)	France	All stages	1990 and 1995	945	Stratified as <75 and >75	FRANCIM; survey given to specialists and GPs	The proportion with resection increased from 84.6% in 1990 to 91.9% in 1995; patients 75+ and with VM less likely to have surgery; the proportion of TE increased over time (3.2% to 13.2%)
Phelip, 2004 (69)	France	All stages	1995	683	≥75; 38.8%	Nine FRANCIM registries; health services data from survey given to gastroenterologists, oncologists, and surgeons	88.4% had resection; age and distant metastases independently associated with resection; 14.2% of patients had resection without laparotomy, which varied across districts; 36.1% of resected patients had a stoma
Wibe, 2004 (72)	Norway	Stages I–III	Surgery 1993–1999	2136	Median 69 (range 18–94)	Norwegian Rectal Cancer Project; hospital databases/project-specific forms from the Rectal Cancer Registry	62% of patients had AR, 38% APR; younger patients had AR more often than older patients; individuals with T4 tumors more likely to receive APR

(Table continues)



Table 3 (Continued).

First author, y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to initial surgical treatment
Engel, 2003 (76)	The Netherlands	NR	Surgery 1994–1999	15 978	Peripheral mean 64.9; university 56.6	Dutch National Medical Registry	Of all rectal resections, 16% were APRs, 84% were RRs; the proportion of APRs decreased from 0.19 to 0.13; the ratio of APR to total resectional rectal surgery (APR plus RR) declined in peripheral hospitals, but not in university
Martijn, 2003 (73)	The Netherlands	All stages	1980–2000	3635	<60: 26.3%; 60–74: 47%; 75+: 26.7%	Eindhoven Cancer Registry	53% had surgery only; treatment with surgery alone decreased from 62% to 42% (1980–2000); surgery + radiotherapy increased (26% vs 40%)
Birbeck, 2002 (80)	United Kingdom	NR	Surgery 1986–1997	586	Median 69.6; range 27.9–96.6	Leeds, United Kingdom; hospital data, case notes from patients with full clinical follow-up	83.3% of surgeries curative resections; 16.7% palliative
Farmer, 2002 (81)	Australia	Dukes A-C	1994	681	NR	Victoria Cancer Registry; physician survey completed for each patient	Restorative AR most common procedure (63.3%); other procedures were APR (23.5%) and local excision (5.0%)
Nesbakken, 2002 (83)	Norway	Dukes A-C	Admitted 1983–1999	312	First period mean 72 (range 27–97); second period mean 73 (range 19–95)	Single institution: Aker Hospital in Oslo, Norway; hospital records, pathology reports, and Cancer Registry	In period 1 (1983–1992), 56.5% had curative resection; 58% LAR, 1% HP and 42% APR; in period 2 (1993–1999), 55.1% had curative resection using ME 67% LAR, 5% HP and 28% APR; in period 1, 0 patients had either total or partial ME vs 66% TME and 34% PME in period 2
García-Granero, 2001 (86)	Spain	Dukes A-C; TNM I–III	1986–1995	Total 202	Median 1: 66 (31,88); median 2: 67 (31,85)	Hospital Clínico Universitario of Valencia Health services data from registry (ie, clinical, operative, pathological, and follow-up data)	Period 1 TE was 1.06 vs 2.7 in period 2; radical resectability 67.7 vs 82.4; APR/overall 25.8 vs 16.7; APR/LAR 54.2 vs 30.5
Marusch, 2001 (85)	Germany	NR	Presented and admitted 1999	1463	NR	Hospital databases/medical records; patients in states of Brackenburg, Saxony, Saxony-Anhalt, Thuringia, and Mecklenberg-West Pomerania	75 hospitals categorized into three annual rectal surgery volume groups: <20 patients/y (n = 44); 20–40 (n = 22); >40 (n = 9); hospitals treating >40 patients/y have lower APR rate vs lower volume hospitals

(Table continues)

**Table 3 (Continued).**

First author, y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to initial surgical treatment
Gatta, 2010 (28)	European collaborative study	NR	1996–1998	6871	≥75: 3.6%; <75: 66.4%	European cancer registries	71% treated with curative intent, ranging from 44% in Kielce to 86% in Genoa; proportion treated decreased with advancing age at diagnosis from 76% in patients under 65 y, 73% in 65 to 74, and 63% in patients of 75 and over ( $P < .001$ )
CRC Green, 2009 (32)	United Kingdom	NR	Hospitalizations 1997–2007	182 191	NR	England; inpatient treatment in HES dataset	LAP procedures increased from <1% of all surgeries to approximately 8% over time; in 2000, NICE recommended against LAP surgery, but recommended it in 2006; between 2003–2004 and 2007, LAP surgery increased 2.04% annually
Kube, 2009 (36)	Germany	All stages	Resections 2000–2005	346 hospitals; 47 436 patients	NR	Hospital data; standardized questionnaire completed at hospital; follow-up survey filled out by patient's doctor or hospital	Rates of curative resection ranged from 80% to 83% for colon and were nearly 85% for rectal cancer
Carsin, 2008 (90)	Ireland	All stages	1994–2002	15 249	Patients ≥20	National Cancer Registry	78% resection; almost all stage I–III had surgery, 51% of stage IV; among stage IV patients, resection less common in older, unmarried, and male patients in multivariate results
Borowski, 2007 (45)	United Kingdom	All stages	Admitted 1998 and 2002	8219	<65: 28.8%; 65–74: 35.7%; 75–84: 29.2%; >84: 6.3%	NORCCAG; hospital data, histopathology records	93.8% had resections, including 96.0% of colon and 91.3% rectal tumors; 74.6% had curative resections; older age, comorbidity, ER surgery and rectal cancer associated with nonresection
Young, 2007 (46)	Australia	All stages	February 2000–January 2001	2984	<60: 22.4%; 60–69: 26.26%; 70–79: 33.3%; ≥80: 17.7%	New South Wales; surgeon questionnaire, cancer registry	Of LAR or ultra-LAR patients, 29.1% had a colonic pouch reconstruction
Lemmens, 2006 (52)	The Netherlands	NR	2002	308	Colon: mean 70, range 41–91; rectal: mean 64, range 33–86	Eindhoven Cancer Registry	55% had LAR; 37% AR; 5% HP; 95% of colon cancer patients had radical surgical treatment; of those with resectable tumors, 89% had curative resection; 20.6% had urgent surgery

(Table continues)

Table 3 (Continued).

First author, Y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to initial surgical treatment
Bouvier, 2005 (57)	France	All stages	1978–1997	2409	80+ at diagnosis	Calvados and Côte-d'Or registries	69% of colon, 54% of rectal cancer patients had curative resection, increasing for all sites over time; patients in urban/perurban areas more likely to have resections
Dejardin, 2005 (59)	France	Non-MET 78%; MET 18%; NR 4%	1995	1413	<65: 30%; 65–74: 35%; 75–84: 25%; >84: 10%; NR: 0.2%	Six FRANCIM registries	22.6% treated for initial surgery in reference center site (ie, university or regional comprehensive cancer centers); women less likely to be treated in reference cancer center and less likely to go reference cancer site for surgery, as travel distance increased
Hall, 2005 (55)	Australia	NR	1982–2001	14 587	<60: 26.6%, ≥60: 73.4%	Western Australia data linkage system; diagnostic codes and registry used to identify patients	85.5% had a surgical procedure; 41% of these had AR and 59% HEM; in adjusted results, surgery receipt associated with private insurance, private hospital status, younger age, female, and less comorbidity
Lemmens, 2005 (60)	The Netherlands	All stages	1995–2001	6931	50+; mean 70	Eindhoven Cancer Registry	TME performed in 20.1% of stage I–II rectal cancer patients and 28.0% of stage III; most patients with stage IV rectal cancer received palliative therapy alone
Robinson, 2005 (64)	New Zealand	All stages; Dukes	1993–1994 and 1998–1999	673	Median 71–90; 51–70	Christchurch Hospital; oncology service or hospital discharge codes, patient notes	Surgery by consultant increased from 44% to 82% over the study period
Barton, 2004 (67)	Australia	All stages	1994–1996	370	Median 68; range 22–98	Cancer registry and hospital databases; Western Sydney and Wentworth Health Areas	80.1% had surgery
Bouhier, 2004 (68)	France	All stages	1990–1999	3135	Mean 70	Calvados Registry	90.9% had resections, including 8.8% endoscopic procedures; rate stable over 10-y study period
Jestin, 2004 (70)	Sweden	All stages	1995–2000 rectal; 1997–2000 colon	3612	Mean: colon 72; rectal 71	Uppsala/Orebro region rectal and colon cancer registries	Colon: 45.2% had rightsided HEM, 10.3% had leftsided HEM, 24.7% sigmoid resection, 6.7% AR, 5.5% HP, 3.3% surgery without resection; rectal: 50.9% had LAR, 24.7% had APR, 1.2% HP, 3.3% surgery without resection

(Table continues)

**Table 3 (Continued).**

First author, y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to initial surgical treatment
McGrath, 2004 (71)	Australia	All stages	February 1–April 30, 2000	1911	Mean 68; median 70; range 16–100	All newly reported cases to any state cancer registry in Australia; physician survey	All patients had surgery, most with curative intent (81.8%); laparoscopic approach in 2.9%; AR most common procedure (35.7%); among rectal cancer patients, TME in 64.6%
Duxbury, 2003 (74)	United Kingdom	NR	Surgery 1999–2000	211	NR	Derriford Hospital, Plymouth, Devon, United Kingdom; consecutive patients undergoing surgery at single hospital	Initially, CRC surgeons more likely to have guideline-consistent practice vs non-CRC surgeon (rectal 55% vs 3%; colon 42% vs 22%); following audits, guideline consistency improved (rectal 90% vs. 0%; colon 78% vs 38%) and fewer procedures by non-CRC surgeon
McFall, 2003 (75)	United Kingdom	NR	Surgery 1990–1996	892	NR	Worthing Hospital, United Kingdom; hospital data and medical records	88% of patients Dukes stage A–C had resection
Campbell, 2002 (78)	United Kingdom	All stages	1995 and 1996	653	≤59: 121 (19%); 60–69: 159 (24%); 70–79: 216 (33%); ≥80: 157 (24%)	Scotland cancer registry; hospitals in Grampian or Highland with case notes and clinical data abstracted	91% had surgery within 1 y of diagnosis; increased stage and increasing age associated with greater likelihood of surgery
McArdle, 2002 (84)	United Kingdom	Dukes A/B	1974–1979; 1991–1994	3200	75+: 35%	Glasgow Royal Infirmary; data from medical records/audits	70% had curative resection; 30% had palliative surgery; females more likely to have curative resection; ER patients less likely to have resection; overall resection higher in later study period
Chiappa, 2001 (87)	Italy	All stages; modified Dukes	Treated 1992–1999	346	Mean 66 (range 23–92)	Single institution; Department of Emergency Surgery, University of Milan, San Raffaele Hospital	74% of patients had curative resections

\* AR = anterior resection; APR = abdominoperineal resection; ER = emergency room; FRANCIM = French network of cancer registries; GP = general practitioner; HEM = hemicolectomy; HES = hospital episode statistics; HP = Hartmann's procedure; LAR = lower anterior resection; LAP = laparoscopy; ME = mesorectal excision; MET = metastatic; NICE = National Institute for Health and Clinical Excellence; NORCCAG = Northern Region Colorectal Cancer Audit Group; NR = not reported; POL = polypectomy; RR = rectal resections; SES = socioeconomic status; TE = transanal excisions; TEM = Transanal Endoscopic Microsurgery; ULAR = ultralow anterior resection; VM = visceral metastasis.

**Table 4.** Patterns of radiation treatment for colorectal cancer (CRC) in Europe, Australia, and New Zealand by cancer site, publication year, and country (n = 32)\*

	<b>First author, Y (ref.)</b>	<b>Country</b>	<b>Stage</b>	<b>Year of diagnosis</b>	<b>N</b>	<b>Age (y)</b>	<b>Health delivery setting and data sources</b>	<b>Findings related to radiation treatment</b>
Rectum	Elferink, 2010 (26)	The Netherlands	Non-MET 77.8%;MET 17.4%; Unknown 4.8%	2001–2006	16 039	<60: 26.2%; 60–74: 43.4%; 75+: 30.3%	Netherlands Cancer Registry	In multivariate analyses, female and older patients and those with lower stage treated at teaching/university hospitals and lower-volume hospitals less likely to have preoperative RT; regional variation also observed
	Elferink, 2010 (30)	The Netherlands	All stages	1989–2006	40 888	≤44: 4%; 45–59: 22%; 60–74: 43%; ≥75: 32%	Netherlands Cancer Registry	Stages II–III patients receiving preoperative RT increased from 1% in 1989–1999 to 68% in 2004–2006 among younger patients; and from 1% to 51% among older patients; among stage II–III patients, postoperative RT decreased from 46% to 4% for younger patients and from 23% to 3% for elderly patients in period 1 received preoperative RT and 49% in period 2 observed
	Khani, 2010 (27)	Sweden	All stages	Surgery 1993–1996; 1996–1999	277	Period 1: median 70, range 30–93; period 2: median 69, range 40–91	County of Vastmanland; four district hospitals (period 1) or in central county hospital (period 2); medical records	41% of patients in period 1 received preoperative RT and 49% in period 2 observed
	Ferenschild, 2009 (33)	The Netherlands	All stages	1996–2003	210	Mean 69; range 40–91	Medical charts, including hospital, radiotherapy, and operation notes	Almost 25% of patients received preoperative RT
	Martling, 2009 (35)	Sweden	All stages	1995–2002	11 774	Median 73, range 23–99 (women); median 71, range 21–95 (men)	National Quality Registry included patient data, adjuvant treatment, surgery	46.5% received preoperative RT; women were less likely to receive than men (42.5% vs 50.1%)
	Vulto, 2009 (34)	The Netherlands	NR	1988–2006	7767	All ages; distribution; for rectal cancer patients, NR	Eindhoven Cancer Registry	RT receipt increased from 47% to 63% (1998–2002 vs 2003–2006); postoperative RT use decreased; in 2004, 50% of all patients received preoperative RT; patients >75 had lower rates of RT vs middle-aged patients; geographic variation and large interhospital variation present
	Hansen, 2007 (48)	Norway	All stages	Surgery 1993–2001	4113	<50: 3.01%; 50–64: 25.7%; 65–74: 33.4%; 75–84: 30.5%; ≥85: 0.63%	50 hospitals; six of these had RT departments	12.5% received RT (6.9% preoperative and 5.6% postoperative); RT rate with younger age and tumor level; patients who had APR or HP received RT three times more often vs those who had AR; total RT rate increased from 4.6% in 1994 to 23.0% in 2001; preoperative RT use higher for those treated in local hospital with RT department
	Vulto, 2007 (89)	The Netherlands	All stages	1996–2002	—	<70: 55.6%; 70+: 44.4%	Eindhoven Cancer Registry	46% of all newly diagnosed patients received RT; 10% received SRT at least once; multivariate analyses showed patients with stage III had SRT more often and patients in the eastern department received PRT more often

(Table continues)

**Table 4 (Continued).**

First author, Y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to radiation treatment
Ng, 2006 (51)	United Kingdom	All stages	1995–1999	207	All ages	Patients from Royal Berkshire Hospital, Reading, England; data sources NR	36.2% receiving surgery also received RT; preoperative RT more likely among patients treated by CRC surgeon
Engel, 2005 (65)	Germany	All stages	1996–1998	882	<70: 62.5%; 70+: 37.4%	Munich Cancer Registry and Munich Field Study	In both UICC II–III patients, 3.5% received RT alone
Vulto, 2006 (53)	The Netherlands	NR	1988–2002	2836	NR	Eindhoven Cancer Registry	The proportion with RT increased over time (33% to 43%)
Phillip, 2004 (69)	France	All stages	1995	683	≥75: 38.8%	Nine FRANCIIM registries; survey of specialists and GPs	Among resected patients, 46.8% had RT
Phillip, 2004 (66)	France	All stages	1990 and 1995	945	Stratified as <75 and >75	FRANCIIM; survey of specialists and GPs	42% of patients in 1990 and 47% in 1995 received adjuvant RT; palliative RT receipt more likely among <75
Wibe, 2004 (72)	Norway	Stages I–III	Surgery 1993–1999	2136	Median 69, range 18–94	Norwegian Rectal Cancer Project; hospital databases/project-specific forms from the Rectal Cancer Registry	RT given to 10%; 6% preoperatively and 4% postoperatively; RT used more often in APR vs AR group (16% vs 6%)
Martijn, 2003 (73)	The Netherlands	All stages	1980–2000	3635	<60: 26.3%; 60–74: 47%; 75+: 26.7%	Eindhoven Cancer Registry	Postoperative RT decreased from 2005 to 2010, whereas preoperative RT increased for all tumor stages and all ages; from 1980 to 1989, 25% had postoperative RT and 1% had preoperative RT; by 1995–2000, 4% had postoperative RT vs 35% preoperative RT
Birbeck, 2002 (80)	United Kingdom	NR	Surgery 1986–1997	586	Median 69.6; range 279–96.6	Leeds, United Kingdom; hospital data and case notes from patients with full clinical follow-up	4.3% received preoperative RT
Farmer, 2002 (81)	Australia	Dukes A-C	1994	681	NR	Victoria Cancer Registry; physician questionnaire for each patient	Among 153 patients with completed RT survey, 74.5% had RT as adjunct to surgical resection, and of these, 4.4% had preoperative RT vs 95.6% postoperative RT
Nesbakken, 2002 (83)	Norway	Dukes A-C	Admitted 1983–1999	312	Period 1: mean 72, range 27–97; period 2: mean 73, range 19–95	Single institution: Aker Hospital in Oslo, Norway; hospital records, pathology reports, Cancer Registry	2% received pre- or post-RT in period 1, whereas 13% received pre- or post-RT in period 2

(Table continues)



Table 4 (Continued).

First author, y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to radiation treatment
Falvre-Finn, 2000 (88)	France	Stage I–III	1976–1996	651	<65: 22.8%; 65–74: 39.4%; 75+: 37.7%	Cancer registry in Côte d'Or, Burgundy; registry provided both patient and health services data	Overall, adjuvant RT given to 37.3% of resected patients; percent of treated patients increased from 14.3% in 1976–1978 to 61.7% in 1994–1996; preoperative RT increased over time, postoperative RT following surgery increased with higher stage; in multivariate results, later period of diagnosis, younger age, surgery type, and hospital type (university vs private) associated with adjuvant RT
CRC Gatta, 2010 (28)	European Collaborative Study	NR	1996–1998	6871	≥75: 33.6%; <75: 66.4%		Only 12% of stage I–III rectal cancer patients received RT; geographical variation in RT use in multivariate results indicated that patients aged ≥75 were less likely to receive RT than <75 age group
Carsin, 2008 (90)	Ireland	All stages	1994–2002	15 249	≥20	National Cancer Registry	13% RT (4% colon; 28% rectum); increased by 10% per year; notable increase in preoperative RT after 2000; for all stages, RT decreased with increasing age; women with stage II disease less likely to get RT; tumor extent associated with RT among stage II and unknown stage patients; preoperative RT use less frequent among female patients and decreased with age
Coriat, 2007 (41)	France	All stages	1998	407	Median 72, range 26–93	Burgundy Registry of GI Cancers	43% with a rectal localization received postoperative RT
Mahboubi, 2007 (49)	France	All stages	1998	389	<65: 26.5%; 65–74: 34.2%; ≥75: 39.3%	Côte-d'Or and Saône-et-Loire registries, Burgundy; medical records, specialists and GP survey	Overall, 14.9% had RT
Young, 2007 (46)	Australia	All stages	February 2000–January 2001	2984	<60: 22.4%; 60–69: 26.3%; 70–79: 33.3%, ≥80: 17.7%	New South Wales Cancer registry; treating surgeon surveys	Of high-risk rectal cancer patients, 59.8% were offered RT
Bouvier, 2005 (57)	France	All stages	1978–1997	2409	80+ at diagnosis	Calvados and Côte-d'Or registries	1% of colon cancer cases and 17% of rectum cases received RT; RT use increased over time
Drug Utilization Review Team in Oncology, 2005 (54)	Italy	NR	Past/current diagnosis October 2000	434	≤50: 15.2%; 51–60: 25.3%; 61–70: 36.6%; >70: 21.0%	86 Italian oncology centers; forms completed by treating oncologist	Only seven patients with colon cancer received RT; 61% of rectal cancer patients received adjuvant RT

(Table continues)

Table 4 (Continued).

First author, Y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to radiation treatment
Gonzalez, 2005 (58)	Spain	All stages	1996–1998	403	Mean 65.4 (men), 63.8 (women)	Hospital Universitario de Bellvitge in Barcelona, Spain	18.8% of men and 20.7% of women had RT
Lemmens, 2005 (60)	The Netherlands	All stages	1995–2001	6931	50+; mean 70	Eindhoven Cancer Registry	Comorbidity influenced adjuvant RT in patients with rectal cancer
Barton, 2004 (67)	Australia	All stages	1994–1996	370	Median 68; range 22–98	Western Sydney and Wentworth Health Areas; cancer registry and hospital databases	6.25% had RT
Bouhier, 2004 (68)	France	All stages	1990–1999	3135	Mean 70	Calvados Registry	53.1% of stage II–III rectal cancers had; preoperative RT given to 90% of these; older patients (≥75 vs <75) less likely to receive RT
McGrath, 2004 (71)	Australia	All stages	All newly reported cases 2000	1911	Mean 68, median 70, range 16–100	All newly reported cases to any state cancer registry in Australia; physician survey	Of 61 rectal cancer surgeries with local invasion, 86.9% offered RT; 65.6% given preoperative RT; among locally advanced patients who did not have surgery, 76.3% offered RT
Campbell, 2002 (78)	United Kingdom	All stages	1995 and 1996	653	≤59: 19%; 60–69: 24%; 70–79: 33%; ≥80: 24%	Scotland cancer registry; hospitals in Grampian or Highland; case notes and clinical data abstracted	13% had RT within 1 y of diagnosis; higher stage and younger stage associated with RT receipt; RT use for colorectal cancer decreased with increasing distance from cancer center

\* AR = anterior resection; APR = abdominoperineal resection; ER = emergency room; FRANCIM = French network of cancer registries; GI = gastrointestinal; GP = general practitioner; HP = Hartmann's procedure; MET = metastatic; NR = not reported; PRT = primary radiotherapy; RT = radiotherapy; SRT = secondary radiotherapy; UICC = Union International Cancer Control.

**Table 5.** Patterns of chemotherapy treatment for colorectal cancer (CRC) in Europe, Australia, and New Zealand by cancer site, publication year, and country (n = 34)\*

	<b>First author, Y (ref.)</b>	<b>Country</b>	<b>Stage</b>	<b>Year of diagnosis</b>	<b>N</b>	<b>Age (y)</b>	<b>Health delivery setting and data sources</b>	<b>Findings related to chemotherapy treatment</b>
Colon	van Steenbergen, 2010 (29)	The Netherlands	Stage III	NR	1637	<65: 514; 65–74: 539; ≥75: 584	Eindhoven Cancer Registry	Proportion of patients receiving adjuvant chemotherapy decreased with increasing age from 85% among aged <65, 68% for 65–74 y and 17% for ≥75 y; interhospital variation was observed
	Alter, 2007 (40)	France	Stage II	Surgery, 2000	532	Mean 72	81 hospitals; data from medical records	19.5% had adjuvant chemotherapy; older patients, higher tumor stage, and having a bowel obstruction or perforation associated with adjuvant chemotherapy use; hospital procedure volume, multidisciplinary consult, and mode of hospital funding (private vs public) also associated
	Lepage, 2006 (49)	France	All stages	2000	567	Mean 70 at diagnosis	Burgundy Registry of Digestive Cancers	Adjuvant chemotherapy performed in 0.9% of stage I, 17.6% of stage II, and 54% of stage III patients; palliative chemotherapy in 48.1% of patients
	Morris, 2007 (44)	Australia	Stage II	1993–2003	812	Mean 64.9 among patients receiving surgery alone	Four major hospitals in Western Australia; pathology reports used to identify patients	18.0% received chemotherapy; 25% of patients ≤65 received chemotherapy compared with 10% of those between 66 and 75 y; patients receiving chemotherapy had tumors often positive for vascular invasion; adjuvant chemotherapy use peaked at 25–30% in late 1990s but decreased to <15% in 2002–2003
	Silvera, 2006 (50)	France	All stages	Hospitalized or had surgery 2001–2002	1842	18+; mean 68.7	Paris metropolitan area; French health insurance funds administrative database; survey of medical advisers	Chemotherapy given to 53.1%; 5.8% of patients with stage I received chemotherapy; 37.7% of stage II, 76.9% of stage III, 81.4% of stage IV
	Lemmens, 2005 (61)	The Netherlands	Stage III	1995–2001	577	All patients 65–79; 65–69: 31.4%; 70–74: 34%; and 75–79: 34.6%	Eindhoven Cancer Registry	80% of patients 65–69 y received chemotherapy vs 28% among 75–79 y; chemotherapy receipt among elderly increased from 19% to 50% over time, with large interhospital variation; in multivariate analyses, patients of older age, female gender, comorbidity, and lower SES less likely to receive chemotherapy; patients with high-grade tumors and stage IIIB received chemotherapy more often
	Phelip, 2005 (63)	France	All stages	1995	1605	75+	FRANCIIM and survey given to specialists	Among nonmetastatic patients <75 y who had complete resection, adjuvant chemotherapy was given to 6.8% of stage I, 49.4% of stage II, and 79.6% of stage III patients; among metastatic patients and those without complete resection, palliative therapy in 61.7%; regional differences observed

(Table continues)

**Table 5 (Continued).**

First author, Y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to chemotherapy treatment
Faivre-Finn, 2002 (82)	France	All stages	1989–1998	4093	<65: 24%; 65–74: 30%; 75+: 46%	Côte-d'Or and Saône-et-Loire registries in Burgundy; hospital data from general and specialty practitioners	18.3% treated with adjuvant chemotherapy; over time, chemotherapy use increased from 3.1% to 24.7%; 26% of eligible patients were treated with palliative chemotherapy, with younger patients and males treated more often; in multivariate results, younger patients, later period and stage of diagnosis significantly more likely to receive adjuvant chemotherapy Among stage III patients, adjuvant chemotherapy rose from 4.1% to 45.7%, though increase slower in patients 75+; in multivariate analyses, younger age, later period of diagnosis, and stage II/III disease associated with chemotherapy use; palliative chemotherapy use rose from 4.0% to 34.5% over time and patients <75 more likely to receive palliative therapy
Faivre-Finn, 2002 (79)	France	All stages	1976–1998	3389	NR	Côte-d'Or registry, Burgundy; hospital data from general and specialty practitioners	Proportion of stage III patients receiving adjuvant chemotherapy increased sharply, particularly among younger patients; chemotherapy in stage IV patients increased from 21% to 66% for younger patients and from 2% to 25% for elderly patients Among patients treated with noncurative intent, 28% of patients received chemotherapy
Elferink, 2010 (30)	The Netherlands	All stages	1989–2006	40 888	≤44: 4%; 45–59: 22%; 60–74: 43%; ≥75: 32%	Netherlands Cancer Registry	In stage II patients, 3.0% received chemotherapy alone compared with 12.8% of stage III patients Adjuvant chemotherapy in patients with resection and no metastasis rose from 8.1% to 19.0%; palliative chemotherapy given to 37.5% of patients <75 with advanced stage and rose to 50.0%; 0 patients >75 received palliative chemotherapy Adjuvant chemotherapy given to 33.2% aged <75 and 4.5% among 75+ with curative surgery Chemotherapy increased from 0% to 10% among stage III patients and from 7% to 30% among stage IV patients 11.9% received adjuvant chemotherapy
Sigurdsson, 2009 (37)	Norway	NR	1997–2002	297	Median 77, range 67–84	Norwegian Colorectal Cancer Registry	Data on chemotherapy limited to 144 patients; in 78% of patients, chemotherapy given postoperatively and to 63.9% within 2 mo of surgery
Engel, 2005 (65)	Germany	All stages	1996–1998	882	<70: 62.5%; 70+: 37.4%	Munich Cancer Registry and Munich Field Study	
Phelip, 2004 (66)	France	All stages	1990, 1995	945	Stratified as <75 and >75	FRANCIM; survey of specialists and GPs	
Phelip, 2004 (69)	France	All stages	1995	683	≥75: 38.8%	FRANCIM; physician survey	
Martijn, 2003 (73)	The Netherlands	All stages	1980–2000	3635	<60: 26.3%; 60–74: 47%; 75+: 26.7%	Eindhoven Cancer Registry	
Birbeck, 2002 (80)	United Kingdom	NR	Surgery 1986–1997	586	Median 69.6, range 27.9–96.6	Leeds, United Kingdom; hospital data, patient case notes with full clinical follow-up	
Farmer, 2002 (81)	Australia	Dukes A-C	1994	681	NR	Victoria Cancer Registry; physician survey completed for each patient	

(Table continues)

**Table 5 (Continued).**

	<b>First author, Y (ref.)</b>	<b>Country</b>	<b>Stage</b>	<b>Year of diagnosis</b>	<b>N</b>	<b>Age (y)</b>	<b>Health delivery setting and data sources</b>	<b>Findings related to chemotherapy treatment</b>
CRC	Gatta, 2010 (28)	European Collaborative Study	Stages I-III	1996-1998	6871	≥75: 33.6%; <75: 66.4%	European cancer registries	Among stage II colon cancer patients, 22% received adjuvant chemotherapy; receipt varied by age (38% for <65 vs 5% for 75+) and cancer registry; among stage III colon cancer patients, 46% received adjuvant chemotherapy and varied by age (69% for <65 vs 16% for 75+) and cancer registry; in multivariate results among stage III colon cancer patients, older age decreased the odds of receiving chemotherapy
	Carsin, 2008 (90)	Ireland	All stages	1994-2002	15 249	Patients ≥20	National Cancer Registry	31% had chemotherapy, increased by 10% per year, for all stages; older, unmarried patients less likely to have chemo; among stage III-IV, strong positive effect of year of diagnosis
	Coriat, 2007 (41)	France	All stages	1998	407	Median age 72; range 26-93	Burgundy Registry of GI Cancers	27% of patients received adjuvant chemotherapy
	Damianovich, 2007 (47)	Australia	100% metastatic	Received medication 2002-2003	1465	70+: 23%; 80+: 2%	Health Insurance Commission	For 5-FU refractory patients, oxaliplatin use increased from 48% to 66% and irinotecan use decreased from 52% to 34% between 2002 and 2003; differences greater for younger vs older patients and pattern of use observed across all states; younger patients switched more than older ones; of the 697 patients who started oxaliplatin in 2002-2003, 40% switched to irinotecan
	Mahboubi, 2007 (49)	France	All stages	1998	389	<65: 26.5%; 65-74: 34.2%; ≥75: 39.3%	Côte-d'Or and Saône-et-Loire registries, Burgundy; medical records and survey of specialists and GPs	Overall, 27.2% had chemotherapy
	Young, 2007 (46)	Australia	All stages	2000-2001	2984	22.4% <60; 26.3% 60-69; 33.3% 70-79; 17.7% ≥80	New South Wales; patients identified through cancer registry and had surgery; physician survey	Of Dukes C colon cancer patients who had surgery with curative intent, 76.0% offered chemotherapy
	Lemmens, 2006 (52)	The Netherlands	NR	Colon 2002; rectal 2002	308	Colon cancer: mean 70, range 41-91; rectal cancer: mean 64, range 33-86	Eindhoven Cancer Registry	95% of patients <70 received chemotherapy vs 48% 70+ years
	Bouvier, 2005 (57)	France	All stages	1978-1997	2409	80+ at diagnosis	Calvados and Côte-d'Or registries	2% colon cancer and 2% rectal cancer patients received chemotherapy; 2.4% stage IV colorectal cancer patients had palliative chemotherapy

(Table continues)

**Table 5 (Continued).**

First author, Y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to chemotherapy treatment
Drug Utilization Review Team in Oncology, 2005 (54)	Italy	NR	October 2000	434	≤50: 15.2%; 51–60: 25.3%; 61–70: 36.6% >70: 21.0%	86 Italian oncology centers; patient, clinical, disease data from treating oncologist forms	Among colon cancer patients, adjuvant chemotherapy given to 42.5%; tumor stage, type of center (hospital vs university), patient age, and number of nodes removed affected decision to give patients chemotherapy 42.7% of men and 51.2% of women had chemotherapy
Gonzalez, 2005 (58)	Spain	All stages	1996–1998	403	Mean 65.4 (men), 63.8 (women)	Hospital Universitario de Bellvitge in Barcelona, Spain	
Lemmens, 2005 (60)	The Netherlands	All stages	1995 to 2001	6931	All patients 50+; mean 70.	Eindhoven Cancer Registry	Among stage III patients, surgery and adjuvant chemotherapy given to 82.8% <65, 42.4% of 65–79, 1.2% of 80+; among stage IV patients, chemotherapy decreased from 41.3% among 50–64 to 1.8% among oldest
Robinson, 2005 (64)	New Zealand	All stages	1993–94 and 1998–99	673	Median 71–90; 51–70	Christchurch Hospital; oncology database, hospital discharge codes, patient notes	Adjuvant chemotherapy for Dukes stage C patients increased from 21% to 45%; chemotherapy for metastatic disease rose from 2.4% to 23% of stage D and from 2.5% to 36.5% for patients who developed metastases
Barton, 2004 (67)	Australia	All stages	1994–1996	370	Median 68, range 22–98	Western Sydney and Wentworth Health Areas; cancer registry and hospital databases	5% received adjuvant chemotherapy not same time as radiotherapy, whereas 6% received adjuvant chemotherapy alone; among eligible colon cancer patients, 51% received adjuvant chemotherapy
Bouhier, 2004 (68)	France	All stages	1990–1999	3135	Mean 70	Calvados Registry of GI Tumors	Among colon cancer patients, 21.8% of stage II and 46.9% of stage III patients had chemotherapy; chemotherapy use increased for stage III patients, but remained stable for stage II; among stage IV patients, 45.9% received palliative chemotherapy and this increased over time; older age (75+) associated with decreased chemotherapy use and general hospitals (vs university centers) less likely to treat stage III patients with chemotherapy
McGrath, 2004 (71)	Australia	All stages	2000	1911	Mean 68, median 70, range 16–100	All state cancer registries; survey given to surgeons	Chemotherapy offered to more patients with Dukes A, B and C rectal cancer vs colon cancer patients (49.4% vs 39.4%)
Campbell, 2002 (78)	United Kingdom	All stages	1995–1996	653	≤59: 19%; 60–70–79: 33%; ≥80: 24%	Scotland cancer registry; hospitals in Grampian or Highland; case notes and clinical data	23% received chemotherapy within 1 y of diagnosis; higher stage and younger age associated with increased chemotherapy receipt
Pitchforth, 2002 (77)	United Kingdom	NR	1992–1996	7303	All ages	Scotland cancer registry and services from Scottish morbidity record inpatient and day case form	13.7% received chemotherapy within 6 mo of first admission; ER admissions less likely to receive chemotherapy; noncancer hospital admittees less likely to get chemotherapy

\* AR = anterior resection; APR = abdominoperineal resection; ER = emergency room; FU = fluorouracil; GI = gastrointestinal; GP = general practitioner; HP = Hartmann's procedure; LAR = lower anterior resection; MET = metastatic; SES = socioeconomic status; ULAR = ultralow anterior resection.



**Table 6.** Patterns of multicomponent care for colorectal cancer in Europe, Australia, and New Zealand by cancer site, publication year, and country (n = 11)\*

	First author, y (ref.)	Country	Stage	Year of diagnosis	N	Age (y)	Health delivery setting and data sources	Findings related to multicomponent care
Rectum	Eiferink, 2010 (30)	The Netherlands	All stages	January 1, 1989–December 31, 2006	40 888	≤44: 4%; 45–59: 22%; 60–74: 43%; ≥75: 32%	Netherlands Cancer Registry	Among younger stage II–III patients, neoadjuvant RT + chemotherapy increased from 1% in 1994–1998 to 9% in 2004–2006; elderly stage II–III patients received neoadjuvant RT + chemotherapy 3% less often in 2004–2006
	Eiferink, 2010 (26)	The Netherlands	Non-MET 77.8%; MET 17.4%; unknown 4.8%	January 1, 2001–December 31, 2006	16 039	<60: 26.2%; 60–74: 43.4%; 75+: 30.3%	Netherlands Cancer Registry	Most patients with T2/T3/T4-M0 tumors had either preoperative RT or neoadjuvant chemoradiation; proportion of patients receiving either preoperative RT or neoadjuvant chemoradiation was higher for <75 vs 75+
	Sigurdsson, 2009 (37)	Norway	NR	1997–2002	297	Median 77, range 67–84	Norwegian Colorectal Cancer Registry	Among patients treated noncuratively, 10% had combination of chemotherapy and RT
	Ptok, 2007 (42)	Germany	Stages I–III	Entered study 2000–2001	1557	Median 66, range 26–92	Multisite observational study; data collected from patients, hospital data	Neoadjuvant RT and radiochemotherapy for rectal cancer increased from 6.5% to 25.0% (2000 vs 2005); adjuvant therapy was 53.4% and 49.7%, respectively; higher-volume hospitals had higher rates of neoadjuvant therapy (16.8% vs 9.9%)
	Engel, 2005 (65)	Germany	All stages	1996–1998	882	<70: 551 (62.5%); 70+: 331 (37.4%)	Munich Cancer Registry and Munich Field Study	9.4% received both pre- and postoperative adjuvant treatment
	Martijn, 2003 (73)	The Netherlands	All stages	1980–2000	3635	<60: 26.3%; 60–74: 47%; 75+: 26.7%	Eindhoven Cancer Registry	14% had surgery + preoperative RT, 17% surgery + postoperative RT, 5% surgery + systemic treatment, 5% “other” or missing treatment, 5% no treatment; treatment with surgery and radiotherapy increased in 1980–2000 (26% to 40%)
	Farmer, 2002 (81)	Australia	Dukes A-C	1994	681	NR	Victoria Cancer Registry; physician questionnaire	Chemotherapy was combined with postoperative RT in 65.3%
Colorectal	Kube, 2009 (36)	Germany	All stages	Resections 2000–2005	346 hospitals; 47 436 patients	NR	Hospital data, standardized questionnaire, follow-up physician survey	Neoadjuvant RT and radiochemotherapy for rectal cancer increased from 6.5% in 2000 to 25.0% in 2005
	Drug Utilization Review Team in Oncology, 2005 (54)	Italy	NR	Past or current diagnosis October 2000	434	≤50: 15.2%; 51–60: 25.3%; 61–70: 36.6%; >70: 21.0%; NR: 19%	86 Italian oncology centers; forms completed by the treating oncologist	82 patients enrolled were treated with adjuvant therapy; adjuvant RT was administered alongside chemotherapy in 45.8%, sequentially with chemotherapy in 28.8%, alone to 1.7%, and in a nonspecified way in 23.7%
	Lemmens, 2005 (60)	The Netherlands	All stages	1995 to 2001	6931	All patients 50+; mean 70	Eindhoven Cancer Registry	The proportion of patients with stage II/III rectal cancer who received adjuvant chemoradiotherapy increased from 3.9% in 1995–1999 to 15.9% in 2001
	McArdle, 2002 (84)	United Kingdom	Dukes A/B	1974–1979; 1991–1994	3200	75+: 35%	Glasgow Royal Infirmary; medical records/audits	Of the total, 5% received adjuvant therapy

\* APR = abdominoperineal resection; LAR = lower anterior resection; RT = radiotherapy.

time among younger patients and in higher-volume hospitals (26,30,36,42,60).

### Post-Diagnostic Surveillance and End-of-Life Care

Seven studies reported information on post-diagnostic surveillance for colorectal cancer, including colonoscopy use, carcinoembryonic antigen testing, chest X-rays, abdominal computed tomography scans or X-rays, and positron emission tomography scans (data not shown) (39,41,49,52,56,62,75). Five studies reported rates of post-diagnostic surveillance in addition to some form of initial care (eg, surgery, chemotherapy), whereas two studies reported exclusively on post-diagnostic surveillance. Studies varied by timeframe for receipt of follow-up care, ranging from 1 year after diagnosis to 3 years post-diagnosis. Notable findings included that patients with advanced-stage cancers and those receiving chemotherapy were more likely to receive follow-up care (39,41). Additionally, variation in post-diagnostic surveillance by physician type (specialist vs general practitioner) and assessment of guideline compliance were also highlighted (39,41,62). The one study conducted in Italy assessing end-of-life care examined patients who died in 2003–2005 and called for guidelines to be created for chemotherapy use among end-of-life patients (data not shown) (43).

### Discussion

This systematic review examined patterns of colorectal cancer care in several European countries, Australia, and New Zealand, and was written as a companion to a review on care patterns in the United States and Canada (91). Included studies spanned over 15 countries and focused on initial care for colorectal cancer, including surgery, RT, and chemotherapy. Similar to the United States and Canada review, our analysis revealed limited information on post-diagnostic surveillance and end-of-life care for colorectal cancer (91), representing potential areas where additional research is needed (39,41,43,49,52,56,62,75). Furthermore, existing studies on end-of-life care have included multiple types of cancer patients, and the extent to which colorectal cancer patients have specific end-of-life care needs is not well understood.

In our analyses of study findings for initial care, there were several findings that were common among studies on surgery, chemotherapy, RT, and multicomponent care. These findings included changing trends over time and variation in rates of treatment by patient demographic and health characteristics (ie, age, gender, socioeconomic status, tumor stage, metastatic tumor status, presence of comorbidities), hospital setting and volume, and region (26,28–30,34,36–38,40,42,45,46–48,55,60,61,66,68,69,72,78,79,88). Among these characteristics, patient age was one of the most consistent findings associated with treatment receipt, with older patients being less likely to receive colorectal cancer care compared with younger patients. This finding may be tied to underrepresentation of elder patients in clinical trials, creating challenges for physicians to determine appropriate treatment for older individuals.

Over time, there were also changing trends in specific treatment types. For example, several studies reported lower rates of APR over time and increasing use of sphincter-sparing surgeries, such as total mesorectal excision and lower anterior resection. This change has particular relevance for quality of life among rectal

cancer patients. Several studies also noted increasing use of preoperative RT alongside decreasing rates of postoperative RT among rectal cancer patients. Chemotherapy rates also increased over time, especially toward the later part of the 1990s.

Of critical importance, we found wide variation in data sources used across studies both between and within countries, making direct comparisons of patient and health services information for initial care challenging. Because of lack of comparability of data reporting and differences in patient populations, comparing rates of surgery, RT, or chemotherapy for colorectal cancer between countries was difficult, and patterns of care identified were incongruous. In this review, the studies that were more amenable to comparisons had greater similarities in type of treatment assessed and patient demographic and clinical characteristics (eg, stage III colon cancer patients). These factors should be considered in future research and data collection efforts.

Moreover, studies had multiple sources of data, ranging from registries to single or multiple institutions. Although studies from particular countries such as France and the Netherlands relied heavily on registry data, others used medical records and hospital data or a mixture of data sources. However, there were varied degrees of population coverage and representativeness even within countries using registry data (eg, FRANCIM). Studies from several countries also did not appear to use centralized registry information. Furthermore, increased linkages between health insurance systems and cancer registry data to provide more detailed information on service utilization patterns may improve current data collection efforts.

Studies also had variability in reporting clinical characteristics that significantly affect treatment and survival as well as variation in time period that trends were assessed. Strikingly, 20% of studies did not report stage of cancer at diagnosis—a fundamental determinant of appropriate cancer treatment. Another important clinical characteristic that was omitted from nearly one-third of studies was year of diagnosis. Additionally, assessment of comparability was limited by reporting of treatment rates for initial care from distinct, disparate, and wide intervals of time, ranging from 1974 to 2006, across studies (26,84).

Further complicating the ability to make comparisons across countries, few studies assessed care in relation to guidelines or other standards, and those which included this information used disparate guidelines for care receipt. Among the studies that discussed use of guidelines, articles compared trends over time for guideline implementation, but used different sets of guidelines or national consensus conference statements (32,39,41,43,62,74). One study also highlighted better guideline-consistent performance among colorectal cancer surgeons compared with other surgeon types (74). Although the creation of guidelines is challenging given the diversity of patient populations and physician practice patterns, efforts could potentially be made to improve consistency of treatment with guidelines among stage III colon cancer patients or stages II–III rectal cancer patients where greater consensus exists.

Notably, many studies omitted important patient characteristics, which are associated with receipt of treatment, including comorbidities, gender, socioeconomic status, urban/rural residence, and patient race/ethnicity or country of origin. Several countries included in this review (ie, England, France, Australia, Germany)

have significant immigrant populations and racial or ethnic diversity among the general population (92,93). In addition, variables related to care coordination (ie, the process of linking patients to timely care throughout the process of treatment), quality of care, case-mix, and social support were missing from nearly all studies. Each of these factors has a potentially important role in treatment receipt and utilization of services, and may vary by patient clinical and demographic characteristics, geographical region, and hospital setting.

It should also be noted that many studies had important limitations. Selection bias and limited geographical coverage were present in several studies. For instance, single-institution studies within a country limit generalizability of findings to other geographical areas. Among studies using registry data, such as those in France, the Netherlands, and Australia, population coverage varied widely both between and within each country.

Although this systematic review made significant efforts to thoroughly evaluate existing literature on patterns of colorectal cancer care, some limitations should be noted. Our search terms and criteria used could have unintentionally resulted in exclusions of relevant studies. However, as an effort to maximize the inclusion of relevant studies, reference lists of identified papers and published reviews were evaluated to identify additional articles. In addition, articles were limited to those published in English, which may have missed relevant studies published in other languages.

These limitations notwithstanding, this review had several important findings and implications. This synthesis of the literature summarizes a large number of studies focusing on colorectal cancer care in Europe, Australia, and New Zealand, and can be used to identify new directions for future research. For instance, one of the primary gaps in existing literature identified by this review was lack of information on post-diagnostic surveillance and end-of-life care among colorectal cancer patients. Another central finding was significant variation in sources of data for colorectal cancer treatment across studies, which varied by patient demographic and health characteristics, study time period, geographic location, and hospital setting. Therefore, future research and policy efforts should minimize inconsistencies in measurement and emphasize standardization of data reporting for colorectal cancer care.

Additional research is also needed that collects and compares standardized data from multiple European nations, such as EUROCORE, which improve data comparability by using similar standards and quality control measures for registration, data collection, and follow-up of patients within cancer registries (3). Researchers and policy makers from individual countries should further work toward increased representativeness and generalizability of data on colorectal cancer treatment between geographical regions within individual nations. Targeted research and policy efforts in these areas will help to harmonize data sources for comparable analyses and allow for improved assessment of care practices globally.

## Appendix

Search #	Limits: English, Journal Article, Humans, Publication Date from 2000 to 2010
1	("Colorectal Neoplasms/drug therapy"[MeSH] OR "Colorectal Neoplasms/radiotherapy"[MeSH] OR "Colorectal Neoplasms/surgery"[MeSH] OR "Colorectal Neoplasms/therapy"[MeSH])
2	"Physician's Practice Patterns"[MeSH]
3	"Guideline Adherence"[MeSH]
4	"Health Services/statistics and numerical data"[Majr] OR "Health Services/trends"[Majr] OR "Health Services/utilization"[Majr]
5	"Quality of Health Care/statistics and numerical data"[Majr] OR "Quality of Health Care/trends"[Majr] OR "Quality of Health Care/utilization"[Majr]
6	"Chemotherapy, Adjuvant/statistics and numerical data"[MeSH] OR "Chemotherapy, Adjuvant/trends"[MeSH] OR "Chemotherapy, Adjuvant/utilization"[MeSH]
7	"Neoadjuvant Therapy/statistics and numerical data"[MeSH] OR "Neoadjuvant Therapy/trends"[MeSH] OR "Neoadjuvant Therapy/utilization"[MeSH]
8	"Radiotherapy, Adjuvant/statistics and numerical data"[MeSH] OR "Radiotherapy, Adjuvant/trends"[MeSH] OR "Radiotherapy, Adjuvant/utilization"[MeSH]
9	"Neoplasm Recurrence, Local/prevention and control"[Majr]
10	"Terminal Care"[MeSH]
11	"Patterns of Care"[Keyword String][Abstract or Title]
12	Search #1 AND (#2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11)

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