6   Colorectal Cancer

Hugh Sanderson, Andrew Walker and Denise Young

1 Summary

Occurrence

Colorectal cancer is a major cause of mortality and morbidity in the UK and care for this disease uses a significant proportion of health service resources. The key epidemiological characteristics of the disease are given in Table 1.

Table 1: Characteristics of colorectal cancer.

Risk factors	High-fat, low-fibre diet, alcohol, presence of adenomatous polyps, presence of predisposing lower gastrointestinal diseases, previous history of colorectal cancer, family history and genetic syndromes (HNPCC and FAP)
Incidence	618 cases per 1,000,000 population per year (S and W Region, 1995) Rare below the age of 40, the incidence rises steeply and continuously in those over 50 years of age
Mortality	320 deaths per 1,000,000 population per year (S and W Region, 1995)
Survival[a]	Stage A: 75% Stage B: 57% Stage C: 35% Stage D: 12%

[a] These are 5-year crude survival rates for patients diagnosed with colorectal cancer in Wessex Region in 1991–95 and include all deaths, not just those due to colorectal cancer.

This chapter considers the options for the provision of care in terms of both cost and outcome to help commissioners gain the best value care for their population. Costs should, however, be interpreted with caution in the light of local variations.

Interventions

Primary prevention

Primary prevention is concerned with reducing the risks of developing colorectal cancer, however, because the causes are not clearly established, prevention is limited to general advice on diet and lifestyle.

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Screening and surveillance

This is a disease in which the stage at diagnosis is very significant in relation to prognosis, consequently considerable effort has gone into testing ways of achieving early diagnosis, and assessing its impact on mortality. Trials of detection of precancerous changes or early tumours through screening and surveillance have been undertaken. Faecal occult blood testing has been shown to be of similar cost-effectiveness to breast cancer treatment, but compliance is low.

A number of conditions increase the risk of developing colorectal cancer, especially family history, specific syndromes (familial adenomatous polyps; FAP) and a history of polyps or ulcerative colitis. Surveillance of high-risk individuals is widely undertaken although good quality data on the cost-effectiveness are lacking.

Investigation

This includes basic examination and radiological contrast examination of the bowel. Flexible sigmoid-oscopy (FS) is useful as a quick examination of the rectum and sigmoid colon, but the most important technique is colonoscopy in which the whole of the bowel can be visualised, and biopsies taken of suspicious lesions. Training is required in order to achieve proficiency in the technique, but sigmoid-oscopy services can be provided by nurses,[1] particularly where the examination can be video-recorded for subsequent review.

Treatment

Surgical excision is the main form of initial treatment, but evidence regarding the effect of surgical specialisation on outcomes is contradictory. Similarly, although more extensive dissection resulting in a total mesorectal excision has been shown in non-randomised trials to improve survival, the cost-effectiveness of this technique has not been demonstrated.

Adjuvant radiotherapy has been shown to reduce recurrence rates. There is some inconclusive evidence to suggest that pre-operative therapy is more effective than postoperative therapy.

Adjuvant chemotherapy is effective for Dukes' stage C cancers and should be used routinely even though there is no consensus on the most effective regime. A multicentre trial is being undertaken to determine the most effective drugs and mode of administration. Trials to determine the effectiveness of chemotherapy in stage B are also continuing.

There are few UK data on the most cost-effective models for palliative care, but there is evidence that specialist palliative care teams can provide more effective services than conventional care methods. This applies to all malignant disease, and palliative care services are not restricted to colorectal cancer.

2 Statement of the problem

Occurrence

Colorectal cancer is the third most common cancer after lung and non-melanoma skin cancers. It is predominantly a disease of the elderly and an average commissioning agency could expect approximately 543 cases per million persons (164 rectal, 379 colon) diagnosed annually and about 296 deaths per million annually.[2,3] Because this is predominantly a disease of the elderly, the age distribution of the population will affect overall incidence. The relevant coding classifications for this disease are given in Appendix I.

Current issues

Because of the strong relationship between stage at diagnosis and prognosis, there is a great deal of interest in finding ways of diagnosing patients earlier. However, although recent trials of faecal occult blood (FOB) testing have shown that reductions in mortality can be achieved, compliance with the screening programme is low, as is compliance with regular FS. As a consequence, there are likely to be difficulties in the design of an effective national screening programme.

There has been some concern in recent years to ensure that colorectal surgery is undertaken by surgeons with a specific interest in the area, and who undertake considerable volumes of colorectal cancer surgery. Despite the attractiveness of the hypothesis that specialists achieve better results, this is not supported by the evidence. However, the general principles of the Calman–Hine report on the organisation of cancer services will ensure that appropriate services for the care of colorectal cancer patients are available at cancer units and cancer centres.

Relating needs to interventions

Large variations in the availability and use of services exist for many conditions. Consequently one of the key tasks of health service commissioners in planning and monitoring the delivery of service is to identify the need in the population, and estimate the care required for those at need. In order to do this systematically, it is necessary to classify groups of individuals in the population into similar need groups. The appropriate packages of care for each of these need groups can then be determined and from these the total costs of care can be calculated. In addition, measures of the performance of services in meeting targets can be specified in relation to the groups of patients and their packages of care.

Sub-categories

This section defines the conditions related to colorectal cancer which require access to health services, and details the various conditions within each group.

Because the stage at diagnosis is so important in determining prognosis and appropriate care, one of the key methods of classification is via pathological staging and grading of colorectal cancers (Appendix II). However, this aspect deals only with classifying patients with diagnosed cancers, and to develop integrated services, a broader classification is required.

Health Benefit Groups (HBGs) were developed as a way of classifying groups of individuals with similar needs. Health care Resource Groups (HRGs) provide a way of classifying similar intervention packages. The information can be organised in the form of a matrix in which the vertical axis contains the HBGs defining groups of people with broadly similar needs. The horizontal axis details the number of people falling into each HBG and the health services that they might receive. In order to cover the whole spectrum of conditions and interventions, four matrices have been developed covering the following areas:

- individuals at risk, requiring promotion/prevention interventions
- individuals presenting with symptoms and signs requiring diagnostic/assessment interventions
- individuals with confirmed disease, requiring specific clinical management
- individuals with the continued consequences of disease, requiring support and care.

Appendix III sets out the HBGs and HRGs related to colorectal cancer. Because this provides a structured way of identifying individuals and services, it is used as the basis of this needs assessment chapter. However, because much of the available data is not presented in this format, it can serve only as a map within which to locate other sources of information.

3 Prevalence and incidence

The incidence of colorectal cancer is 618 per 1 000 000 population. The death rate is 320 per 1 000 000. Forty-five per cent of patients are over the age of 75 when a diagnosis of colorectal cancer is made.[4] The age distribution of the population is considered the most important factor determining the overall incidence.

Colorectal cancer is the third most common cancer after lung and non-melanoma skin cancers. The incidence rates for men and women are similar, but colon cancer is about twice as common in women as rectal cancer, whereas in men the incidence of colon and rectal cancers is almost the same.

Colorectal cancer is the second biggest cause of cancer death in this country and the fifth largest cause of death overall. Table 2 gives the age-specific death rates per 1 000 000 population.

Table 2: Colorectal cancer rates per 1,000,000 population (S and W Region, 1995).

	Age				
	0–44	**45–64**	**65–74**	**75+**	**Total**
Incidence	19	570	1,944	3,415	618
Mortality	6	243	890	2,065	320

Source: S and W Regional Cancer Intelligence Unit.[4]

More than half of all deaths are in the 75+ age group. However, owing to the poor overall survival from this disease it is still a significant cause of premature death with 163 411 years of life lost each year in England and Wales.[2]

Population at risk

General risk factors

The cause or causes of colorectal cancer are not known. However, several factors are known to increase the chance of development of disease.

High-fat, low-fibre diet

There is considerable evidence to suggest that diet is associated with the development of this disease. Early correlation studies have linked high colorectal cancer rates to countries with a diet high in fat content and a low fibre intake.[5] Observational studies have consistently reported an inverse relationship between a diet that is low in consumption of fruit and vegetables and colorectal cancer.[6–8] One study estimated a relative risk of 1.9 for 'low intake' compared with 'high intake'.[7]

Alcohol consumption

High alcohol intake, particularly beer, has been implicated in the development of rectal cancers.[9] In addition, one study revealed an association between alcohol consumption and colon cancer with a relative risk for drinkers vs. non-drinkers of 4.38 and 1.92 for men and women respectively.[10]

Tobacco smoking

Recent cohort studies with at least 20 years follow-up have reported a weak positive association between tobacco smoking and colorectal cancer.[11]

Sedentary lifestyle

Observational studies have shown that a sedentary lifestyle increases the risk of colon cancer.[8]

Adenomatous polyps

It has been suggested that most cancers of the colon and rectum evolve from isolated adenomatous polyps (the polyp–cancer theory).[12] The risk of malignant change depends upon the size of the polyp. Small polyps (< 1 cm) represent about 60% of all polyps but only about 1% are malignant. Large polyps (> 2 cm) only represent around 20% of polyps but have a much higher malignancy rate (approximately 50%).

Specific risk factors

Certain groups are at higher than average risk of developing colorectal cancer. These include individuals with:

- ulcerative colitis
- Crohn's disease
- previous history of adenomatous polyp
- previous history of colorectal cancer
- family history
- genetic syndromes.

Ulcerative colitis and Crohn's disease

There is an increased risk of colorectal cancer for patients with long-standing ulcerative colitis and to a lesser extent, Crohn's disease. The prevalence of ulcerative colitis is around 1600 per 1 000 000 population and that of Crohn's disease about 500 per 1 000 000. In a population of 1 000 000 there will be approximately 2100 patients with inflammatory bowel disease who may require monitoring. The risk of developing colorectal cancer becomes significant between 8 and 10 years following a diagnosis of inflammatory bowel disease.

Family history

Close relatives of people diagnosed with colorectal cancer are at increased risk of this disease. Risk is greater the closer the family relationship, the number of relatives affected and the younger they are at the time of diagnosis.[13–15] A significant family history is defined as close relatives of cases diagnosed before the age of

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45 or two or more close relatives with bowel cancer, especially when one or more of the cases is diagnosed at a young age.[16]

Hodgson *et al.*[17] calculated the lifetime risks of death from colorectal cancer for relatives of index patients with colorectal cancer (Table 3).

Table 3: Lifetime risks of colorectal cancer in first degree relatives of patients with colorectal cancer.

Population risk	1 in 50
One first degree relative affected diagnosed after age 45	1 in 17
One first and one second degree relative affected, diagnosed after age 45	1 in 12
One first degree relative affected, diagnosed before age 45	1 in 10
Two first degree relatives affected	1 in 6
Dominant pedigree (50% risk of inheriting genetic predisposition)	1 in 2

Source: Hodgson *et al.*[17]

Guidelines from the Yorkshire Cancer Organisation suggest that about 10% of the population aged 50 and over have at least one first-degree relative affected by colorectal cancer. This suggests that there are around 31 000 people per 1 000 000 population with a positive family history of colorectal cancer.

Genetic syndromes

Two genetic syndromes which predispose to colorectal cancer are familial adenomatous polyposis (FAP) and hereditary non-polyposis cancer of the colon (HNPCC).

FAP is characterised by the presence of hundreds of polyps lining the large intestine. It is caused by the presence of mutations in the adenomatous polyposis coli (APC) gene; over 80% of families with FAP have an identified APC mutation.[18] Its prevalence has been estimated at around 1 in every 8000–10 000 births[16] and it accounts for approximately 1% of cases of colorectal cancer.[19] Mountney *et al.*[20] reported a point prevalence of 1 per 35 000, which suggests that there are around 29 affected individuals per 1 000 000 population. If untreated, patients with FAP would usually die of colorectal cancer before the age of 40.[21]

The HNPCC mutation affects approximately 2–5% of colorectal cancer patients and is associated with a lifetime risk of 80%.[18] Data from Glasgow indicate a prevalence of around 190 per 1 000 000 population. HNPCC mutation carriers also have an increased risk of developing other cancers, such as those of the endometrium, ovary, pancreas and larynx.

Previous history of colorectal cancer

Patients who have undergone successful treatment of colorectal cancer are at increased risk of developing a second primary tumour (5% at 25 years).[12] Current survival data suggest that around 210 people per 1 000 000 population of each year's cohort will survive to 5 years and experience the same life expectancy as their peers. Because these are mainly elderly, the pool of 5+ years survival with a previous history of colorectal cancer is likely to be between 1000 and 1500.

People with symptoms requiring diagnostic interventions

Primary care and referrals

The incidence of new colorectal cancers presenting to the general practitioner is around 3 per 10 000.[22] Patients may present with one or more of the following symptoms which may be associated with colorectal cancer: rectal bleeding, unexplained iron-deficiency anaemia, change in bowel habits, unexplained weight loss, abdominal pain, faecal incontinence, bowel obstruction and production of mucus from the rectum.

Many of these symptoms occur frequently in the general population and may have many medical explanations which causes problems for accurate diagnosis. Researchers have attempted to investigate the predictive value of symptoms for the diagnosis of colorectal cancer, most notably that of visible rectal bleeding. Rectal bleeding is very common, occurring in up to one in six of the general population each year.[23] However, colorectal cancer will be responsible for the bleeding in only a small proportion of these people. In one recent American study, consecutive patients attending clinics were asked if they had noticed rectal blood during the last 3 months and had not sought medical attention. Of 201 individuals who reported rectal bleeding, 6.5% were subsequently found to have cancer of the colon.[24] Goulston and Dent[25] also investigated this issue in a study of 145 patients consulting their general practitioner with rectal bleeding. Colorectal cancer was found responsible for the bleeding in 10% of patients. A similar study was conducted in The Netherlands to examine the predictive value of rectal bleeding in 290 patients aged between 18 and 75.[26] It was found that 20% of patients aged 60–75 and 2% of those aged 50–59 with rectal bleeding had colorectal cancer. Three variables were found to be significantly predictive of colorectal cancer, namely age, change in bowel habit and blood on or mixed with stool.

Approximately 5% of patients with colorectal cancer present asymptomatically or as a result of screening, 63% present symptomatically and 32% present as emergency admissions. Therefore, among a population of 1 000 000 people, 27 present to the health service asymptomatically, 342 symptomatically and 174 as emergencies.

In patients who present with a diagnosis of colorectal cancer, little extra diagnostic investigation is required. British Society of Gastroenterology guidance[27] suggests a rate of at least 2000 per million each for FS and colonoscopy, although not all of these have symptoms suggesting cancer. Patients who present to the health services as emergencies may be suffering from obstruction or perforation. In these cases, a diagnosis of colorectal cancer is usually established after emergency laparotomy.

Confirmed disease requiring specific curative and caring interventions

The rate of progression of disease is variable, some tumours may be very slow growing while in other cases, local and distant spread may be rapid and uncontrollable. For this reason, it is misleading to use the terms early and late as synonymous with the degree of spread of the disease. Prognosis and treatment are dependent upon the degree to which the cancer has advanced at the time of diagnosis, survival for advanced disease being very poor.

Dukes' staging of colorectal cancer, developed to define the degree of advancement, is a histological grading, and does not include metastatic spread.[28] Union Internationale Contre le Cancer (UICC, 1987) modification of this staging is summarised in Table 4 (*see* overleaf) and detailed in Appendix II.

Data from the Wessex Colorectal Audit suggest that approximately 11% of patients are stage A at diagnosis, 33% are stage B, 19% are stage C, 23% are stage D and 13% are unknown (probably mainly C and D; Table 5, *see* overleaf). In a population of 1 000 000 people, one would expect 62 cases of stage A colorectal cancer, 178 cases of stage B, 105 cases of stage C and 127 cases of stage D, with 70 unstaged.

Table 4: Dukes' staging.

Stages	
Stage I (A)	Tumour confined to mucosa and submucosa of the bowel wall
Stage II (B)	Tumour penetrating the muscle wall of the bowel
Stage III (C)	Metastasis to regional lymph nodes
Stage IV (D)	Distant metastasis (i.e. distant spread)

Table 5: Distribution of colorectal cancer at diagnosis (1994).

	Colon cases (per million)	Rectum cases (per million)	All cases (per million)
A	6.1 (33)	5.3 (29)	11 (62)
B	24.4 (132)	8.5 (46)	33 (178)
C	13.1 (71)	6.3 (34)	19 (105)
D	17.6 (96)	5.7 (31)	23 (127)
Not known	8.7 (47)	4.2 (23)	13 (70)
	69.8 (379)	30.2 (164)	100 (543)

Approximately 40% of patients survive to 5 years, at which point survivors have a life expectancy very similar to the normal population. Survival and treatment effectiveness is dependent upon the stage of cancer at diagnosis.[29,30] The stage distribution of colorectal cancer at diagnosis and the associated 5-year survival for each group are shown in Tables 5 and 6.

Table 6: Five-year survival by stage.[a]

Stage	Colorectal (%)	Rectal (%)	Colon (%)	Recto-sigmoid (%)
Overall	41	42	41	40
A	75	71	76	92
B	57	58	57	59
C	35	34	37	27
D	12	8	14	10
Not known	16	20	18	0

[a] Data from Wessex Colorectal Cancer Audit, 1999.

Consequences of disease

As a consequence of disease, supportive care may be required to relieve symptoms, provide nursing care and alleviate distress. In addition, terminal care may be provided for patients where cure is not achieved.

4 Services available, volumes and costs

This section describes the range of services that may be provided for patients with colorectal cancer at present and identifies the HRGs which cover these interventions, and the costs and volumes of these services. At present, only some of these services can be specified in terms of an HRG code.

There are no specific services for the primary prevention or early detection of colorectal cancer in the general population in the UK. Surveillance is offered in some areas for patients identified as being at increased risk of developing colorectal cancer. Diagnostic methods include colonoscopy, sigmoidoscopy, barium enema, histological assessment of biopsies, ultrasound, computed tomography (CT) scanning, immunoscintology and magnetic resonance imaging (MRI).

Curative treatment includes surgery with or without adjuvant radiotherapy and chemotherapy, and routine follow-up. Palliative care to achieve symptom control may include surgery, radiotherapy and chemotherapy. Terminal care can be based in the hospital, hospice or home.

Primary prevention

Health promotion

Although direct causal relationships between lifestyle and the development of colorectal cancer are not clearly established, the relevant health promotion advice is provided by many districts (Table 7). Such advice is usually provided in the form of general lifestyle advice and is not specific to colorectal cancer risk (HRGs for primary prevention are not yet defined).

Table 7: Primary prevention advice.

Risk factor	Advice
Diet	Increase intake of fruit and vegetables
Alcohol	Decrease alcohol consumption
Tobacco smoking	Stop smoking
Sedentary lifestyle	Physical activity should be taken at least three times per week for a minimum of 20 minutes on each occasion (SHSAC, 1993)

Chemoprevention

There is some evidence that the regular use of non-steroidal anti-inflammatory drugs, including aspirin, may reduce the incidence of and mortality from colorectal cancer, however, there is no evidence on which to base an estimate of the frequency of advice to take, or prescription for aspirin, specifically to avoid colorectal cancer.

Early detection

Early detection of people at average risk

FOB testing and FS are the two most commonly advocated screening methods. General population screening for colorectal cancer is not currently offered within the NHS, but two trials of FOB and

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colonoscopy are about to be set up under the auspices of the UK National Screening Committee. At present, fewer than 5% of cases of colorectal cancer are detected by screening.

People at increased risk of colorectal cancer

Patients with a previous history of colorectal cancer, adenomas found symptomatically and ulcerative colitis are usually monitored routinely via colonoscopic surveillance. Although there are no agreed protocols, patients who are known to be at substantial risk because of a positive family history or genetic predisposition may be offered a range of services locally or regionally. These may include routine screening surveillance, genetic testing, genetic counselling and, in the case of FAP patients, prophylactic colectomy once multiple adenomas have developed.

Investigations and diagnosis

Misdiagnosis by the GP can lead to delay before the patient is referred for specialist investigation. The most common misdiagnosis is haemorrhoids, often as a result of inadequate investigations. MacArthur and Smith[31] reported delays of over 3 months before hospital referral. There is, however, no strong evidence that longer delay leads to poorer outcomes. Delays can occur at two other stages: first, delays before the patient consults the GP; and second, delays between GP referral and treatment. Macadam[32] reported delays of many weeks in 50% of patients before consulting their GP. Studies have reported that the main reason for patient delay is that they did not consider their symptoms to be serious.[32]

A patient suspected of having colorectal cancer will be referred to a surgeon for diagnostic investigation. A very small number (< 5%) will have been detected through screening. Of the remaining patients, 25–40% may present as an emergency,[33] although this was generally lower in the Wessex Colorectal Cancer Audit (average 20%).

Diagnosis

Symptomatic patients undergo a number of diagnostic investigations including colonoscopy, sigmoid-oscopy and double-contrast barium enema. Histological confirmation of the diagnosis is usually required before surgery. Patients with a diagnosis should undergo further investigation to provide information on cancer stage unless the findings are unlikely to influence management.[34] A number of techniques is used including ultrasound, CT scanning, immunoscintology and MRI. Patients who present as an emergency typically require urgent surgery and may have few investigations before proceeding to theatre.

Treatment services

Surgery

Surgery is the mainstay of treatment for the majority of patients. Between 70 and 90% with a diagnosis of colorectal cancer are considered suitable for surgical intervention, although in the Wessex Colorectal Cancer Audit the procedure was considered curative in only 47% of cases, the remainder were palliative or not stated. The proportion of patients presenting as an emergency is about 20%, but may be as low as 10%.[4] The chosen surgical procedure depends on two main factors: whether the patient presents electively or as an emergency and the position of the tumour in the bowel.

The numbers, rates and costs by HRG for patients with a primary or secondary diagnosis of colorectal cancer are shown in Table 8.

Table 8: Inpatient episodes for patients with malignancy of the colon/rectum in HRGs F31–F37 (1995–96 Hospital Episode Statistics, England).

		N (total cases in HRG)	N (diagnosis of malignancy)	N (diagnosis of malignancy/ million)	LOS (malignant)	LOS all cases	Elective cost/FCE (£)	Emergency cost/FCE (£)	Elective cost (£)/ million (80%)	Emergency cost (£)/ million (20%)
F31	Large intestine. Complex procedure	9,512	6,744	138	(16.9)	14.8	3,860	4,306	426,191	118,857
F32	Large intestine. Very major procedure	19,390	11,463	234	(15.2)	13.3	3,331	3,761	623,616	176,013
F33	Large intestine. Major procedure with cc	3,697	862	17.6	(16.4)	13.2	2,835	3,389	39,917	11,929
F34	Large intestine. Major procedure without cc	6,780	938	19	(14.11)	8.8	2,217	2,606	33,698	9,904
F35	Large intestine. Endoscopy	113,632	4,951	101	(0.1)	0.5	464	493	37,483	9,957
F36	Large intestine > 69 ir wcc	43,748	13,184	270	6.4	904	1,017	1,240	219,573	66,978
F37	Large intestine < 70 w/o cc	21,940	4,996	102	3.2	657	845	827	68,950	16,863
									1,449,428	410,500
									Total cost	£1,859,928

Costs derived from National Schedule of Reference Costs, 1998.[35]

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From national hospital data for England (HES 94/95) there are 86 237 finished (inpatient and daycase) consultant episodes (FCEs) for patients with a diagnosis of colorectal cancer. This is 1759 FCEs per million persons, or 3.2 FCEs per new patient with colorectal cancer per year. These consume 514 000 bed-days, which is equivalent to 10 500 bed-days per million or 19 bed-days per new colorectal cancer patient per year. Of these, about 30% (509 FCEs per million) are due to surgical procedures on the large bowel HRGs (F31–F35), the remainder are in medical or other procedure HRGs. These surgical HRGs, however, account for 61% of the bed-days (6405 bed-days per million) and, depending upon the number of repeat procedures (i.e. endoscopy, colectomy, colostomy, procedure, etc.), may represent procedures to about 90% of newly diagnosed cancers. These cannot be assigned to stages, but assuming an equal split of 80/20 for elective/emergency HRG costs, the total cost for surgical FCEs (F31–F35) is £1 487 565.

Some patients with metastatic colorectal cancer are suitable for resection of the deposits in the liver. The numbers of liver procedures for patients with a primary diagnosis of colorectal cancer are shown in Table 9. By using the reference costs for these HRGs, the cost of liver procedures can be estimated at £9337 per million persons.

Table 9: Liver procedures for patients with a diagnosis of colorectal cancer (1995–96 Hospital Episode Statistics).

	N	*N*/million	Cost/case (£)	Cost/million (£)
GO2 Complex	62	1.3	3,756	4,882.8
GO3 Very major	36	0.7	2,429	1,700.3
GO4 Major > 69 wcc	101	2.1	1,163	2,442.3
GO5 Major < 70 wocc	24	0.5	625	312.5
Total				£9,337.9

Thromboprophylaxis and antibiotic prophylaxis is usually used in patients who undergo colorectal surgery.

Of 4117 operated colorectal cancers in the Wessex Colorectal Cancer Audit, there were 1290 colostomies (31%) and 705 were permanent (17%). This represents 26 and 14% of all colorectal cancers, respectively. These patients require special support from a stoma nurse and the recurring cost of colostomy is estimated to be around £2000 per patient. This suggests a cost of about £150 000 pa per million.

Some patients may require palliative surgery to reduce symptoms. Local relapse following apparently curative resection of rectal cancer may occur in 20–45% of patients depending on the cancer stage (108–250 per million).[36] Most recurrences occur within 5 years of the initial treatment.

Radiotherapy

Radiotherapy can be used to treat rectal carcinomas. This may be pre-operative, post-operative, primary radical or palliative. There is no established role for adjuvant radiotherapy in the management of cancer of the colon.

Estimated volumes and costs of radiotherapy are given in Table 10. They are derived in the following way:

- **Pre-operative** radiotherapy is given to some patients with operable rectal cancers to shrink the tumour and enable it to be excised more readily and to prevent local recurrences, hence improving the chance of survival. Relevant HRG: W14 complex + imaging 4–12 fractions; estimated as 50% of A + B

Table 10: Estimated volumes and costs for radiotherapy for rectal cancer for a population of 1,000,000.

	Estimated rate	**No./million**	**HRG (cost)**	**Cost/million (£)**
Pre-operative	50% A+B	37	W14 (£1,058)	39,146
Post-operative	20% B+C	20	W15 (£1,902)	19,020
			W16 (£2,390)	23,900
Primary radical	20% C+D	13	W15 (£1,902)	12,363
			W16 (£2,390)	15,535
Palliative	20% C+D	13	W04 (£616)	4,004
			W03 (£200)	1,300
Total				115,268

Radiotherapy HRG costs from Northampton Acute Trust, 1997.[37]

- **Post-operative.** Between 10 and 20% of patients with rectal carcinomas undergoing curative surgery are given post-operative radiotherapy. This group consists mainly of patients with stage C or B tumours. Radiotherapy is used to contain local spread of the disease, particularly within the pelvis where the disease becomes particularly unpleasant and distressing if recurrent. Relevant HRGs: W15 complex + imaging 13–23 fractions; W16 complex + imaging 24 fractions; estimated as 20% of B + C
- **Primary** radical radiotherapy may be used in patients with inoperable rectal tumours or those with medical conditions that preclude them from surgery. Relevant HRGs: W15 complex + imaging 13–23 fractions; W16 complex + imaging 24 fractions; estimated as 20% of C + D
- **Palliative** radiotherapy is used to reduce symptoms in patients with locally advanced rectal cancer who have not previously undergone radiotherapy. Relevant HRGs: W04 simple, no simulator 4–12 fractions; W03 simple, no simulator 0–3 fractions; estimated as 20% of C+D.

Chemotherapy

Chemotherapy is recommended for those with Dukes' stage C colorectal cancer. It is not normally provided for patients with stage A disease, but may be considered for stage B colorectal cancer. Therefore, approximately 105 people per 1 000 000 may receive chemotherapy annually for colorectal cancer, however, there are few national data to confirm this. Depending upon the outcome of trials for stage B this may increase.

The usual regime is 5-fluorouracil and folinic acid (5-FUFA). HRGs for chemotherapy are not yet finalised but the draft grouping 'Simple, low cost' covers this regime. Costs for Northampton are estimated at £272 per patient.

Palliative

Chemotherapy may be given to patients with advanced or recurrent colorectal cancer for the palliation of symptoms. The mainstay treatment of palliative chemotherapy is 5-FU.

Because of the difficulties of identifying the diagnosis in statistical returns on chemotherapy courses, and the lack of information on outpatient activity, it is difficult to provide a useful estimate of chemotherapy costs for colorectal cancer.

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Follow-up

Most patients are followed up as outpatients at intervals ranging from every 3 months to yearly. Investigations performed may include one or a combination of the following: clinical examination, colonoscopy, FS, barium enema, FOB tests, serum carcinoembryonic antigen (CEA) tests, CT scan, chest X-ray, full blood count, liver ultrasound and liver function testing.[38] HRGs for outpatient visits are not yet finalised or costed.

Support services

Palliative care

Palliative care is defined as '. . . active total care offered to a patient with a progressive illness and their family when it is recognised that the illness is no longer curable, in order to concentrate on the quality of life and alleviation of distressing symptoms within the framework of a co-ordinated service.'[39] Palliative care in general has been considered in detail in a separate chapter of the Needs Assessment Reviews.[40] The discussion here focuses mainly on the issues in relation to colorectal cancer, but the design and delivery of palliative care services need to be considered in relation to all patients requiring such care.

A wide range of palliative care services is usually available locally including specialist palliative care services, such as hospices and mobile palliative care teams, and general services, including primary and hospital care. Voluntary and local authority services also continue to play a large role.

Previous studies of symptom frequency in those with terminal illness suggest that within a population of 1 000 000 people, 270 have pain, 151 have trouble breathing and 164 have symptoms of vomiting or nausea that require treatment. Most colorectal cancer patients with terminal illness usually experience more than one symptom.[40] Cancer patients have been shown to have a higher prevalence of anxiety and depression than the general population.[40] Approximately 106 family members and 80 patients per 1 000 000 may exhibit severe anxiety, fears or worries. These people may need access to more specialist services.

A preliminary estimate of the desirable level of costs of palliative care has been made by the National Council for Hospice and Specialist Palliative Care Services (Table 11). (These are based on policy guidance and represent desired levels of provision rather than actual. It is likely that this overestimates costs in most districts.) These are very preliminary estimates, which will be refined over time, but they provide an initial view of the likely costs. These are based on annual deaths of 2800 per million and therefore are adjusted pro rata to estimate for the 320 deaths per year from colorectal cancer.

Table 11: Target level of resourcing for palliative services.

	Total cost/million (£)	Colorectal cost/million (£)
Community specialist palliative care team	850,000	97,100
Specialist palliative day care	1,000,000	114,300
Hospital palliative care teams	500,000–2,500,000	57,000–285,700
Specialist palliative inpatient care	3,800,000	434,300
Total		554,000–703,000

The Glasgow pilot of HBGs and HRGs for colorectal cancer

This section draws on the experience of Greater Glasgow Health Board (GGHB) who acted as a pilot site for sets of matrices covering three cancer sites including breast, lung and colorectal cancer between October 1996 and June 1997.[41] The summary matrix for colorectal cancer (adjusted for a population of 1 000 000) is shown in Table 12. It illustrates the total costs for a population of 1 000 000 and is based on the detailed matrices in Appendix IV.

Table 12: Colorectal cancer matrices from Glasgow exercise per 1,000,000 population.

Summary matrix	Promotion and primary prevention	Investigation and diagnosis	Initial care	Continuing care	Total
At risk	£106,980				
Presentation		£41,668	£371,200		
Confirmed disease			£3,749,676		
Continuing disease states				£?	
Total					£4,269,523

At present, HRG costs are only available for some services and interventions related to colorectal cancer. Where these are available they have been included in the matrices and in their absence, they have been completed using a variety of sources including price tariffs for GP fundholders, cost data from resource management departments and average specialty costs from routine financial returns. Given local variations, all cost data should be interpreted with caution.

When this pilot was carried out, Matrix 4 was concerned with the care of patients from palliation and supportive services. During the pilot, no information was available on the need for such services by patients with colorectal cancer in the GGHB area and this matrix was not completed. The summary matrix provided in Table 14 covers only the first three matrices

5 Effectiveness of services and interventions

This section summarises the available evidence of the effectiveness and cost-effectiveness of services for colorectal cancer.

Primary prevention

Health promotion

There is a paucity of evidence on the effectiveness and cost-effectiveness of most health promotion activities, including lifestyle advice relevant to the prevention of colorectal cancer. Observational and correlation studies provide some support for reductions in colorectal cancer incidence due to lifestyle changes. However, given the complexity of the causal chain linking primary prevention to such reductions,

it is difficult to be sure that the observed changes in health status are the result of a particular intervention under study.[42]

Chemoprevention

Evidence on the effectiveness of aspirin as a chemopreventive agent is equivocal with supporting evidence coming from nine observational studies[43–51] and negative evidence from one cohort,[52,53] one case–control[54] and one randomised trial.[55] Supporting observational studies have suggested that regular low-dose aspirin use correlates with a reduction in colorectal cancer risk of between 40 and 50%. Given the relatively low cost of aspirin and the potential health benefit, this issue should be kept under review.

Early detection

Early detection of people at average risk

There is interest in population screening for colorectal cancer, however, the supporting evidence on the effectiveness and cost-effectiveness of the available options is limited. The results of two recent randomised controlled trials of FOB screening have reported reductions in mortality from colorectal cancer of between 15 and 18% (UK and Danish studies respectively).[56,57] Estimates of the cost per Quality Adjusted Life Year (QALY) from the UK trial show FOB screening to be of similar cost-effectiveness to screening for breast cancer.[58] A multicentre trial is currently underway in the UK to assess the effectiveness and cost-effectiveness of once-only FS screening for colorectal cancer and two pilot studies of FOB and colonoscopy will be initiated early in 2000.[59]

Observational studies suggest that FS may be a more effective screening test then FOB testing. Case–control studies have suggested that it can reduce mortality from colorectal cancers by 60–80%.[60,61] However, it is likely that these figures over-estimate the benefits given the biases inherent in observational studies.

Compliance with colorectal cancer screening protocols has been poor in UK trials to date and remains a concern of those interested in population screening. In the FOB testing trial 57% of participants completed at least one screening but only 38% completed all the FOB tests they were offered.[62] Initial results available from one centre involved in the FS trial indicate a compliance rate of 44%,[62] but more recent studies suggest that compliance rates of around 60% can be achieved.[59]

Early detection of people at increased risk from colorectal cancer

There are inadequate data from well-designed clinical trials to demonstrate the effectiveness and thus cost-effectiveness of surveillance protocols for people known to be at increased risk from colorectal cancer.

In patients in whom polyps have been identified, their removal and histological assessment is common.[63] There are no data as to the appropriate management of patients with small polyps not amenable to removal. One trial demonstrated that 3-year colonoscopic surveillance can be as effective as annual follow-up.[64] There is also some evidence that surveillance may only be justified in patients with tubovillous, villous or large adenomas in the rectosigmoid.[65]

There are few effectiveness data supporting reduced morbidity or mortality from routinely screening HNPCC patients. Some studies have suggested that prognosis can be improved in carriers but it is unclear whether this observation is due to surveillance or some other artefact (e.g. earlier diagnosis, longer lead time, improved awareness of signs and symptoms of disease).[66–68]

It is argued that surveillance screening of FAP patients is justified by studies comparing the incidence of malignancies in symptomatic patients with lower rates in asymptomatic cases.[69] However, no evaluations are cited in the literature to date. Once multiple adenomas have developed in these patients the recommended curative treatment is colectomy.[70,71]

Direct evidence of benefit from routine surveillance of patients at increased risk because of a positive family history is also weak. Several studies have demonstrated an increased prevalence of polyps in relatives over controls,[72,73] however, the link to final health outcome is not established.

Routine surveillance of patients with diseases associated with increased risk of developing colorectal cancer (e.g. ulcerative colitis, Crohn's disease) is recommended by the British Society of Gastroenterology. However, as before, there is a lack of documented evidence of health benefit in such patients.

Investigations and diagnosis

Referrals

There is evidence of delays in patient referrals at three stages from the onset of symptoms: first, delays before consulting the GP; second, delays before patients are referred for specialist treatment; and third, in some cases there may be delays from the time of referral until diagnosis and treatment.[32,33,69,74–79] A recent review of the research evidence concluded that there is little to suggest that such delays affect outcomes.[29,32,74,77,80–82]

Diagnosis

The main diagnostic methods, colonoscopy, sigmoidoscopy and double-contrast barium enema, are reported to have similar costs and effectiveness when the latter are used in combination.[83–85] Some studies show that effectiveness improves with operator practice.[86–88]

There is a lack of evidence on the effectiveness and cost-effectiveness of other techniques used (ultrasound, CT scanning, immunoscintology and MRI) in the diagnosis of colorectal cancer.

Treatment

Surgery

Patients undergoing surgery have an estimated average survival of 3 years. However, 5-year survival is dependent upon stage at diagnosis, but after that time the survival curve is no different to that of the rest of the population.

Specialisation

Depending on local provision, surgery may be performed by specialist surgeons or by surgeons with no specialist interest in colorectal surgery. Several observational studies have revealed substantial variations between surgeons in terms of their patient outcomes.[89–100] Such observations are reported to remain after case-mix, skill of the surgeon and chance variations are taken into account.[34] However, a review of the evidence that specialisation and increased patient volume improves outcomes concluded that the available research evidence is contradictory.[15]

Technique

Survival chances are better in patients with rectal cancer when the tumour is removed completely. There is some evidence from non-randomised studies that total mesorectal excision (TME), a surgical technique in which great care is taken to remove all the tissue around the tumour, improves survival and reduces local recurrence rates. It is, however, a longer procedure requiring more theatre time, hospital bed-days and in some cases a temporary stoma.[101,102] The relative cost-effectiveness of this procedure has not been assessed formally, thus it is not clear that the potential for improved outcomes justifies the required increased resource use. A recent systematic review concluded that 'randomised controlled trials, perhaps comparing total mesorectal excision with conventional surgery plus radiotherapy is required . . .'.[16]

Prophylaxis

A review of randomised trials of antimicrobial prophylaxis concluded that it is effective for the prevention of infections in patients who undergo colorectal surgery.[103] Surgical wound infection rates in control patients ranged from 32 to 58% compared with a pooled figure of 11.1% for patients given antimicrobial prophylaxis. It is not possible to identify the most effective regimen.[16] The Antiplatelet Trialists' Collaboration reported a reduction in the risk of deep vein thrombosis with antiplatelet therapy from 33.6 to 24.8%. The odds of pulmonary embolism were also lower with therapy (1.0% vs. 2.7%).[104]

Patients presenting electively have a higher chance of survival than emergency admissions.[4,90,92–94,97,105] However, a recent review concluded that it is not clear how such emergency admissions can be avoided or outcomes improved.[34]

Radiotherapy

Data from randomised trials demonstrate that adjuvant radiotherapy can reduce local recurrence in patients with operable rectal cancer, however, there is a lack of economic analysis in this area.

Pre-operative

Evidence from meta-analyses (carried out by the Colorectal Cancer Collaborative Group) of pre-operative radiotherapy trials provides strong evidence that local recurrence among patients undergoing curative surgery for rectal tumours can be reduced by about 50%.[16] Only a small reduction in overall mortality (4%) was found, however, there were significantly fewer deaths from colorectal cancer in the pre-operative radiotherapy group.[16] The Scottish Intercollegiate Guidelines Network (SIGN) guidelines on colorectal cancer also reviewed the existing randomised trials. They concluded that pre-operative radiotherapy should be given to patients who are considered operable but have tethered rectal cancers.[69,106,107]

Post-operative

A meta-analysis of the results from six randomised trials provides evidence of a 33% reduction in local recurrences with post-operative therapy (stage B and C rectal tumours). As with pre-operative radiotherapy, only a very small overall survival advantage is observed.[16]

Pre-operative vs. post-operative

The Colorectal Cancer Collaborative Group's meta-analysis provides evidence of reduced local recurrences and moderately improved survival in patients receiving pre-operative as opposed to post-operative

radiotherapy.[16] This finding is also supported by a study which directly compared pre-operative and post-operative radiotherapy and found that there were fewer recurrences among curatively resected patients with a 1-week pre-operative regime than with a 6-week post-operative regime.[108] However, after a systematic review of the research evidence the SIGN guidelines were unable to reach a conclusion on this issue.

Primary

Primary radical radiotherapy has been shown to be an effective treatment for patients with inoperable rectal tumours or those with medical conditions precluding them from surgery. One study found that small tumours were likely to regress following radiotherapy. Larger tumours were rendered either operable or regressed sufficiently to allow relief from symptoms.[109]

Palliative

Two studies reported subjective improvement of symptoms in 80–90% of patients with presacral recurrences after radical surgery and no prior radiotherapy.[110,111]

Chemotherapy

Adjuvant

The effectiveness of adjuvant chemotherapy in Dukes' stage C colorectal cancers was assessed in a recent systematic overview of randomised trials. The pooled results of 25 studies evaluating prolonged (>3 months) systemic chemotherapy using 5-FUFA suggest an absolute increase in 5-year survival of 6% (range 2–10%).[16] The data reviewed in this area often come from trials including patients with colon cancer only. Thus, there is less direct evidence for patients with Dukes' stage C rectal cancers. However, combined chemotherapy and radiotherapy has demonstrated a survival benefit in patients with Dukes' stage B and C rectal cancers than radiotherapy alone.[112]

There is a lack of relevant evidence to support the use of adjuvant chemotherapy in patients with Dukes' stage B colon or rectal cancer and these patients should be entered into clinical trials (e.g. the QUASAR study). The use of chemotherapy is not supported by the available evidence in patients with Dukes' stage A colorectal cancer.

There is no consensus as to the most effective chemotherapy regime. Current evidence suggests that the FUFA combination should be recommended but there is no evidence on which of the several FUFA regimens in use is optimal.[16] A 1-week post-operative infusion of 5-FU directly to the liver through the portal vein may reduce mortality by 12%, however, this technique requires further investigation before specific recommendations can be made (e.g. AXIS study).[16]

There is very little evidence on the cost-effectiveness of adjuvant chemotherapy in colorectal cancer patients. Two economic evaluations suggest that it may be relatively cost-effective in patients with Dukes' stage C cancers given intraportally or systemically.[113,114]

Palliative

Chemotherapy in advanced colorectal cancer can have substantial palliative benefit, however, supporting economic evidence is still lacking. Many studies have shown symptomatic benefits and two randomised controlled trials have demonstrated survival advantages of 5–6 months.[115,116] 5-FU remains the mainstay of treatment, however, the optimum regimen is unknown.

Palliative

There is very little research evidence available on the effectiveness and cost-effectiveness of different ways of providing palliative care services for patients with incurable colorectal cancer. Current evidence suggests that a mix of services is necessary and the views of patients and their families should be the main criterion for evaluation of this service. Townsend et al.[117] found that, in ideal circumstances, up to 70% of terminally ill patients would prefer to be cared for at home and for about one half of these patients the final choice was for home care, allowing for the pressure on carers as the illness progressed. Moreover, of those who finally died in hospital, 63% had stated a preference to die at home. A recent study found that as death approached, patients changed their preference for terminal care from hospital or home to hospice care.[118] Approximately 30% of cancer deaths included in the Regional Study of Care for the Dying died at home.[119]

Overall, there is very little evidence to support the use of conventional care alone, both hospital and community based.[120–125] The main problem of caring for terminally ill patients in a general hospital setting is felt to be the inevitable incompatibility between the demands of acute care and the needs of the terminally ill and their relatives for open-ended conversation and emotional support. Moreover, competing for resources with those who are curable may mean that terminally ill patients have less than adequate provision of care.

North American studies have suggested that the inpatient hospice model is at least as effective as conventional methods of inpatient care and the costs of hospice care are considered to be similar to conventional methods.[123,126–134] One American study found that hospice and specialist palliative care services used a higher number of nursing staff per patient than conventional care, but fewer procedures.[132] There is little evidence on costs or effectiveness from the UK.

There is evidence that specialist palliative care teams can provide more effective services than conventional care methods.[129,135–143] There is some weak evidence to suggest that delayed referrals to specialist palliative care services can increase the time spent in hospital by terminally ill colorectal cancer patients and lead to increased morbidity.[144,145] Home care teams have been shown to reduce the length of stay in hospital of terminally ill patients, some also demonstrating equal or reduced costs.[144,145] Several reports have recommended the use of multidisciplinary palliative care teams.[146,147]

There is very little comparative evidence for other palliative care services, such as hospital support services, day care, practical support and respite care and hospice at home.

Follow-up

The frequency and nature of follow-up varies widely and there is very little evidence on the benefits of specific and more intensive regimes. Hence, overall the majority of these services cannot be shown to be cost-effective at present.[148–156]

Summary of recommendations

Table 13 (*see* overleaf) provides a summary of the key recommendations for the provision of colorectal cancer services.

Table 13: Summary of recommendations.

	Strength of recommendation	Evidence
Primary prevention		
Health promotion advice	C	III/II
Chemoprevention	C	II
Early detection		
Population screening programme	B	I
Screening high-risk groups	C	III
Surgery		
Access to specialist surgeon	C	III
Radiotherapy		
Adjuvant radiotherapy	B	III
Primary radical	B	III
Palliative	B	III
Chemotherapy		
Adjuvant chemotherapy	A	I
Palliative	A/B	II/I
Follow-up		
Current provision	C	IV
Palliative care		
Specialist palliative care teams	B/A	II/I
Inpatient hospice facilities	B/A	II

See Appendix 5 for definitions.

6 Models of care

Structure of services for colorectal cancer

The recommendations of the Calman–Hine report[157] should form the basis of models of care for patients with colorectal cancer. The recommended structure is 'based on a network of expertise in cancer care reaching from primary care through Cancer Units in district hospitals to Cancer Centres'. Specialisation in cancer care is achieved via three levels of care:

- primary care
- the cancer unit
- the cancer centre.

Primary care must be the focus of care with effective communication taking place between primary care teams, cancer units and cancer centres. Designated cancer units should be available in most district general hospitals with a full range of supportive services. They should be able to support clinical teams with sufficient expertise and facilities to manage common cancers, including colorectal cancer. The unit should ensure close integration of primary and secondary care and the identification of appropriate rapid referral patterns for patients with symptoms indicating a high risk of malignancy. Designated cancer centres

should provide expertise in the management of all cancers, including referrals of more complicated common cancers from cancer units. They should provide specialist diagnostic and therapeutic techniques including radiotherapy.

The application of this model to colorectal cancer services is likely to concentrate the delivery of surgical and chemotherapy services within cancer centres, as well as requiring consideration of the organisation of colonoscopy and surveillance.

Options for colorectal cancer services

This section draws together the evidence on alternative treatments and interventions for colorectal cancer. Given that cancer treatment remains a high priority area for health care commissioners, it is assumed that the decision facing policy-makers is *how* to treat colorectal cancer rather than *whether* to treat.

The three main areas in which services for colorectal cancer could be extended are:

- primary prevention – by reducing exposure to factors thought to increase an individual's risk for colorectal cancer
- early detection – by introducing general population screening or screening sub-groups known to be at increased risk for colorectal cancer
- treatment – by treating symptomatic disease.

From these categories a list of service options can be drawn up. These include:

- faecal occult blood screening of the general population
- screening first-degree relatives of patients diagnosed with colorectal cancer
- once-only flexible sigmoidoscopy screening of the general population
- systematic follow-up of adenoma patients by endoscopy
- radiotherapy after supposedly curative surgical resection of rectal cancer
- chemotherapy after supposedly curative surgical resection of stage C colon cancer
- surgical resection of hepatic liver metastases for advanced disease.

Primary prevention interventions are not considered further in this section given the lack of direct evidence on the effectiveness of health promotion activities. While some estimates of effect exist, great uncertainty surrounds the costs of such activities and the timing of related health benefits.

The other main area excluded from analysis is the follow-up of patients who have had a supposedly curative resection and aggressive treatment of recurrence. Despite little evidence of effectiveness from randomised trials, this practice is widely established. The problem is in two stages: first, is it worth screening asymptomatic people for recurrence; and second, is it worth treating recurrence once it has been identified? The second issue is more complex because it requires an estimate of the numbers who will benefit and the extent of the benefit which is rarely reported. Another problem for evaluation in this area is that much of the benefit of follow-up may come from the reassurance provided merely by 'going through the motions' of the monitoring process. Thus, this area is not considered further other than to note the need for further research.

The evidence on the costs and benefits of each option is now considered in turn in order to produce some comparable data and attempt to rank interventions in terms of a common unit of effectiveness.

Faecal occult blood screening of the general population

The MRC trial of faecal occult blood screening for colorectal cancer in the general population reported a reduction in colorectal cancer mortality of 15% in the screened group. This screening trial was also the

subject of an economic evaluation lasting more than 10 years. The additional costs of the screening population were £3 058 016 per 100 000 population. When the results of the clinical paper were adjusted for a population of 100 000, the cost per life saved was £37 293.[56,58] The UK National Screening Committee (NSC) is sponsoring two sites to assess the feasibility, public acceptance and cost-effectiveness of colorectal cancer screening using FOB and colonoscopy for those with strong positive FOB tests and the results from this should be available by 2002. In the meantime, formal advice from the NSC is that no new screening programmes should be introduced pending the outcome of these pilot trials.

Screening first-degree relatives of patients diagnosed with colorectal cancer

There have been no randomised trials to establish the efficacy of screening the relatives of colorectal cancer patients. The following estimates are based on the data of Houlston *et al.*[72] In England and Wales, 664 cases of colorectal cancer occurred in patients aged less than 45, generating 2445 first-degree relatives (60% parents, 40% siblings). These people would undergo colonoscopic surveillance every 5 years, except for those in whom adenomas are detected and who would be screened every 3 years (11%). Assuming an average life expectancy of 40 years for siblings and 15 years for parents, a total of 13 122 colonoscopies would be required costing a total of £3.5 million. It is estimated that screening would detect 244 cases of colorectal cancer. Of these, only 65% would represent lives saved since a proportion would undergo curative resection even if presenting symptomatically. Thus, 159 lives would be saved at a cost per life saved of £22 090. These estimates do not consider the costs of identifying, contacting and counselling relatives, however, these are likely to be small relative to the costs of investigation. The figures also assume 100% compliance and no net effects on treatment costs.

Once-only flexible sigmoidoscopy screening of the general population

There is no randomised trial evidence on the efficacy of screening for colorectal cancer by once-only FS although a multicentre trial is now underway in the UK. The following calculations are based on a national screening programme consisting of a single FS at age 58 and colonoscopic surveillance for those found to have high-risk adenomas. A screening interval of 5 years is assumed and three screening rounds are built into the following calculations. There are about 600 000 people aged 58 years in the UK. Assuming 45% compliance, it would cost approximately £60 million to offer the screening to the entire population (FS, £179; colonoscopy, £267; histological assessment of one polyp, £33). Based on the calculations of Atkin *et al.*,[158] adjusting for a compliance of 45%, it is estimated that 2249 colorectal cancer deaths would be prevented. This equates to a cost per life saved of £26 814.

Systematic follow-up of adenoma patients by endoscopy

One evaluation found that 25% of the total costs of a screening programme were due to adenoma follow-up demonstrating the potential significance of this intervention.[159] However, there is no randomised trial evidence on the health gain of adenoma follow-up by any protocol. Ransohoff *et al.*[160] calculated that 226 colonoscopic investigations would have to be carried out in order to save one life. This calculation was based on 5-yearly colonoscopy follow-up of a 50-year-old man who had had an adenoma excised. This protocol was estimated to avert around 75% of the colorectal cancer deaths which would have resulted from recurrence. Assuming the cost of colonoscopy is £267, the cost per life saved is £60 342.

Radiotherapy after supposedly curative surgical resection of rectal cancer

A recent meta-analysis concluded that only a small overall survival advantage is observed in patients receiving post-operative radiotherapy.[16] Assuming that 10 000 cases of rectal cancer are diagnosed each

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year and that 61% are at stages B and C, 6100 patients are eligible for post-operative radiotherapy. It is assumed that a fraction costs £100 on an outpatient basis and that each patient receives 20 fractions. The other costs associated with treatment such as the simulator, planning sessions and clinic visits are assumed to cost £1000 per patient. About 10% of patients suffer an adverse reaction to therapy requiring a 5-day stay in hospital at a cost of £127 per day. The total cost for 6100 patients would be around £18.7 million and an additional 610 lives would be saved. Thus, the cost per life saved is £30 635.

Chemotherapy after supposedly curative surgical resection of stage C colon cancer

Adjuvant chemotherapy in Dukes' stage C colonic cancers was estimated to reduce mortality by around 6%. Approximately 4400 patients are diagnosed with stage C colon cancer each year. The cost of one cycle of chemotherapy on a daycare basis is £319 and an average of eight cycles per patient is assumed. Approximately 30% of patients experience side-effects requiring inpatient admission. The same cost and length of stay assumptions are used as for radiotherapy above. The total cost of treatment is around £15 000 000 and an additional 270 lives would be saved. The cost per life saved is £56 342.

Surgical resection of hepatic liver metastases for advanced disease

Expert opinion suggests that 5% of cases of metastatic colorectal cancer could be cured as a result of resection if guidelines for case selection were carefully adhered to. Each year, 6714 patients present to the health service with advanced colorectal cancer. The mortality rate in these patients following initial admission is 31% and these patients are not considered further.[166] Those who survive will undergo a CT scan to establish the extent of their disease and 5% of these will be eligible for surgical resection. The operation lasts around 4 hours and results in an inpatient stay of 15 days. Theatre time is assumed to cost £5.55 per minute and the same assumptions are made about the costs of an inpatients stay as for radiotherapy and chemotherapy above. The total cost of treatment is approximately £1.7 million and if 20% of those undergoing surgery are cured, 46 lives are saved; the cost per life saved is £36 385.

Summary

The above results are drawn together in Table 14.

Table 14: Cost per life saved for alternative interventions in colorectal cancer.

Intervention	Cost per life saved (£)
Screening first degree relatives	22,090
Flexible sigmoidoscopy screening	26,814
Post-operative radiotherapy for rectal cancer	30,635
Resection of liver metastases	36,385
Faecal occult blood screening	37,293
Chemotherapy for colon cancer	56,342
Adenoma follow-up	60,342

Limitations

Given the poor quality of some of the underlying evidence, the results of this exercise must be interpreted with caution by health care commissioners. Potential users of the information must make a judgement about the quality of this data and, in particular, whether it is strong enough for them to base their decisions on. The cost data are particularly difficult to assess, since local cost variations may be substantial and might have an effect on the ranking of these options. Over the next few years costing information should become more reliable and inclusive, and it may then be possible to assess the costs per life saved better.

Some would argue that the measure of effectiveness applied, i.e. lives saved, is unsatisfactory since it does not consider the length of life gained. The application of this unit of outcome implies that saving the life of a 40-year-old has the same value as saving the life of an 80-year-old, a value judgement that many would disagree with. However, the affected age group is relatively homogenous and such comparisons do have some value. To the extent that this is an important issue, it could be argued that it supports the above ranking since the younger age groups are the ones who will tend to benefit most from screening programmes.

Quality of life considerations are also omitted from the above calculations. However, an examination of the evidence for colorectal cancer appears to broadly confirm the findings of a study of the breast screening literature which concluded that quality-adjustment of life-year gains made little difference to rankings based life-year gains alone.[162] The main concern regarding quality of life in colorectal cancer treatment relates to adjustment to a colostomy. However, a study of the post-operative life of such patients found them 'normal' on a variety of indicators.[163] Only during the terminal stages of disease are the effects likely to be so unpleasant as to be important. This stage of disease is often short for many patients such that lives saved may form a reasonable basis for comparing the costs and benefits of alternative interventions.

7 Outcome measures

'The New NHS' White Paper provides six principles which underlie the proposed changes. This section outlines the way in which these principles can be used to assess the performance of the NHS in relation to colorectal cancer services by adopting the proposed National Performance Framework. It is designed to support the broader goals highlighted by the White Paper and focus on the results achievable by the health service in a way which is meaningful to all parties concerned.

The six areas of the proposed new performance framework are:

1   health improvement
2   fair access
3   effective delivery of appropriate health care
4   efficiency
5   patient/carer experience
6   health outcomes of NHS care.

Table 15 (*see* overleaf) shows how colorectal cancer could be assessed against each of the six areas.

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Table 15: Potential performance indicators in colorectal cancer.

Areas	Performance indicators
Health improvement	Standardised mortality ratios
Fair access	Waiting times
Effective delivery of appropriate health care	
Known to be effective	Percentage of patients receiving appropriate treatments
Appropriate to need	Standardised treatment rates by type
	Terminal care
Timeliness	*Stage at diagnosis*
Service organisation	Implementation of Calman–Hine recommendations
Efficiency	Unit costs of care Cost per HRG
Patient/carer experience	Waiting times from initial consultation and access to specialist services
	Waiting times from referral to time test results available
	Waiting times from diagnosis to treatment
	Patient anxiety (during diagnosis, treatment, terminal care and follow-up)
	Patient satisfaction with information provision/ involvement in care/dignity in terminal care/symptom control/outcome
	Reassurance (e.g. high-risk patients)
	Complaints
Health outcomes of NHS care	
NHS success in reducing levels of risk	*Percentage of population adopting low-risk behaviours (e.g diet)*
	Early detection of risk (?)
	Genetic counselling (?)
NHS success in reducing level of disease, impairment and complications of treatment	Cancer registrations
	Asymptomatic cancers detected at an early stage
	Incidence of avoidable complications (e.g. recurrence, distant metastases, complications of treatment)
	Percentage of patients requiring colostomy
NHS success in restoring function and improving quality of life of patients/carers	*Measurement of physical and mental health status using appropriate measure*
NHS success in reducing premature death	5-year survival
	5-year survival standardised for age and stage

Italics indicate where new data would need to be collected.

8 Information and research requirements

Data requirements

The data requirements of the proposed National Performance Framework (*see* Section 6) are considerable and, if implemented fully, would require the collection of a considerable amount of new data. These data would include:

- stage at diagnosis
- 5-year survival standardised for age and stage
- percentage of asymptomatic cancers detected at an early stage
- incidence of avoidable complications
- percentage of patients requiring colostomy
- percentage of patients adopting low-risk behaviours
- early detection of risk
- provision of genetic counselling
- measurement of physical and health status
- patient anxiety
- patient satisfaction
- provision of reassurance
- number of complaints.

Every region has a cancer registry providing information on the incidence and mortality from colorectal cancer. The introduction of the collection of the above data, in particular stage at diagnosis, will increase the potential uses of this disease register.

The experience of the patient and carer(s) is, of course, of paramount importance. In a population of 1 000 000, there are 543 new cases of colorectal cancer per year; 309 of these are terminal. Colorectal cancer is, therefore, a major cause of mortality and morbidity in patients, and the cause of considerable morbidity for family members and carers. Commissioners of cancer services should ensure the collection of appropriate data to ensure the experience of the patient and carer(s) is the best possible.

The role of HBGs in decision-making

HBGs have been developed by the National Case-mix Office as a means of bringing together information on the patient, the services used, costs and (eventual) outcomes. The sections above demonstrate how they might be used in a needs assessment of colorectal cancer; demonstration projects involving other diseases and client groups have also been carried out.

However, further work is required to identify their optimal role in commissioning decisions. For example, the level of detail and amount of effort devoted to the matrices still needs to be determined in order to provide an appropriate balance between the cost of the information and it's value in supporting decisions. Another issue is how to achieve consistency and accuracy in data quality so that HBGs can be used in comparisons between the services provided to different populations.

The development of clinical information systems and the electronic patient record should address many of these issues, however, flows of reliable patient-based information that can be used for planning and monitoring will take a number of years to establish.

A model of the natural history of disease

Observational studies and clinical trials have revealed data on the natural history of colorectal cancer that is potentially useful in planning decisions in general and in the design of research programmes in particular. However, these data have not been systematically assembled, evaluated, graded and combined into a model for general use.

For example, data collected during the MRC trial of population screening by FOBT could be used to estimate key parameters in the natural history of adenomas and cancer. If this data were assembled into a model then subsequent screening trials, such as the evaluation of FS screening, could have been designed to maximise the efficacy of the intervention. Similar arguments apply to the treatment of symptomatic disease. Variations in medical decision-making create 'natural experiments' which can give hints (no more than this) about the way disease progresses. Models of this type would allow the effects of proposed trial protocols to be simulated and revised; the findings of the trial could then be used to validate the model.

The result would be a powerful tool for planning and treatment decision-making.

Effectiveness and efficiency

This report has highlighted the lack of information about the clinical and cost-effectiveness of services for patients with colorectal cancer. There is a dearth of information on the relative costs and benefits of preventive activities, screening of average and high-risk individuals, radiotherapy and chemotherapy; the shortage is especially notable in palliative care services, follow-up of treated cases and options for genetics services. More research is needed into the efficacy and cost-effectiveness of the current practice of regular follow-up of patients with a history of colorectal cancer. At present there is a lack of evidence that follow-up is effective in detecting disease recurrence at an earlier stage or reduces disease specific mortality. Likewise further research is required on the relative costs and benefits of different methods of providing palliative care services. It is essential that the needs and opinions of both patients and carers are taken into account. There are many uncertainties about the clinical and cost-effectiveness of proposals for the organisation of colorectal cancer genetics services. Recommendations have been made in some areas but these are not strongly supported by the existing evidence base. The economic analysis provided in Section 5 of this report is a first attempt to rank selected interventions in terms of a common unit of effectiveness. However, the limitations of this exercise must be noted and commissioners must interpret the results with caution.

Implications of cancer genetics for colorectal cancer services

In recent years, there has been an increase in the number of individuals seeking advice about the risks of developing cancer against the background of their family history. This demand is likely to grow given the ever increasing publicity in the medical literature and popular press. Current services are unco-ordinated and vary from region to region. There are no agreed protocols for determining the level of individual risk or the management of those considered to be at medium or high risk. Health care commissioners need to determine how they are going to respond to the growing demand for colorectal cancer genetic services in their area.

A report by the Genetics Sub-Committee of the Priority Areas Cancer Team in Scotland[164] states that there are three possible options:

- maintain the current fragmented service
- population screening to identify patients at risk
- develop a system of screening patients at relatively high risk of developing colorectal cancer.

Current evidence suggests that the third option of a selective approach to screening may be the most cost-effective solution since the incidence of these cancers is very small in the general population. It suggested that the basic aims of genetic services for people concerned about colorectal cancer should be:

- to provide advice and counselling about familial risks
- to identify those who are at medium or high risk on the basis of their family history
- to establish effective screening protocols for the management of these patients.

This report stresses that successful implementation of proposals for colorectal cancer genetic services will require close co-operation between all the parties involved – primary care, genetics clinics and those providing the screening services. The initial point of contact for many individuals concerned about familial cancer risk is primary care. Clinics should provide guidance for primary care staff to assist them in assessing patient risk. Individuals considered to be at medium or high risk should be referred to genetics clinics for a more detailed risk assessment. Agreement is also required on the appropriate screening protocols for individuals at medium and high levels of risk.

The report goes on to define medium-risk individuals as those at three times the population risk and suggests that they should be referred to the relevant cancer unit for surveillance in line with agreed protocols. High-risk individuals are defined as those at over three times the population risk and recommend that they be seen by the cancer genetics co-ordinator for appropriate counselling and DNA testing where a disease-specific mutation has been identified in the family.[164]

Cancer registries

Cancer registers contain valuable information about the incidence and prevalence of malignant disease in the population. However, the failure of registers to be linked into routine health service activity data has greatly limited the application of this information for practical planning and monitoring. Within the new information strategy, effort will need to be put into practical linkage of clinical information to registries, so that an accurate picture of the clinical condition of individuals and their treatments can be collated, and used for analysis. To achieve this requires a solution to the issues of confidentiality and the use of named data, and greater consistency and accuracy of clinical record keeping. This is particularly the case in the collection of staging information, which is often inadequately recorded in the patients notes.

While much of this work will be carried out centrally, local organisations (both providers and commissioners) will need to develop better linkages of information systems, provide appropriate incentives to ensure accurate and timely data, and invest in the informatics skills required to turn the raw patient-based data into useful information. This will require investment, but offers a way to improve the efficiency, effectiveness and equity of services. In addition, the proposed collection of a minimum data set by hospices will provide much needed data on the numbers and types of patients receiving hospice based palliative care.

Cancer trials

As noted in this chapter, there are still unanswered questions about the most effective forms of prevention, early detection, treatment and palliative care for patients with colorectal cancer. Commissioners of health care services should ensure that relevant clinical trials are supported as part of the framework of long-term agreements.

Appendix I. Codings and classifications relevant to colorectal cancer

Diagnosis codes relevant to colorectal cancer (ICD 10)

C180   Mal. neop – Caecum.
C182   Mal. neop – Ascending colon.
C183   Mal. neop – Hepatic flexure.
C184   Mal. neop – Transverse colon.
C185   Mal. neop – Splenic flexure.
C186   Mal. neop – Descending colon.
C187   Mal. neop – Sigmoid colon.
C188   Mal. neop – Overlapping lesion of colon.
C189   Mal. neop – Colon, unspecified.
C19X   Mal. neop – Rectosigmoid junction.
C20X   Mal. neop – Rectum.
C218   Overlapping lesion of rectum, anus and anal canal.

Procedure codes relevant to colorectal cancer (OPCS 4)

H041   Panproctocolectomy and ileostomy.
H042   Panproctocolectomy and anastomosis of ileum to anus and create pouch hfq.
H043   Panproctocolectomy and anastomosis of ileum to anus nec.
H048   Total excision of colon and rectum OS.
H049   Total excision of colon and rectum unspecified.
H051   Total colectomy and anastomosis of ileum to rectum.
H052   Total colectomy and ileostomy and creation of rectal fistula hfq.
H053   Total colectomy and ileostomy nec.
H061   Extended right hemicolectomy and end-to-end anastomosis.
H062   Extended right hemicolectomy and anastomosis ileum to colon.
H063   Extended right hemicolectomy and anastomosis nec.
H064   Extended right hemicolectomy and ileostomy hfq.
H068   Extended excision of right hemicolon OS.
H069   Extended excision of right hemicolon unspecified.
H071   Right hemicolectomy and end-to-end anastomosis ileum to colon.
H072   Rightt hemicolectomy and side-to-side anast ileum to transverse colon.
H073   Right hemicolectomy and anastomosis nec.
H074   Right hemicolectomy and ileostomy hfq.
H078   Other excision of right hemicolon OS.
H079   Other excision of right hemicolon unspecified.
H081   Transverse colectomy and end-to-end anastomosis.
H082   Transverse colectomy and anastomosis of ileum to colon.
H083   Transverse colectomy and anastomosis nec.
H084   Transverse colectomy and ileostomy hfq.
H085   Transverse colectomy and exteriorisation of bowel nec.
H088   Excision of transverse colon OS.
H089   Excision of transverse colon unspecified.
H091   Left hemicolectomy and end-to-end anastomosis colon to rectum.
H092   Left hemicolectomy and end-to-end anastomosis colon to colon.

H093   Left hemicolectomy and anastomosis nec.
H094   Left hemicolectomy and ileostomy hfq.
H095   Left hemicolectomy and exteriorisation of bowel nec.
H098   Excision of left hemicolon OS.
H099   Excision of left hemicolon unspecified.
H101   Sigmoid colectomy and end-to-end anastomosis ileum to rectum.
H102   Sigmoid colectomy and anastomosis of colon to rectum.
H103   Sigmoid colectomy and anastomosis nec.
H104   Sigmoid colectomy and ileostomy hfq.
H105   Sigmoid colectomy and exteriorisation of bowel nec.
H108   Excision of sigmoid colon OS.
H109   Excision of sigmoid colon unspecified.
H111   Colectomy and end-to-end anastomosis of colon to colon nec.
H112   Colectomy and side-to-side anastomosis of ileum to colon nec.
H113   Colectomy and anastomosis nec.
H114   Colectomy and ileostomy nec.
H115   Colectomy and exteriorisation of bowel nec.
H118   Other excision of colon OS.
H119   Other excision of colon unspecified.
H121   Excision of diverticulum of colon.
H122   Excision of lesion of colon nec.
H123   Destruction of lesion of colon nec.
H128   Extirpation of lesion of colon OS.
H129   Extirpation of lesion of colon unspecified.
H131   Bypass of colon by anastomosis of ileum to colon.
H132   Bypass of colon by anastomosis of caecum to sigmoid colon.
H133   Bypass colon by anastomosis of transverse colon to sigmoid colon.
H134   Bypass of colon by anastomosis of transverse colon to rectum.
H135   Bypass of colon by anastomosis of colon to rectum nec.
H138   Bypass of colon OS.
H139   Bypass of colon unspecified.
H141   Tube caecostomy.
H142   Refashioning of caecostomy.
H143   Closure of caecostomy.
H148   Exteriorisation of caecum OS.
H149   Exteriorisation of caecum unspecified.
H151   Loop colostomy.
H152   End colostomy.
H153   Refashioning of colostomy.
H154   Closure of colostomy.
H155   Dilation of colostomy.
H156   Reduction of prolapse of colostomy.
H158   Other exteriorisation of colon OS.
H159   Other exteriorisation of colon unspecified.
H161   Drainage of colon.
H162   Caecotomy.
H163   Colotomy.
H168   Incision of colon OS.

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H169 Incision of colon unspecified.
H181 Open colonoscopy.
H188 Open endoscopic operations on colon OS.
H189 Open endoscopic operations on colon unspecified.
H198 Other open operations on colon OS.
H201 Fibreoptic endoscopic snare resection of lesion of colon.
H202 Fibreoptic endoscopic cauterisation of lesion of colon.
H203 Fibreoptic endoscopic laser destruction of lesion of colon.
H204 Fibreoptic endoscopic destruction of lesion of colon nec.
H208 Endoscopic extirpation of lesion of colon OS.
H209 Endoscopic extirpation of lesion of colon unspecified.
H218 Other therapeutic endoscopic operations on colon OS.
H219 Other therapeutic endoscopic operations on colon unspecified.
H221 Diagnostic fibreoptic endoscopic examination of colon and biopsy lesion of colon.
H228 Diagnostic endoscopic examination of colon OS.
H229 Diagnostic endoscopic examination of colon unspecified.
H231 Endoscopic snare resect lesn lower bowel use fibreoptic sigmoidoscope.
H232 Endoscopic cauterisation lesion lower bowel using fibreoptic sigmoidoscope.
H233 Endoscopic laser destruct lesn low bowel using fibreoptic sigmoidoscope.
H234 Endoscopic destruct lesn lower bowel using fibreoptic sigmoidoscope nec.
H238 Endoscopic extirp lesion lower bowel using fibreoptic sigmoidoscope OS.
H239 Endoscopic extirp lesion lower bowel using fibreoptic sigmoidoscope US.
H248 Other therap endos ops lower bowel using fibreoptic sigmoidoscope OS.
H249 Other therap endos ops lower bowel using fibreoptic sigmoidoscope US.
H251 Diagnostic endoscopic exam low bowel and biopsy lesn use fibreoptic sigmoidoscope.
H258 Diagnostic endoscopic exam low bowel using fibreoptic sigmoidoscope OS.
H259 Diagnostic endoscopic exam low bowel using fibreoptic sigmoidoscope US.
H261 Endoscopic snare resect lesn sigmoid colon using rigid sigmoidoscope.
H262 Endoscopic cauterisation lesn sigmoid colon using rigid sigmoidoscope.
H263 Endoscopic laser destruct lesn sigmoid colon using rigid sigmoidoscope.
H264 Endoscopic cryotherapy lesion sigmoid colon using rigid sigmoidoscope.
H265 Endoscopic destruct lesion sigmoid colon using rigid sigmoidoscope nec.
H268 Endoscopic extirp lesion sigmoid colon using rigid sigmoidoscope OS.
H269 Endoscopic extirp lesion sigmoid colon using rigid sigmoidoscope US.
H278 Other therap endos ops sigmoid colon using rigid sigmoidoscope OS.
H279 Other therap endos ops sigmoid colon using rigid sigmoidoscope US.
H281 Diagnostic endoscopic exam sigmoid colon and biopsy lesion using rigid sigmoidoscope.
H288 Diagnostic endoscopic exam sigmoid colon using rigid sigmoidoscope OS.
H289 Diagnostic endoscopic exam sigmoid colon using rigid sigmoidoscope US.
H331 Abdominoperineal excision of rectum and end colostomy.
H332 Proctectomy and anastomosis of colon to anus.
H333 Anterior resection rectum and anast colon to rectum using staples.
H334 Anterior resection of rectum and anastomosis nec.
H335 Rectosigmoidectomy and closure rectal stump and exteriorisation of bowel.
H336 Anterior resection of rectum and exteriorisation of bowel.
H338 Excision of rectum OS.
H339 Excision of rectum unspecified.
H341 Open excision of lesion of rectum.

H342 Open cauterisation of lesion of rectum.
H343 Open cryotherapy to lesion of rectum.
H344 Open laser destruction of lesion of rectum.
H345 Open destruction of lesion of rectum nec.
H348 Open extirpation of lesion of rectum OS.
H349 Open extirpation of lesion of rectum unspecified.
H404 Trans-sphincteric anastomosis of colon to anus.
H411 Rectosigmoidectomy and peranal anastomosis.

Inpatient HRGs relevant to colorectal cancer. Version 3 (1997)

F31   Large intestine – Complex procedures.
F32   Large intestine – Very major procedures.
F33   Large intestine – Major procedures w cc.
F34   Large intestine – Major procedures w/o cc.
F35   Large intestine – Endoscopic or intermediate procedures.
F36   Large intestinal disorders > 69 or w cc.
F37   Large intestinal disorders < 70 w/o cc.
G02   Liver – Complex procedures.
G03   Liver – Very major procedures.
G04   Liver – Major procedures > 69 or w cc.
G05   Liver – Major procedures < 70 w/o cc.

Radiotherapy HRGs

HRG   Description
w01   Inpatient unsealed source brachytherapy.
w02   Outpatient unsealed source brachytherapy.
w03   Mechanical afterload, high-dose brachytherapy with anaesthetic.
w03   Mechanical afterload, high-dose brachytherapy without anaesthetic.
w05   Mechanical afterload, low-dose brachytherapy with anaesthetic.
w06   Mechanical afterload, low-dose brachytherapy without anaesthetic.
w07   Manual afterload, high-dose brachytherapy with anaesthetic.
w08   Manual afterload, high-dose brachytherapy without anaesthetic.
w09   Manual afterload, low-dose brachytherapy with anaesthetic.
w10   Manual afterload, low-dose brachytherapy without anaesthetic.
w11   Live source, high-dose brachytherapy with anaesthetic.
w12   Live source, high-dose brachytherapy without anaesthetic.
w13   Live source, low-dose brachytherapy with anaesthetic.
w14   Live source, low-dose brachytherapy without anaesthetic.
w15   Teletherapy with technical support, hyperfractionation.
w16   Teletherapy with technical support, > 23 fractions.
w17   Teletherapy with technical support, > 12 < 24 fractions.
w18   Teletherapy with technical support, > 3 < 13 fractions.
w19   Teletherapy with technical support, < 4 fractions.
w20   Complex teletherapy with planning, hyperfractionation.
w21   Complex teletherapy with planning, > 23 fractions.

w22   Complex teletherapy with planning, > 12 < 24 fractions.
w23   Complex teletherapy with planning, > 3 < 13 fractions.
w24   Complex teletherapy with planning, < 4 fractions.
w25   Complex teletherapy, hyperfractionation.
w26   Complex teletherapy, > 23 fractions.
w27   Complex teletherapy, > 12 < 24 fractions.
w28   Complex teletherapy, > 3 < 13 fractions.
w29   Complex teletherapy, < 4 fractions.
w30   Simple teletherapy with simulator, hyperfractionation.
w31   Simple teletherapy with simulator, > 23 fractions.
w32   Simple teletherapy with simulator, > 12 < 24 fractions.
w33   Simple teletherapy with simulator, > 3 < 13 fractions.
w34   Simple teletherapy with simulator, < 4 fractions.
w35   Simple teletherapy, hyperfractionation.
w36   Simple teletherapy, > 23 fractions.
w37   Simple teletherapy, > 12 < 24 fractions.
w38   Simple teletherapy, > 3 < 13 fractions.
w39   Simple teletherapy, < 4 fractions.
w40   Superficial teletherapy, hyperfractionation.
w41   Superficial teletherapy, > 23 fractions.
w42   Superficial teletherapy, > 12 < 24 fractions.
w43   Superficial teletherapy, > 3 < 13 fractions.
w44   Superficial teletherapy, < 4 fractions.

HRG – Condensed Chemotherapy Groups (Draft, 1998)

Group 1

Suitable for administration in a cancer unit or centre.

- Administration fairly straightforward, given staff training.
- Doses fairly standard.
- Low toxicity expected – low-risk of myelosuppression.
- Side-effect profile can be managed on an outpatients basis.

e.g. oral regimes, single agent and simple combinations CMF.

Group 2

Suitable for administration in a cancer unit or centre.

- Generally given as an outpatient but admission may be required during course for complications and side-effects.
- Needs a specialist facility available intermittently.
- Fairly toxic and likelihood of some degree of myelosuppression.

e.g. CHOP, anthracycline regimes.

Group 3

Suitable for administration only in a cancer centre.

- Generally requires admission with trained staff available 24 hours/day.
- Specialist administration – includes protracted infusional regimes.
- Expected toxicity and myelosuppression.

e.g. BEP.

Group 4

Suitable for administration only in a cancer centre.

- Complex regimes.
- Extended admission and extensive specialist support required.
- Expected toxicity and severe myelosuppression.

Extra groups for hormones and biological response modifiers.

Appendix II. UICC staging of colorectal cancer

Dukes' staging of colorectal cancer

Stage A   Tumour confined to the mucosa and submucosa of the bowel wall
Stage B   Tumour penetrating through the muscle wall of the bowel
Stage C   Metastasis to regional lymph nodes
Stage D   Distant metastasis

Stage grouping

AJCC/UICC				Dukes'
Stage 0	Tis	N0	M0	
Stage I	T1	N0	M0	A
	T2	N0	M0	
Stage II	T3	N0	M0	B
	T4	N0	M0	
Stage III	Any T	N1	M0	C
	Any T	N2	M0	
	Any T	N3	M0	
Stage IV	Any T	Any N	M1	D

Note: Dukes' stage B is a composite of better (T3, N0, M0) prognostic groups, as in Dukes' stage C (Any T, N1, M0 and Any T, N2, N3 M0).

Histopathologic type

This stage classification applies to carcinomas that arise in the colon, rectum or appendix. It does not apply to sarcomas, lymphomas, or carcinoid tumours. The histologic types include:

- adenocarcinoma *in situ*
- adenocarcinoma
- mucinous adenocarcinoma (colloid type: > 50% mucinous carcinoma)
- signet ring cell carcinoma (> 50% signet ring cell)
- squamous cell (epidermoid) carcinoma
- adenosquamous carcinoma
- small cell (oat cell) carcinoma
- undifferentiated carcinoma
- carcinoma, NOS.

Histopathologic grade (G)

GX   Grade cannot be assessed.
G1   Well differentiated.
G2   Moderately differentiated.
G3   Poorly differentiated.
G4   Undifferentiated.

Appendix III. HBGs/HRGs for colorectal cancer

The HBG/HRG matrix is a methodology that permits the systematic review of the epidemiology of a condition and the appropriate packages of care for those conditions. In order to provide a comprehensive view of health conditions and services, the matrix is split into four components:

- at risk/prevention
- symptomatic presentation/diagnostic investigation
- diagnosed disease/curative service
- continuing consequences of disease/care and palliation.

Matrices have been developed for a number of conditions (including colorectal cancer) and have been piloted in a number of districts as part of the systematic needs assessment process. In these pilots, the methodology was generally found to be useful, although the capture of the necessary data with existing information systems was difficult.

The development of the HBG/HRG matrix will be continued as part of the NHS information strategy, in order to help local users extract useful and comparable information from patient-based information systems and electronic patient records.

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Summary

HBGs	Promotion/primary prevention	Investigation and diagnosis	Initial care	Continuing care
At risk				
Whole population	Health promotion			
	Screening and prophylactic interventions			
Population at specific risk/screening population				
Follow-up screening for previously treated disease				
Presentation				
Asymptomatic, screen detected or incidental finding		Physical examination		
		Chemistry		
		Imaging		
		Cytology		
		Biopsy		
Symptomatic presentation		Special investigation		
		Special support		
Confirmed disease				
Dukes' stage A			Surgery	
Dukes' stage B			Chemotherapy	
Dukes' stage C			Radiotherapy	
Dukes' stage D			Special support	
Continuing disease state				
Non-progressive disease				Community general input
Functional ability				
Pain			Specialist input	
Other symptoms				
Progressive disease			Voluntary sector	
Functional ability				
Pain				
Other symptoms				

Matrix 1: At risk

HBGs	Numbers/rates	Health promotion[a]	Screening and prophylactic interventions Special investigations[b]	Colon and rectum (f35 cat 2)[c]	Special support
Whole population					
Population at specific risk[d]					
Follow-up screening for previously treated disease					

[a] Alerting people to: change in bowel habits, change in colour of stools, rectal bleeding. Promoting a healthy diet.
[b] For example, faecal occult blood testing and genetic testing, Ba enema.
[c] f35 cat 2: sigmoidoscopy.
[d] For example, those with positive family history, ulcerative colitis, previous history of colorectal polyps, hereditary non-polyposis cancer of the colon (HNPCC) and familial adenomatous polyposis.

Matrix 2: Presentation

HBGs	Numbers/rates	Physical examination	Chemistry	Imaging[a]	Cytology/Biopsy[b] (f35 CAT 2)	Special investigation	Special support
Asymptomatic, screen detected or incidental finding							
Symptomatic presentation							
Elective[c]							
Emergency[c]							

[a] Plain X-rays, contrast studies, ultrasound and CAT scans.
[b] This may be through an endoscope (sigmoidoscopy, colonoscopy etc.).
[c] Presentation might include pain, mass, rectal bleeding and change in bowel habit.
[d] Emergency presentation might be with perforation or obstruction.

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Matrix 3: Confirmed disease

HBGs	Numbers/ rates	Surgery Colon and rectum (cat6 f31, cat5 f32)	Resection of liver (cat5 g2, cat4 g3)	Chemo-therapy	Radiotherapy Teletherapy (W15–W44)	Brachytherapy (W1–W14)c	Special support District nursing	Dietetics	Specialist nursing
Dukes' A									
Dukes' B									
Dukes' C									
Dukes' D									

Matrix 4: Continuing disease state

HBGs	Numbers/ rates	Community general input GP/primary care	Occupational therapy	Physio-therapy	District nursing	Social/ psychological	Otherc	Specialist inputa	Voluntary sectorb
Non-progressive disease									
Functional ability									
Pain									
Other symptoms									
Progressive disease									
Functional ability									
Pain									
Other symptoms									

a For example, from hospices, etc.
b Services purchased for the voluntary sector wherever appropriate/necessary.
c This might include clinical psychology, dietetics, health visiting, midwifery, podiatry/chiropody and speech and language therapy wherever applicable.

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Functional ability

Scoring for the Barthel ADL Index

Bowels

0   incontinent (or needs to be given enemas)
1   occasional accident (once a week)
2   continent

Bladder

0   incontinent, or catheterised and unable to manage alone
1   occasional accident (maximum once per 24 hours)
2   continent

Grooming

0   needs help with personal care
1   independent face/hair/teeth/shaving (implements provided)

Toilet use

0   dependent
1   needs some help, but can do something alone
2   independent (on and off, dressing, wiping)

Feeding

0   unable
1   needs help cutting, spreading butter, etc.
2   independent

Transfer (bed to chair and back)

0   unable, no sitting balance
1   major help (one or two people, physical), can sit
2   minor help (verbal or physical)
3   independent

Mobility

0   dependent
1   wheelchair independent, including corners
2   walks with help of one person (verbal or physical)
3   independent (but may use any aid, e.g. stick)

Dressing

0   dependent
1   needs help, but can do about half unaided
2   independent (includes buttons, zips, laces, etc.)

Stairs

0   unable
1   needs help (verbal, physical, carrying aid)
2   independent

Bathing

0   dependent
1   independent (or in shower)

Total score 0–20

A = Independent, B = Mild dependence, C = Moderate dependence, D = Severe dependence, E = Very severe dependence.

Severity of pain assessment scoring

Other disabling symptoms

(May be non-specific for a particular disorder) can include:

- nausea
- vomiting
- lethergy
- malaise
- weight loss
- anorexia
- depression.

The matrix does not take account of severity of symptoms or range of possibilities with current groupings (? to categorise by symptom or severity of symptom).

Basic care

This includes care for basic daily needs.

Specialised care

This includes more specialised care, e.g. nursing, medical, physiotherapy (for contractures), speech therapy for swallowing disorders associated with for example Parkinson's disease and motor neurone disease.

Provision of aids and appliances

This includes assessment and instruction for use.

Maintenance of aids and appliances

May include help with use and continual appraisal.

Family support

Includes counselling for all.

Local and general symptoms of colorectal cancer

	Right colon (%)	**Left colon (%)**	**Rectum (%)**
Pain	80	60	5
Mass	70	40	–
Rectal bleeding			60
Change in bowel habit	40	60	80
Weight loss	50	15	25
Vomiting	30	10	–
Obstruction	5	20	5

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Appendix IV. Pilot HBG/HRG matrix results from Greater Glasgow Health Board

Matrix 1 outlines the risk factors associated with the development of colorectal cancer, estimating the numbers of people per 1 000 000 population considered to be at increased risk for the disease. It attempts to quantify the costs associated with services aimed at primary and secondary prevention in the different groups.

The different types of diagnostic test available for each type of presentation to the health service and their associated costs are shown in Matrix 2.

Matrix 3 uses Dukes' staging as the relevant HBGs and shows the primary treatments and costs in each group. When this pilot was carried out, Matrix 4 was concerned with the follow-up of patients such as palliation and supportive services. During the pilot, no information was available on the need for such services by patients with colorectal cancer in the GGHB area and this matrix was not completed. The summary matrix provided covers only the first three matrices.

Colorectal cancer matrices from Glasgow exercise per 1,000,000 population

Summary matrix	Promotion and primary prevention	Investigation and diagnosis	Initial care	Continuing care	Total
At risk	£106,980				
Presentation		£41,668	£371,200		
Confirmed disease			£3,749,676		
Continuing disease states				£?	
Total					£4,269,523

Matrix 1: Primary and secondary prevention of disease

	Prevalence	Health promotion	FOB[a]	Screening endoscopic (F35 = £298)	Genetic	Special support[b]	Total
Whole population	1,000,000	£50,000					
Low risk							
Age 50+	310,000						
High-fat, low-fibre diet	448,380	£50,000					
High risk							
Positive family history	31,000						
Ulcerative colitis/Crohns	21,000						
Previous history of CRC	1,500						
HNPCC	190			£5,662			
FAP	29			£2,160			
Total		£100,000	£0	£7,822	£0	£0	£107,822

[a] 1997–98 cost returns.
[b] No HRG costs available.

Matrix 2: Diagnosis of disease

	Prevalence	Examn. bloods, FOB	Endoscopy	Emergency laparotomy	Ultrasound	CT	Total
		£127	£298	£4,000	£32	£78	
Asymptomatic/screen detected	27.15	3,448.05	8,090.7		868.8	2,117.7	
Symptomatic local	407.25	51,720.75	121,360.5		9,774	23,824.13	
Pain	162.9						
Mass	122.175						
Rectal bleeding	134.3925						
Change bowel habit	285.075						
Obstruction	40.725						
Perforation	24.435						
Generalised							
Weight loss	244.35						
Vomiting	183.2625						
Anaemia	122.175						
Emergency admission	108.6	6,896.1	16,181.4	217,200	868.8	2117.7	
		62,064.9	145,632,6	217,200	11,511.6	28,059.53	464,468.6
Total	543						

Matrix 3: Treatment of diagnosed disease

	Preva-lence	Surgery Ops on colon	Ops on rectum	Liver resection	Chemo-therapy Group 1	Group 2	Group 3	Group 4	Radio-therapy Simple palliative	Complex	Special support
Dukes' A	58	£101,243	£67,495	£0	£0	£0	£0	£0	£0	£0	£11,600
Dukes' B	174	£379,661	£253,107	£0	£0	£0	£0	£0	£0	£0	£34,800
Dukes' C	203	£442,938	£295,292	£0	£625,595	£398,591	£185,745	£0	£68,573	£0	£40,600
Dukes' D	145	£237,288	£158,192	£36,250	£0	£113,883	£132,675	£0	£137,147	£0	£29,000
Total	580	£1,161,130	£774,087	£36,250	£625,595	£512,474	£318,420	£0	£205,720	£0	£116,000

Appendix V

Strength of recommendations

A   Good evidence to support.
B   Fair evidence to support.
C   Poor evidence to support.
D   Fair evidence to reject.
E   Good evidence to reject.

Quality of evidence

I   At least one randomised controlled trial.
II(2)   Well designed cohort or case controlled study.
II(3)   Multiple timed series or dramatic results from uncontrolled experiments.
III   Opinions of respected authorities.
IV   Inadequate or conflicting evidence.

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