National Bowel Cancer Audit Report 2015

Supportive Document

Contents

This document accompanies the 2015 Annual Report of the National Bowel Cancer Audit and contains additional methods and results. The chapter numbers correspond to those in the Annual Report.

2. Methods

2.1 Data processing

The Audit dataset was redesigned for patients diagnosed from 1 April 2013 and data is now submitted to the Audit via the HSCIC's Clinical Audit Platform (CAP). Data collected in the CAP system cannot have more than one treatment record listed per patient. The previous data collection system (Open Exeter) allowed multiple treatment records that underwent data processing to obtain one treatment record, as described below.

Multiple records in Open Exeter

It was assumed that multiple tumour and multiple treatment records involved the same tumour episode if their dates fell within a period of two years. If that was the case an algorithm developed by the Project Team was applied to reconcile potentially conflicting information between the multiple records.

Multiple tumour records in Open Exeter

If multiple tumour records were available, a second tumour diagnosed within two years was considered a duplicate record, irrespective of the tumour site. Second tumours diagnosed more than two years after a first tumour were considered to be separate cancers.

If a second tumour record was present that was diagnosed within two years, the earliest date of diagnosis and the most advanced or most severe results was taken from the available records. In cases where there was conflicting information about tumour site, this was resolved by choosing the site that was compatible with available treatment information; if no treatment record was available, the most distal site was chosen.

Multiple treatment records in Open Exeter

In cases where there was conflicting information on treatment data, the most recent date and the value that reflected the most advanced or severe results were taken. Procedures and treatments were assumed to have been carried out if they were recorded in at least one of the multiple treatment records. In cases where there was conflicting information about the surgical procedure, the procedure selected was the one that was most compatible with the site recorded in the tumour record.

It was not possible to distinguish between patients who have not undergone a surgical procedure and those for whom the data item was missing. This problem was addressed by searching for any information that indicated that a patient had undergone a surgical procedure (e.g. number of excised nodes, circumferential margins, and post-operative complications). Patients with missing data on type of surgery, but information indicating that they had undergone surgery, were entered into the category "other procedure".

Transferring data to CAP system

The final dataset extracted from Open Exeter to produce the 2014 Annual Report and Consultant Outcomes Publication contained data submitted for diagnoses between April 2007 and March 2013. An algorithm was developed to convert data items from this dataset into equivalent data items in the new dataset.

All (see duplicate records below) patient, tumour and surgery records were transferred and all pathology records were transferred for patients with a surgery record. This dataset now sits within the HSCIC's CAP system and can be accessed by users along with the new data.

Duplicate records in Open Exeter and CAP

By the time of data transfer approximately 1 per cent of patients in the final Open Exeter dataset also had records on the CAP system. The Open Exeter data for these patients was not transferred, but was available from the HSCIC on request by the relevant Trust to check and upload manually if required.

2.2 Case ascertainment

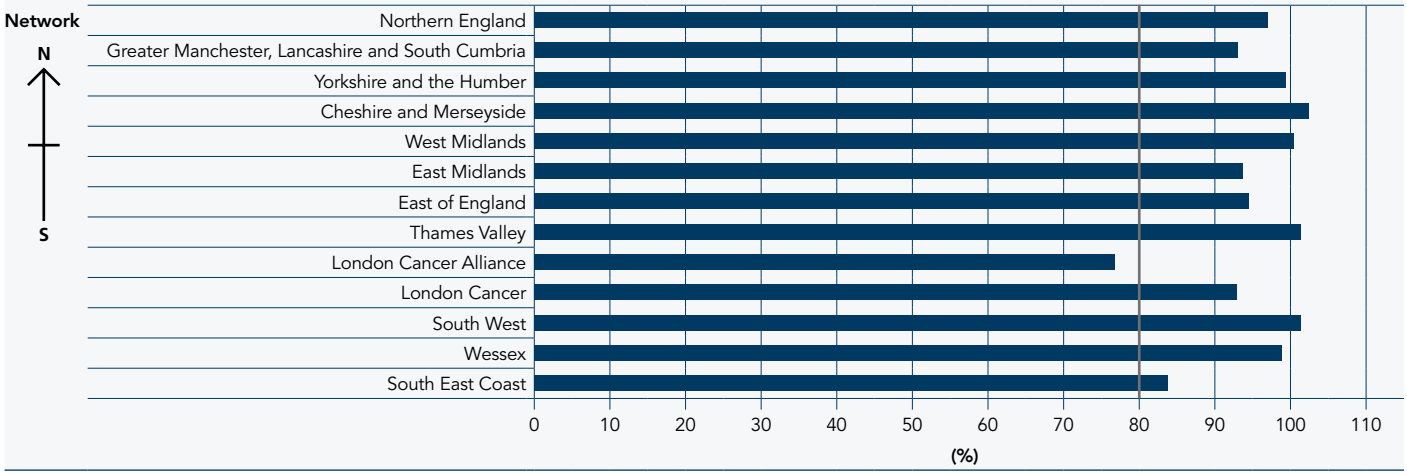
The Hospital Episode Statistics (HES) administrative database, containing records of all admissions to English NHS Trusts, was used to estimate the denominator of this proportion. A patient was considered to be diagnosed with primary bowel cancer when admitted to hospital for the first time with a diagnosis of bowel cancer (C18, C19 or C20 according to the International Classification of Diseases 10th Revision) in the first diagnosis field. It was assumed to be a first admission with bowel cancer if no bowel cancer diagnosis could be identified in any of the diagnostic fields since 1 April 2009. The equivalent administrative database for Wales, Patient Episode Database for Wales (PEDW), was unavailable; therefore no case ascertainment is presented for Welsh MDTs.

Case ascertainment by year for England is given in Table S2.1. Case ascertainment by English Strategic Clinical Network is given in Figure S2.1.

Table S2.1
Case ascertainment by year for England

	2009-10	2010-11	2011-12	2012-13	2013-14
Patients identified in HES	30,959	31,740	32,372	31,607	30,630
Patients identified in audit	25,296	27,694	28,379	29,421	28,644
% case ascertainment	**82**	**87**	**88**	**93**	**94**

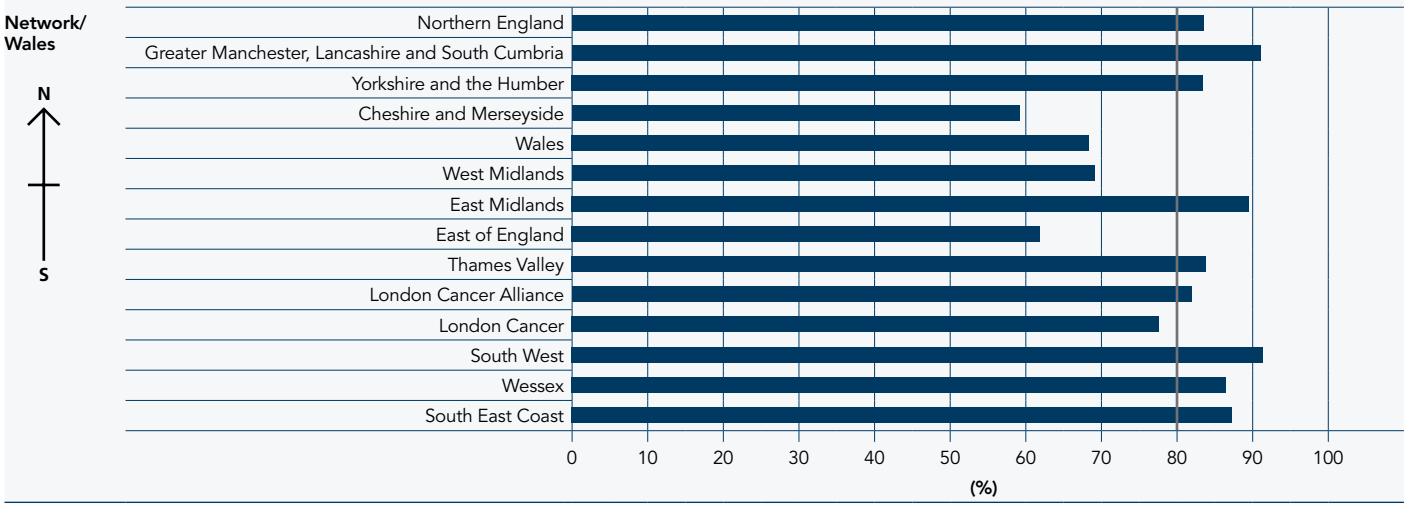
Figure S2.1
Case ascertainment by English Strategic Clinical Network



2.3 Data completeness

Data completeness is defined as the proportion of patients with complete data items on all seven of the variables: age, sex, ASA grade, pathological TNM stage (tumour, node, metastasis staging) and site of cancer, as these Audit variables are used for risk adjustment when comparing post-operative mortality between Strategic Clinical Networks and Trusts. More detail is given in Chapter 2 of the Annual Report. Figure S2.2 shows the data completeness by Strategic Clinical Network and Wales.

Figure S2.2
Percentage of patients undergoing major surgery with complete data on the seven items from the Audit used in risk adjustment, by English Strategic Clinical Network/Wales



2.4 Handling missing data

For the four adjusted outcomes reported at Trust and Network level, multiple imputation was used to fill in any missing information on the risk factors. The method, known as Multiple Imputation using Chained Equations, uses a patient's other risk-factors to predict their missing information, whilst taking into account the uncertainty due to their missing information. In addition to the variables in the risk-adjustment model, and the outcomes, the following variables were included in the imputation model: surgical urgency, mode of admission according to the Audit, surgical procedure, number of lymph nodes extracted, number of positive lymph nodes extracted, Index of Multiple Deprivation, length of hospital stay, and days from diagnosis to surgery. Amongst patients undergoing major surgery, 5.7 per cent were missing ASA grade, 4.1 per cent were missing TNM T stage, 4.3 per cent were missing TNM N stage and 15.8 per cent were missing TNM M-stage. Mode of admission and Charlson comorbidity score came from HES and were both missing in patients who were not linked to HES. Virtually all patients had complete data on sex, age, and site of cancer.

2.5 Statistical Analysis

Funnel plots

Funnel plots are used to make comparisons between networks or between Trusts/hospitals. The rate for each Strategic Clinical Network/Trust/hospital is plotted against the total number of patients used to estimate the rate. The "target" is specified as the average rate across all Strategic Clinical Networks/Trusts/hospitals. In this report, those Cancer Networks, trusts or hospitals with results outside the outer (99.8 per cent) funnel limit are considered as potential outliers.

The funnel limits depend on the target rate and the number of patients included in the estimate; rate estimates have greater uncertainty when estimated from fewer patients. Results fall outside the inner limits if they are statistically significantly different from the target at a 0.05 level, and outside the outer limits if they are statistically significantly different from the target at a 0.002 level. The inner funnel limit is the threshold for an "alert" and the outer funnel level is the threshold for an "alarm". This implies that 95 per cent of the trusts or hospitals are expected to be within the inner funnel limits and 99.8 per cent within the outer funnel limits, if they are all performing according to the target.

3. Colorectal cancer – care pathways

Table S3.1
Description of management of the 30,663 patients with a known cancer site

		Colon		Rectosigmoid		Rectal	
		Number	%	Number	%	Number	%
Total patients per cancer site		**19,947**		**1,668**		**9,048**	
Patients undergoing surgery		**15,487**		**1,233**		**6,292**	
Seen by clinical nurse specialist	**Yes**	14,313	92.0	1,231	93.8	6,758	93.9
	No	1,244	8.0	81	6.2	439	6.1
	Missing (% of total)	4,390 (22.0)		356 (21.3)		1,851 (20.5)	
Surgery type	**Major resection**	13,415	86.6	1,052	85.3	4,978	79.1
	Local excision	604	3.9	47	3.8	645	10.3
	Non resectional procedure	562	3.6	89	7.2	435	6.9
	Other procedure	906	5.9	45	3.6	234	3.7
	No surgery (% of total)	4,460 (22.4)		435 (26.1)		2,756 (30.5)	
Urgency of operation	**Elective**	9,281	60.2	849	69.1	4,502	71.9
	Scheduled	2,613	17.0	216	17.6	1,335	21.3
	Urgent	1,425	9.2	67	5.5	246	3.9
	Emergency	2,093	13.6	96	7.8	181	2.9
	Missing (% of total)	75 (0.4)		5 (0.3)		28 (0.3)	
	No surgery (% of total)	4,460 (22.4)		435 (26.1)		2,756 (30.5)	
Laparoscopy	**Open**	6,090	44.7	413	37.4	2,159	40.3
	Laparoscopic converted to open	1,159	8.5	112	10.1	512	9.5
	Laparoscopic completed	6,362	46.7	579	52.4	2,691	50.2
	Missing (% of total)	1,876 (9.4)		129 (7.7)		930 (10.3)	
	No surgery (% of total)	4,460 (22.4)		435 (26.1)		2,756 (30.5)	

4. Surgical care

Table S4.1
Description of the 19,445 patients who underwent major surgery by cancer site

		Colon		Rectosigmoid		Rectal	
		Number	%	Number	%	Number	%
Total patients undergoing major resection		**13,415**		**1,052**		**4,978**	
Sex	**Male**	7,191	53.6	661	62.9	3,235	65.1
	Female	6,213	46.4	390	37.1	1,737	34.9
	Missing (% of total)	11 (0.1)		1 (0.1)		6 (0.1)	
Age-group	**≤65 yrs**	3,743	27.9	385	36.6	1,971	39.6
	65-74 yrs	4,175	31.1	336	31.9	1,707	34.3
	75-84 yrs	4,293	32.0	262	24.9	1,147	23.0
	85+ yrs	1,204	9.0	69	6.6	153	3.1
ASA	**1**	1,417	11.2	183	18.7	693	14.7
	2	6,954	55.0	550	56.1	2,921	61.9
	3	3,828	30.3	222	22.6	1,043	22.1
	4 or 5	446	3.5	26	2.7	59	1.3
	Missing (% of total)	770 (5.7)		71 (6.7)		262 (5.3)	
Pre-treatment T stage	**T1**	450	3.4	26	2.5	187	3.8
	T2	1,961	14.6	245	23.3	1,326	26.6
	T3	5,387	40.2	474	45.1	2,515	50.5
	T4	2,237	16.7	113	10.7	475	9.5
	Tx	836	6.2	49	4.7	85	1.7
	T9	2,544	19.0	145	13.8	390	7.8
Pre-treatment N stage	**N0**	5,553	41.4	483	45.9	2,198	44.2
	N1	3,367	25.1	291	27.7	1,492	30.0
	N2	1,473	11.0	112	10.6	796	16.0
	Nx	566	4.2	27	2.6	79	1.6
	N9	2,456	18.3	139	13.2	413	8.3
Pre-treatment M stage	**M0**	9,296	69.3	743	70.6	3,833	77.0
	M1	1,168	8.7	95	9.0	251	5.0
	Mx	647	4.8	74	7.0	307	6.2
	M9	2,304	17.2	140	13.3	587	11.8
Mode of admission (from HES)	**Elective**	8,796	78.2	832	91.8	4,028	95.6
	Emergency	2,448	21.8	74	8.2	186	4.4
	Missing (% of total)*	2,170 (16.2)		146 (13.9)		764 (15.3)	
Comorbidities (from HES)	**0**	6,316	56.1	582	64.2	2,654	63.0
	1	3,415	30.3	231	25.5	1,107	26.3
	2+	1,525	13.5	94	10.4	453	10.7
	Missing (% of total)*	2,159 (16.1)		145 (13.8)		764 (15.3)	

* includes patients from Wales who could not be linked to Welsh equivalent of HES (PEDW)

Figure S4.1
Major surgery carried out as an urgent or emergency procedure by English Strategic Clinical Network/Wales

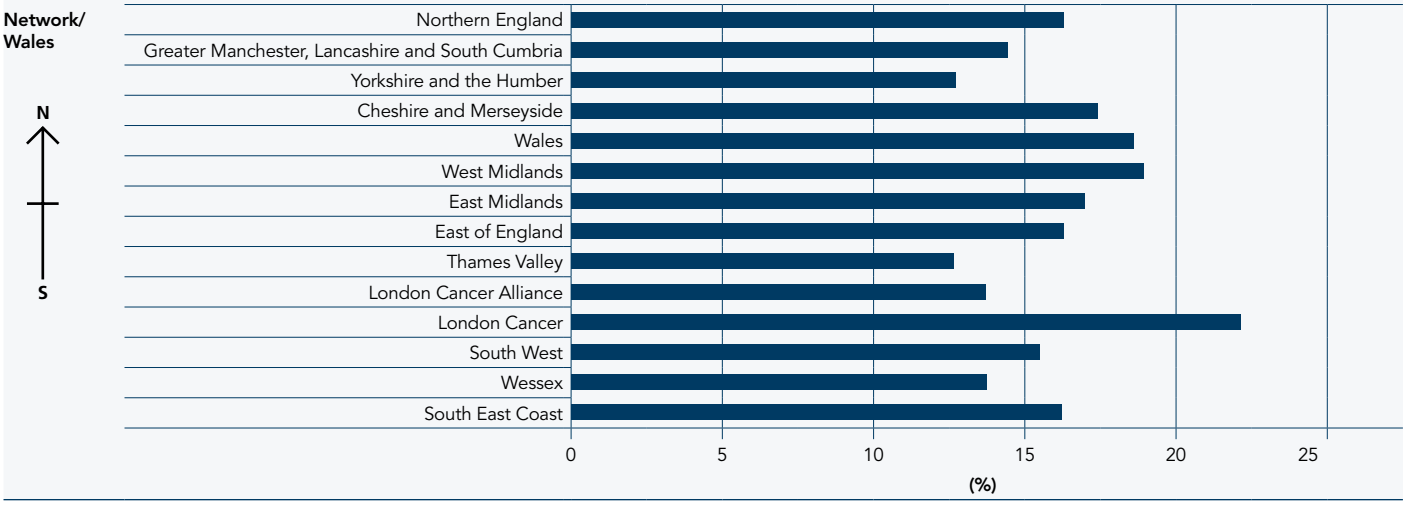


Table S4.2
Surgical access by patient characteristics for the 19,361 patients undergoing major surgery where surgical access recorded

			Open		Laparoscopic converted to open		Laparoscopic completed	
		Total number	Number	%	Number	%	Number	%
Overall		**19,361**	**8,314**	**42.9**	**1,759**	**9.1**	**9,288**	48.0
Sex	**Male**	**11,034**	4,721	42.8	1,139	10.3	5,174	46.9
	Female	**8,309**	3,586	43.2	617	7.4	4,106	49.4
	Missing	**18**	7	38.9	3	16.7	8	44.4
Age-group	**≤64 yrs**	**6,071**	2,511	41.4	562	9.3	2,998	49.4
	65-74 yrs	**6,197**	2,585	41.7	608	9.8	3,004	48.5
	75-84 yrs	**5,679**	2,507	44.1	493	8.7	2,679	47.2
	85+ yrs	**1,414**	711	50.3	96	6.8	607	42.9
ASA grade	**1**	**2,288**	771	33.7	190	8.3	1,327	58.0
	2	**10,371**	4,040	39.0	1,010	9.7	5,321	51.3
	3	**5,074**	2,561	50.5	469	9.2	2,044	40.3
	4 or 5	**525**	368	70.1	31	5.9	126	24.0
	Missing	**1,103**	574	52.0	59	5.3	470	42.6
Pre-treatment T stage	**T1**	**657**	187	28.5	71	10.8	399	60.7
	T2	**3,515**	1,152	32.8	345	9.8	2,018	57.4
	T3	**8,347**	3,292	39.4	753	9.0	4,302	51.5
	T4	**2,805**	1,697	60.5	229	8.2	879	31.3
	Tx	**966**	432	44.7	95	9.8	439	45.4
	T9	**3,071**	1,554	50.6	266	8.7	1,251	40.7
Pre-treatment N stage	**N0**	**8,183**	3,094	37.8	742	9.1	4,347	53.1
	N1	**5,139**	2,198	42.8	462	9.0	2,479	48.2
	N2	**2,370**	1,147	48.4	236	10.0	987	41.6
	Nx	**668**	348	52.1	65	9.7	255	38.2
	N9	**3,001**	1,527	50.9	254	8.5	1,220	40.7
Pre-treatment M stage	**M0**	**13,804**	5,527	40.0	1,289	9.3	6,988	50.6
	M1	**1,509**	857	56.8	109	7.2	543	36.0
	Mx	**1,028**	523	50.9	92	8.9	413	40.2
	M9	**3,020**	1,407	46.6	269	8.9	1,344	44.5
Mode of admission (from HES)	**Elective**	**13,586**	4,766	35.1	1,355	10.0	7,465	54.9
	Emergency	**2,686**	1,966	73.2	127	4.7	593	22.1
	Missing*	**3,089**	1,582	51.2	277	9.0	1,230	39.8
Surgical urgency	**Elective**	**12,659**	4,468	35.3	1,215	9.6	6,976	55.1
	Scheduled	**3,592**	1,434	39.9	397	11.1	1,761	49.0
	Urgent	**1,279**	928	72.6	67	5.2	284	22.2
	Emergency	**1,805**	1,471	81.5	77	4.3	257	14.2
	Missing	**26**	13	50.0	3	11.5	10	38.5
Cancer site	**Caecum/ascending colon**	**5,443**	2,271	41.7	440	8.1	2,732	50.2
	Hepatic flexure	**822**	366	44.5	73	8.9	383	46.6
	Transverse colon	**1,259**	712	56.6	88	7.0	459	36.5
	Splenic flexure/descending colon	**1,263**	699	55.3	108	8.6	456	36.1
	Sigmoid colon	**4,559**	1,873	41.1	437	9.6	2,249	49.3
	Rectosigmoid	**1,053**	384	36.5	113	10.7	556	52.8
	Rectal	**4,962**	2,009	40.5	500	10.1	2,453	49.4
Comorbidities (from HES)	**0**	**9,505**	3,804	40.0	841	8.8	4,860	51.1
	1	**4,726**	2,015	42.6	459	9.7	2,252	47.7
	2+	**2,054**	922	44.9	184	9.0	948	46.2
	Missing *	**3,076**	1,573	51.1	275	8.9	1,228	39.9

* includes patients from Wales who could not be linked to Welsh equivalent of HES (PEDW)

6. Rectal cancer

Table S6.1
Description of management of patients who had a major resection following a diagnosis of rectal cancer between 1 April 2013 and 31 March 2014

		Number	%
Total number of patients with rectal cancer who had major surgery		**4,978**	
Pre-operative Treatment	**Chemotherapy**	211	4.2
	Chemoradiotherapy	1,181	23.7
	Teletherapy	537	10.8
	Brachytherapy	7	0.1
	No treatment or none reported	3,042	61.1
Circumferential resection margins	**Negative**	3,438	92.8
	Positive	268	7.2
	Missing (% of total)	1,272 (25.6)	
Rectal surgical procedures	**Anterior Resection (AR)**	3,000	60.3
	APER	1,299	26.1
	Hartman's	446	9.0
	Other procedure	233	4.7
Post-operative destination	**Standard Ward**	1,352	53.5
	High Care Area	365	14.4
	HDU - Level 2	589	23.3
	ICU - Level 3	220	8.7
	Missing (% of total)	2,452 (49.3)	
Post-operative Treatment	**Chemotherapy**	1,213	24.4
	Chemoradiotherapy	164	3.3
	Teletherapy	40	0.8
	Brachytherapy	0	0.0
	No treatment or none reported	3,561	71.5

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