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Where are the inequalities in colorectal cancer care in a country with universal healthcare? A systematic review and narrative synthesis

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1 Abstract

Objective

Patients diagnosed with colorectal cancer living in more deprived areas experience
worse survival than those in more affluent areas. Those living in more deprived areas
face barriers to accessing timely, quality healthcare. These barriers may contribute to
socioeconomic inequalities in survival. We evaluated the literature for any association
between socioeconomic group, hospital delay, and treatments received among patients
with colorectal cancer in the United Kingdom, a country with universal healthcare.

9 Design

10 MEDLINE, EMBASE, CINAHL, CENTRAL, SCIE, AMED and PsycINFO were

11 searched from inception to January 2023. Grey literature, including HMIC, BASE, and

12 Google Advanced Search, and forward and backward citation searches were conducted.

13 Two reviewers independently reviewed titles, abstracts, and full-text articles.

14 Observational UK-based studies were included if they reported socioeconomic

15 measures and an association with either hospital delay or treatments received. The

16 QUIPS tool assessed bias risk, and a narrative synthesis was conducted. The review is

17 reported to PRISMA 2020 and registered with PROSPERO [CRD42022347652].

Results

19 Forty-one of the 7,209 identified references were included. Twelve studies evaluated

20 seven different hospital intervals. There was a significant association between area-level

21 deprivation and a longer time from first presentation in primary care to diagnosis.

22 Thirty-two studies evaluated treatments received. There were socioeconomic

23 inequalities in surgery and chemotherapy but not radiotherapy.

24 Conclusion

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1	Patients with colorectal cancer face inequalities across the cancer care continuum.
2	Further research is needed to understand why and what evidence-based actions can
3	reduce these inequalities in treatment. Qualitative research of patients and clinicians
4	conducted across various settings would provide a rich understanding of the complex
5	factors that drive these inequalities. Further research should also consider using a causal
6	approach to future studies to considerably strengthen the interpretation. Clinicians can
7	try and mitigate some potential causes of colorectal cancer inequalities, including
8	signposting to financial advice and patient transport schemes.
9	Trial registration
10	PROSPERO [CRD42022347652].
11	Strengths and limitations
12	• The searches were extensive – conducted across eight databases, supplemented
13	with citation searching and hand-searching websites.
14	• The search strategy was validated.
15	• The inclusion of non-peer-reviewed literature was a key strength.
16	• Due to heterogeneous methods, meta-analysis was not possible.
17	Funding
18	This work was funded in whole by Yorkshire Cancer Research (award reference number
19	HEND405). Yorkshire Cancer Research has not been involved in any other aspect of the
20	project, such as the design, data collection, analysis, or interpretation.
21	Competing interests

22 The authors declare no conflict of interest.

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1	Introduction
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Colorectal cancer is the second most common cause of cancer-related death in the 2 3 United Kingdom (UK).(1) Survival has improved since the 1990s but lags behind 4 comparable countries.(2) There are also survival gradients within countries, including 5 those with universal healthcare, such as the UK and Australia.(3) In particular, patients 6 living in more deprived areas experience significantly worse survival outcomes.(1, 3) 7 Healthcare systems can contribute to these inequalities, as treatment differences likely compound differential outcomes across populations.(2) 8

Timely diagnosis and treatment are also essential, with delays associated with worse 9

10 outcomes. The Aarhus statement suggested a framework for measuring these delays,

11 categorising the patient journey into patient, doctor and system intervals.(4)

12 Specifically, the system interval was defined as the period from primary care-initiated

investigations or referral to the commencement of treatment.(4) Socioeconomic 13

circumstances can impact this interval and yet is comparatively under-researched. 14

Existing inequalities have been exacerbated by the COVID-19 pandemic, with 15

vulnerable patient groups disproportionately affected by suboptimal care.(5) The 16

evolution of precision medicine and the development of new technologies and surgical 17

approaches will likely worsen existing inequalities, a process described as the "inverse

equity law".(6) Worryingly, disparities in access to precision oncology are already well 19

20 documented.(7) Understanding where inequalities are in the pathways of care for

21 patients with colorectal cancer is essential to inform policy and identify areas of further

research to target evidence-based action. 22

We evaluated the literature for any association between socioeconomic group, system 23 interval, and treatment amongst patients with colorectal cancer in the UK. By focusing 24

exclusively on studies conducted within a single country with a universal healthcare 25

1	system, our systematic review homogenised the healthcare infrastructure, policy, and
2	patient population, ensuring a more interpretable analysis of disparities in cancer care
3	with greater scope for policy impact.
4	Methods
5	This systematic review was registered with PROSPERO (CRD42022347652). The
6	review is reported according to the PRISMA 2020 statement (Appendix S1).(8)
7	Eligibility criteria
8	Published and grey-literature observational studies were considered for inclusion if
9	relevant outcomes of patients with a primary diagnosis of colorectal cancer (ICD10
10	C18-C20) in the UK were reported.
11	Outcomes were only included if they had been analysed by a measure of socioeconomic
12	status [e.g., an area-based measure such as the Index of Multiple Deprivation (IMD) or
13	individual measures such as occupation]. The relevant outcomes were defined as
14	follows:
15	• The association between socioeconomic status and the length of the system interval,
16	as defined by the Aarhus statement.(4) Any part of the system interval could have
17	been measured.
18	• Or receipt of cancer-directed treatment. Studies evaluating palliative or supportive
19	care only were excluded.
20	Information sources
21	The following bibliographic databases were searched from inception to 26/01/2023:
22	MEDLINE, EMBASE, AMED and PsycINFO, CINAHL, CENTRAL and Science
23	Citation Index Expanded.

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2	1	The grey literature was searched using HMIC, BASE, NICE Evidence Search and
3 4	2	
5	2	Google Advanced Search on 26/01/2023. In addition, twelve websites were
6 7	3	systematically hand-searched, and backwards and forward citation searches were
8 9	4	conducted on 30/03/2023 (details in Appendix S2).
10 11 12 13	5	Search strategy
14 15	6	The search strategies are listed in Appendix S3. The search strategy was developed and
16 17	7	validated in conjunction with SG, an information specialist (details in Appendix S4).
18 19 20	8	BPS and another reviewer (MS or KS) independently screened all titles and abstracts
21 22	9	against the pre-determined eligibility criteria. The full texts of eligible titles and
23 24	10	abstracts were obtained and independently screened for inclusion. Conflicts were
25 26 27	11	resolved by consensus.
28 29 30	12	Data Collection Process
31 32	13	One researcher (BPS) extracted information from the included studies, collating the
33 34 35	14	relevant data onto a data extraction form. A second author (KS) checked the extracted
36 37	15	data, and discrepancies were reconciled by consensus. The data items and effect
38 39 40	16	measures that were sought for extraction are detailed in Appendix S5.
41 42	17	Study risk of bias assessment
43 44 45	18	Two researchers (BPS and KS) independently evaluated the study risk of bias against
46 47	19	domains adapted from the Quality in Prognosis Studies tool (QUIPS).(9) Each domain
48 49 50	20	was judged to have a high, moderate, or low risk of bias, with the evaluations collated
51 52	21	onto a pre-prepared form (Appendix S6).
53 54 55	22	Risk of bias assessments informed the narrative synthesis, with greater weight given to
55 56 57	23	studies with a lower risk of bias. A study's evidence was considered "strong" if there
58 59 60	24	were no high risk of bias categories, "moderate" if there was a high risk of bias in one

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1 category, and "weak" if there were two or more categories at high risk of bias.

- 2 However, studies were not excluded based on this.
- 3 Synthesis methods

A narrative synthesis was conducted, according to the synthesis without meta-analysis 4 in systematic reviews reporting guideline.(10) An overall assessment of the association 5 6 between socioeconomic status and each outcome was made, considering the consistency and strength of supporting evidence from each study. Coefficients were extracted based 7 on multivariable models. Given the inherent methodological heterogeneity, diverse 8 9 patient populations, varying measures of deprivation, and significant statistical heterogeneity observed across the included studies, a meta-analysis was deemed 10 inappropriate as it could yield misleading or oversimplified results. 11

- 12 **Results**
- 13 Study Selection

14 The database searches yielded 7,201 studies, 214 of which were retrieved for full-text

15 screening. An additional six studies were identified from the grey literature. Overall,

16 forty-one studies were included (Figure 1).(11)

- 17 Study Characteristics
- 18 The characteristics of the included studies are summarised in Appendix S7. The system
- 19 interval was examined in twelve studies, with seven different time points evaluated,
- summarised in Figure 2.(12-23) Fifteen studies reported the receipt of surgery,(19, 20,
- 21 24-36) seven studies evaluated surgical variation,(37-43) fourteen studies reported the
- receipt of chemotherapy, (19, 20, 24-27, 44-51) seven reported the receipt of
- radiotherapy, (19, 20, 25-27, 43, 52) and two reported the receipt of any treatment. (17,
- 24 46)

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2	1	Thirty-two of the forty-one studies adjusted or stratified for at least one other factor.(12-
3		
4 5	2	26, 32-41, 44-49, 51) The remaining nine studies provided unadjusted rates.(27-31, 42,
6	3	43, 50, 52)
7	5	45, 50, 52)
8 9	_	
10	4	Risk of bias in studies
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12 13	5	Assessments of the risk of bias are summarised in Figure 3 and Appendix S6. The
14	6	domain most at risk of bias was study confounding, with sixteen studies at high risk of
15	0	domain most at fisk of blas was study comounding, with sixteen studies at high fisk of
16 17	7	bias.(13, 27-31, 39-43, 47-50, 52) Although some of these studies conducted adjusted
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19 20	8	analyses, important factors such as stage were unaccounted for.
20		
22	9	Results of studies reporting variations in the system interval
23 24		
25	10	Referral to first-seen interval
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27 28	11	Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies
29		
30	12	estimated the odds of being seen by a specialist within two weeks of referral; one
31 32	13	demonstrated reduced unadjusted odds (OR 0.80),(18) while there was no significant
33	10	demonstrated reduced analysisted odds (off 0.000),(10) while there was no significant
34	14	association in the other (OR 0.95) after adjusting for age, stage and site (colon vs
35 36		
37	15	rectal).(15) (Appendix S8)
38		
39 40	16	Another study used generalised linear modelling to estimate the association between
41	47	en e
42 43	17	occupation and the number of days to see a specialist after referral, adjusting for age,
44	18	marital status and ethnicity.(13) This study reported no significant association.(13)
45		
46 47	19	Overall, the evidence was inconclusive for an association between deprivation and the
48	• •	
49	20	referral to first-seen interval. (Table 1; Appendix S8)
50 51		
52	21	First seen to diagnosis interval
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54 55	22	One study estimated the association between occupation and the number of days from
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57	23	the first hospital appointment to communication of diagnosis.(13) A significant
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1	association was demonstrated (p=0.028), but no magnitude or direction of effect was
2	provided. The evidence was, therefore, inconclusive. (Table 1; Appendix S8)
3	Diagnosis to treatment interval
4	Five studies evaluated the diagnosis to treatment interval.(14-18) Two estimated the
5	number of days from diagnosis to major surgery, adjusting for; stage, sex, age, grade
6	and morphology.(14, 16) No significant associations were demonstrated. (Appendix S8)
7	Two studies evaluated the likelihood of commencing treatment within 31 days from the
8	date a treatment plan was agreed upon.(15, 18) One study demonstrated increased
9	unadjusted odds (OR 1.28),(18) while the other presented reduced adjusted odds of
10	patients from the most deprived areas commencing treatment within 31 days (OR
11	0.91).(15) (Appendix S8)
12	Another study calculated the likelihood of treatment for the most deprived quintile
13	across several time points. They demonstrated reduced adjusted odds of treatment
14	within one week (OR 0.78), one month (OR 0.84) and two to three months (OR 0.91)
15	but non-reduced odds at four to six months (OR 1.07) after the first contact with the
16	health system.(17) (Appendix S8)
17	Overall, the evidence for an association between deprivation and length of the diagnosis
18	to treatment interval was inconclusive. (Table 1; Appendix S8)
19	Test to diagnosis interval / secondary care diagnostic interval
20	One study evaluated the secondary care diagnostic interval (SCDI), defined as the
21	period between the date of the first interaction with secondary care to the date of
22	diagnosis.(12) This study evaluated the factors associated with an interval greater than
23	the median, adjusting for sex, age, stage, comorbidities, ethnicity, route to diagnosis and

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2	1	additional diagnostic tests.(12) The odds of a longer interval were not significantly
3	T	additional diagnostic tests.(12) The odds of a longer interval were not significantly
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5	2	increased for patients from the most deprived quintile (OR 1.07). (Appendix S8)
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8	3	Another study evaluated the time from the first investigation to cancer diagnosis.(23)
9		
10	4	The authors conducted quantile regression, adjusting for age, comorbidities, sex, test
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12	5	type and symptom category, focussing on the median and 75 th centiles.(23) There was
13	5	type and symptom category, rocussing on the median and 75 contries.(25) There was
14	_	
	6	no significant association between deprivation and interval length. (Appendix S8)
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17	7	Overall, there was no evidence of a prolonged SCDI or test-to-diagnosis interval for
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19	8	patients from the most deprived background. (Table 1; Appendix S8)
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22	9	First presentation to diagnosis interval
23	5	T is presentation to all ghosis interval
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25	10	Three studies evaluated the time from the first symptom or feature of colorectal cancer
26	10	Three studies evaluated the time nom the first symptom of feature of colorectal calleer
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28	11	in primary care records to diagnosis.(21-23) One study demonstrated an association
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30	12	between deprivation and a longer interval in two of three econometric analyses.(21) The
31		
32	10	other two studies conducted quantile regression, focusing on the median and 75 th
33	13	other two studies conducted quantifie regression, focusing on the median and 75 th
34		
35	14	centiles, adjusting for age, comorbidities, sex and type of symptom.(22, 23) Both
36		
37	15	studies demonstrated an association between the most deprived quintile and a longer
38	10	studies demonstrated un association between the most deprived quintife and a ronger
39		
40	16	first presentation to diagnosis interval for patients with colon cancer (e.g. adjusted
40		
	17	median interval of 204 versus 126 days).(22) Meanwhile, there was no such association
42		
43	18	among patients with rectal cancer, (23) possibly reflecting that patients with rectal
44	10	among patients with rectar cancer,(25) possibly reneeting that patients with rectar
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46	19	cancer are more likely to present with localising symptoms. (Appendix S8)
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49	20	Overall, three robust studies provided evidence that patients from the most deprived
50		
51	21	quintile experienced a longer first presentation to diagnosis interval. (Table 1; Appendix
52		and the second a reason mot presentation to anti-nois interval. (Tuble 1, Appendix
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54	22	S8
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57	23	Symptom to diagnosis interval
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1	One study estimated the effect of occupation on the time between a patient's first
2	symptom and diagnosis.(13) No significant effect was demonstrated, adjusting for
3	ethnicity, age, marital status and sex.(13) (Table 1; Appendix S8)
4	Referral to treatment interval
5	Four studies evaluated the time from referral to treatment.(15, 18-20) Two studies
6	demonstrated no significant association between deprivation and the likelihood of
7	commencing treatment within 62 days of referral (range of ORs 1.02-1.07).(18, 19)
8	Another study demonstrated reduced odds of patients commencing treatment within 62
9	days of referral, adjusted for age, stage, referral interval and first treatment received
10	(OR 0.82).(15) (Appendix S8)
11	Meanwhile, one study estimated hazard ratios for the time between referral and first
12	treatment, adjusting for stage, distance and presentation.(20) There was no significant
13	association between deprivation and time to treatment (HR 1.24). (Appendix S8)
14	Overall, the association between deprivation and this interval was inconclusive. (Table
15	1; Appendix S8)
16	Results of studies reporting treatment inequalities
17	Results of studies reporting likelihood of receipt of primary surgery
18	The outcome of interest was primary surgery in eleven studies, here defined as resection
19	of the tumour.(19, 20, 24-31, 36) Five studies clearly defined the outcome as a tumour
20	resection,(25, 27-29, 36) while the received surgical procedure was not identified in the
21	other six studies.(19, 20, 24, 26, 30, 31) (Appendix S9)
22	Across seven studies, adjustment was made for different factors: age,(19, 20, 24-26, 29,
23	36) stage,(19, 20, 24-26, 36) sex,(19, 24-26, 29, 36) comorbidity,(24, 25, 36) site (colon
24	vs rectum),(19, 25, 36) distance or time to hospital,(20, 26) year of diagnosis,(24, 36)

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2	1	region,(19) and histology, grade and presentation.(36) Meanwhile, four studies provided
3 4	2	(27, 29, 20, 21) (A = 1)
5	2	only rates of patients receiving surgery.(27, 28, 30, 31) (Appendix S9)
6 7	2	
8	3	Six studies presented reduced odds of surgery for patients from the most deprived
9 10	4	background (range of ORs 0.32-0.99).(24, 26-28, 30, 31) One study presented increased
11 12	5	odds of not receiving surgery amongst the most deprived patients with rectal cancer
13 14 15	6	(OR 1.35) but no significant association among patients with colon cancer (OR
16 17	7	0.96).(36) Meanwhile, one study presented increased odds of surgery for patients from
18 19	8	the most deprived background (OR 1.63),(25) and three studies demonstrated no
20 21 22	9	association (range of ORs 0.52-0.88).(19, 20, 29) Overall, there was moderate evidence
23 24	10	of the effect of deprivation due to a lack of consistent effect across the mixed-strength
25 26	11	studies. (Table 1; Appendix S9)
27 28 29	12	Results of studies reporting likelihood of receipt of surgery for oligometastatic disease
30		
31 32	13	Four studies examined the receipt of surgery in presumed oligometastatic disease, all
33 34 35	14	adjusted for age, stage, comorbidity, and site (colon vs. rectal).(32-35) Three studies
36 37	15	examined the receipt of liver resection, demonstrating significantly reduced odds of
38 39	16	resection for patients from the most deprived group (range of ORs 0.70-0.76).(32-34)
40 41 42	17	One study examined the receipt of pulmonary resection, with no significant association
42 43 44	18	demonstrated between deprivation and the likelihood of resection (OR 1.04).(35) (Table
45 46	19	1; Appendix S9)
47 48	20	Results of studies reporting likelihood of surgical variation
49 50		
51 52	21	Seven studies evaluated variations in surgery.(37-43) Six reported rates or odds of
53 54 55	22	abdominoperineal resection (APER) or anterior resection (AR).(37-42) Five studies
55 56 57	23	adjusted for important variables, including age,(37-40) sex,(37-41) stage,(37, 38) year
58 59	24	of diagnosis or resection,(37-41) surgeon workload,(37, 38) and admission type.(37-40)
60	25	Five of the seven studies demonstrated that APER was significantly more likely than

1	AR for patients from the most deprived areas (range of ORs 1.37-1.64).(37, 39-42)
2	(Table 1; Appendix S10)
3	Meanwhile, one study of 120 patients presented unadjusted rates of total pelvic
4	exenteration (TPE) compared with partial pelvic exenteration (PPE).(43) There was a
5	non-significant association between deprivation and the unadjusted odds of TPE (OR
6	1.75). (Table 1; Appendix S10)
7	Results of studies reporting likelihood of receipt of chemotherapy
8	Thirteen studies examined whether patients received any chemotherapy,(19, 20, 24-27,
9	44-50) eleven of which conducted adjusted analyses.(19, 20, 24-26, 44-49) Six studies
10	evaluated the use of adjuvant chemotherapy.(24, 44, 45, 49-51) Two studies evaluated
11	the use of palliative chemotherapy.(24, 46) Meanwhile, the intent of chemotherapy was
12	unknown in the remaining seven studies.(19, 20, 25-27, 47, 48)
13	Eight studies demonstrated reduced adjusted odds of chemotherapy for patients from the
14	most deprived group (range of ORs 0.44-0.99).(19, 24-26, 44, 45, 47, 48) One study
15	demonstrated reduced adjusted odds for patients from the most deprived group with
16	colon (OR 0.45) but not rectal cancer (OR 0.73).(46) Two studies did not show a
17	significant association between deprivation and receipt of chemotherapy (range of ORs
18	0.49-2.13).(20, 49) (Appendix S11)
19	Meanwhile, two studies presented unadjusted rates.(27, 50) One demonstrated reduced
20	odds of chemotherapy for the most deprived patients with colorectal cancer (OR
21	0.31).(50) The other demonstrated reduced odds of chemotherapy for the most deprived
22	patients with colon (OR 0.85) but not rectal cancer (OR 1.03).(27) (Appendix S11)
23	One study examined the receipt of combination versus single-agent chemotherapy,
24	adjusting for age, sex, ethnicity, tumour size, lymph node yield and year of

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1	diagnosis.(51) However, no adjustment was made for co-morbidity. Patients from the
2	most deprived area had significantly reduced odds of receiving combination
3	chemotherapy (OR 0.50).(51) (Appendix S11)
4	Five of the six studies evaluating the use of adjuvant chemotherapy demonstrated
5	inequalities.(24, 44, 45, 50, 51) Meanwhile, both studies evaluating the use of palliative
6	chemotherapy demonstrated similar inequalities.(24, 46) Overall, the evidence
7	supported the hypothesis that patients from the most deprived group are less likely to
8	receive chemotherapy or combination adjuvant chemotherapy. (Table 1; Appendix S11)
9	Results of studies reporting likelihood of receipt of radiotherapy
10	Seven studies reported receipt of radiotherapy by socioeconomic group.(19, 20, 25-27,
11	43, 52) Two studies evaluated the use of neoadjuvant radiotherapy.(19, 43) One study
12	evaluated patterns of pre and post-operative radiotherapy.(52) The intent of
13	radiotherapy was unknown in four studies.(20, 25-27)
14	Three studies conducted analyses that adjusted for important factors, including; age,(20,
15	25, 26) stage,(20, 25, 26) sex,(25, 26) distance or journey time,(20, 26) tumour site
16	(colon vs rectum),(20) and comorbidity.(25) None of these studies demonstrated a
17	significant association between deprivation group and radiotherapy (range of ORs 0.85-
18	0.99). The remaining four studies reported unadjusted rates of radiotherapy.(19, 27, 43,
19	52) Two of these studies demonstrated increased odds of radiotherapy for patients from
20	the most deprived group (range of ORs 1.33-1.39).(27, 52) The other two studies looked
21	at rates of neoadjuvant radiotherapy specifically and did not show a significant
22	association between deprivation and odds of treatment (range of ORs 1.00-1.15).(19,
23	43) (Appendix S12)
24	Overall, there was no evidence to support an association between socioeconomic status
25	and receipt of radiotherapy. (Table 1; Appendix S12) This conclusion may depend on

the intent of radiotherapy and would, therefore, have been stronger if all outcomes were

- differentiated by intent (e.g. neoadjuvant or palliative).
- Results of studies reporting receipt of any treatment
- Two studies evaluated the likelihood of any treatment by deprivation quintile, adjusting
- for age, (17, 46) sex(46) and stage. (17, 46) It was assumed this meant receiving surgery,
- radiotherapy, or chemotherapy. However, these outcomes needed to be more clearly
- defined. Both studies reported significantly reduced odds of any treatment within six
- months of diagnosis(46) or six months of the first contact with the NHS (range of ORs
- 0.54-0.87).(17) (Table 1; Appendix S13)

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Specific outcome reported	Overall assessment/conclusion	No. studies (no. subjects)	Studies demonstrating adverse effect of deprivation	Studies demonstrating protective effect of deprivation	Studies demonstrating no impact of deprivation	Further information
Referral to first seen interval	Inconclusive impact of deprivation on the length of the referral to first seen interval	3 (86,644)	1 Strong(18)	-	1 Strong(15) 1 Weak(13)	
First seen to diagnosis interval	Inconclusive impact of deprivation on the length of the first seen to diagnosis interval	1 (15,891)	-	1 Weak(13)	-	
Referral to treatment interval	Inconclusive impact of deprivation on the length of the referral to treatment interval	4 (69,892)	1 Strong(15)	-	1 Strong(18) 2 Weak(19, 20)	
Diagnosis to treatment interval	Inconclusive impact of deprivation on the length of the diagnosis to treatment interval	5 (292,502)	1 Strong(15) 1 Moderate(17)	1 Strong(18)	2 Strong(14, 16)	Appendix S8: Results of studies reporting variations in the system
Test to diagnosis / secondary care diagnostic interval	No impact of deprivation on the length of the test to diagnosis/secondary care diagnostic interval	2 (68,794)	-	-	2 Strong(12, 23)	interval
First presentation to diagnosis interval	Deprivation associated with increased length of the first presentation to diagnosis interval	3 (at least 6,951)	3 Strong*(21-23)	-	1 Strong*(23)	
Symptom to diagnosis interval	Inconclusive impact of deprivation on the length of the symptom to diagnosis interval	1 (15,891)	-0/-	-	1 Weak(13)	

Table 1: Narrative synthesis - assessment of the relationship between deprivation, the system interval and treatment received ich only

Specific outcome reported	Overall assessment/conclusion	No. studies (no. subjects)	Studies demonstrating adverse effect of deprivation	Studies demonstrating protective effect of deprivation	Studies demonstrating no impact of deprivation	Further information
Likelihood of receipt of surgery	Moderate evidence for reduced surgery with increasing deprivation.	11 (374,869)	2 Strong*(24, 36) 1 Moderate(27) 4 Weak(26, 28, 30, 31)	1 Strong(25)	1 Strong*(36) 3 Weak(19, 20, 29)	Appendix S9: Results – Likelihood of receipt of surgery
Likelihood of receipt of liver resection	Strong evidence for reduced liver resection with increasing deprivation	3 (285,194)	3 Strong(32-34)	-	-	Appendix S9: Results – Likelihood of receipt of surgery
Likelihood of receipt of pulmonary resection	No impact of deprivation on likelihood of pulmonary resection	1 (80,869)	-	-	1 Strong(35)	Appendix S9: Results – Likelihood of receipt of surgery
Likelihood of receipt of APER	Strong evidence for increased likelihood of APER vs. AR with increasing deprivation	6 (128,946)	1 Strong(37) 4 Weak(39-42)	-	1 Weak(38)	Appendix S10: Results – Likelihood of surgical variation
Likelihood of receipt of TPE	No impact of deprivation on likelihood of TPE vs. PPE with increasing deprivation	1 (120)	er:	-	1 Weak(43)	Appendix S10: Results – Likelihood of surgical variation
Likelihood of receipt of chemotherapy	Strong evidence for reduced chemotherapy with increasing deprivation	13 (251,862)	4 Strong(24, 25, 44, 45) 2 Moderate*(27, 47) 5 Weak*(19, 26, 46, 48, 50)	4	1 Moderate*(27) 3 Weak*(20, 46, 49)	Appendix S11: Results – Likelihood of receipt of chemotherapy
Likelihood of receipt of combination chemotherapy	Strong evidence for reduced use of combination chemotherapy with increasing deprivation	1 (8,750)	1 Strong(51)	- 0/	27,	Appendix S11: Results – Likelihood of receipt of chemotherapy
Likelihood of receipt of radiotherapy	No impact of deprivation on likelihood of radiotherapy	7 (79,053)	-	1 Moderate(27) 1 Weak(52)	1 Strong(25) 4 Weak(19, 20, 26, 43)	Appendix S12: Results – Likelihood of receipt of radiotherapy
Likelihood of receipt of any treatment	Moderate evidence for reduced any treatment with increasing deprivation	2 (90,138)	1 Moderate(17) 1 Weak(46)	-	-	Appendix S13: Results – Likelihood of receipt of any treatment

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1 Discussion

2 Main Findings

3 This is the first systematic review to evaluate what is already known about the

- 4 relationship between socioeconomic status, the system interval, and the treatment that
- 5 patients with colorectal cancer receive.

6 Diagnostic and treatment delays

There were seven intervals evaluated. The evidence for system delays was generally 7 inconclusive, given substantial heterogeneity in methods and outcomes. However, there 8 was substantial evidence that the first presentation to diagnosis interval was longer for 9 patients from the most deprived background, depending on the underlying site. The 10 underlying reasons require further elucidation using qualitative studies. This would help 11 us understand the extent to which these delays are driven by patient or healthcare factors 12 and how these can be addressed. Possible causes include missed appointments due to 13 competing demands such as employment or care responsibilities. (53, 54) Other reasons 14 might include complex transport and travel arrangements causing difficulties in 15 attending appointments. (53, 54) 16

17 Surgery in the management of colorectal cancer

18 There was moderate evidence for inequalities in primary surgery. However, most

19 studies had limitations; few adjusted for stage, most combined colon and rectal cancers,

and many included patients diagnosed before 2010.

21 However, there was strong and consistent evidence that patients from the most deprived

- areas were less likely to undergo a liver resection and were more likely to undergo an
- 23 APER than anterior resection. APER is associated with a worse quality of life and is
- 24 generally considered less preferable if a less deforming surgery is possible.

1	Despite adjustment, socioeconomic inequalities were frequently observed. This suggests
2	the presence of uncaptured factors such as co-morbidity or frailty. There may also have
3	been variations in access to specialist care, financial and employment factors, patient
4	choice, health-seeking behaviours and health literacy, all of which warrant further
5	investigation.(55-57)
6	Chemotherapy in the management of colorectal cancer
7	There was strong evidence that patients from more deprived areas were less likely to
8	receive chemotherapy or combination adjuvant chemotherapy. Trust in clinicians,
9	financial and employment factors, social support, adequate communication and
10	provision of information are critical in influencing the use of chemotherapy.(58-61)
11	These, amongst other uncaptured factors such as comorbidity or frailty, could be
12	responsible for the observed inequalities.
13	Radiotherapy in the management of rectal cancer
14	There was no evidence that patients from more deprived areas were less likely to
15	receive radiotherapy. The absence of observed inequalities could reflect the nature of
16	this outpatient treatment and the availability of patient transport. This is compared with,
17	for example, surgery, which necessitates hospital admission and prolonged time away
18	from work and social support. A lung cancer study similarly demonstrated a greater
19	likelihood of radiotherapy but a reduced likelihood of surgery amongst less affluent
20	patients.(62)
21	Strengths and weaknesses
22	This systematic review identified many studies and employed a robust methodology.
23	The process of identifying search terms was thorough, and the search was validated.

- 24 The searches were extensive, conducted across eight databases, supplemented with
- citation searching and a thorough examination of the grey literature. These additional

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1		
2	1	search methods identified six studies.(27, 28, 35, 36, 44, 52) Inclusion of non-peer-
3		
4	2	reviewed literature was also a key strength of this review.(25, 27, 28, 36)
5		
6	-	
7 8	3	The included studies were, however, heterogeneous in the methodology and populations
o 9		
10	4	studied. Out of forty-one studies, only fifteen included patients diagnosed after
11		
12	5	2010.(12, 14, 18, 21-23, 27, 32, 33, 35, 36, 43-45, 51) Of the six studies evaluating the
13		
14	6	system interval in patients diagnosed since 2010, four demonstrated some
15		
16	7	inequalities.(18, 21-23) Meanwhile, seven out of the nine studies that evaluated
17	•	
18	8	inequalities in treatments amongst patients diagnosed after 2010 demonstrated the
19	0	inequalities in reaching anongst patients diagnosed after 2010 demonstrated the
20	0	progence of inequalities (27, 22, 22, 26, 44, 45, 51) Therefore, although most studies
21 22	9	presence of inequalities.(27, 32, 33, 36, 44, 45, 51) Therefore, although most studies
22		
24	10	included patients from over a decade ago, inequalities persisted in recent cohorts despite
25		
26	11	a national focus on reducing inequalities.
27		
28	12	Another limitation was that studies frequently analysed colorectal cancer as a single
29	12	Another minitation was that studies nequently analysed colorectal cancel as a single
30	10	disease despite differences in presentation and management. Significantly, no study
31	13	disease despite differences in presentation and management. Significantly, no study
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33	14	utilised causal inference approaches, exemplified by an absence of reported directed
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35 36	15	acyclic graphs.(63) The methods used could have introduced a bias known as the "table
37		
38	16	2 fallacy", whereby estimates from regression models are mistakenly interpreted.(63)
39		
40	17	Using a causal approach to future studies would considerably strengthen the
41		
42	18	interpretation and, thus, meaningfully impact policy.(64)
43		interpretation and, thus, meaningfully impact policy.(64)
44		
45	19	Implications for policy and practice
46		
47	20	Due to significant heterogeneity across studies, we could not firmly conclude whether
48 49	20	Due to significant neterogeneity across staties, we could not mining conclude whether
50	21	patients from more deprived backgrounds systematically experience longer system
51	21	patients from more deprived backgrounds systematically experience longer system
52	22	intervale Harrows COVID 10 detrimentally immediated concern diagnostic activity for
53	22	intervals. However, COVID-19 detrimentally impacted cancer diagnostic activity for
54	•	
55	23	most patients, especially those in deprived areas.(5) It is important to ensure measures
56		· · · · · · · · · · · · · · · · · · ·
57	24	are in place to monitor the system interval for patients most at risk of delays.(5)
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1	There was moderate evidence of socioeconomic inequalities in surgery and strong
2	evidence for inequalities in chemotherapy. Some inequalities may partly be due to
3	wording in clinical guidelines. For example, the National Institute for Health and Care
4	Excellence advises that primary surgery for colorectal cancer is "offered" (a strong
5	recommendation); the same guideline advises liver resection be "considered" (less
6	certain benefit).(65) Similarly, adjuvant chemotherapy can be estimated to reduce the
7	risk of death in stage III disease by 10-15%. However, there is a significant risk of long-
8	term toxicity. Patients must carefully weigh the potential harms and benefits of these
9	less strongly recommended treatments. Shared-decision making is vital. Inequalities
10	will result when some patients experience better shared-decision making and can cover
11	the costs of additional treatment, such as time off work.(66)
12	Clinicians can mitigate some of the effects of deprivation. Such strategies may include
13	referring patients for pre-rehabilitation, tailored communication, and ensuring patients
14	are aware of appropriate financial support and transport schemes.(66)
15	Further studies are needed to evaluate for inequalities in novel treatments. In the era of
16	precision oncology and an ever-increasing armamentarium of novel treatments, the
17	marginal benefits of new therapies mustn't just be experienced by the most affluent. A
18	prostate cancer study exemplified this, demonstrating that patients from more deprived
19	backgrounds living at greater distances from specialist centres were significantly less
20	likely to receive robotic prostatectomy.(67) If we accept the benefit of newer surgical
21	technology and techniques, such as robotic surgery, these should be available for all
22	patients no matter where they live.
23	Future research

Further research evaluating the whole of the system interval is needed. Further researchshould also aim to understand why deprivation is associated with a reduced likelihood

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1 2 3	1	of chemotherapy and surgery. In particular, observational research of recent cohorts
5 4 5	2	should utilise causal inference. Beyond this, qualitative research will be of great value
6 7	3	in gaining a richer insight into the causes and drivers of these inequalities.
8		
9 10	4	Conclusions
11 12	5	Despite a healthcare system that provides free healthcare at the point of access, there
13 14	6	were unexplained socioeconomic inequalities in surgery, chemotherapy and aspects of
15 16		
17 18	7	the system interval. Further research is needed to understand the variations in treatment
19 20	8	between socioeconomic groups.
21	0	Differences in action colorion for treatment have been linked with were colorected
22 23	9	Differences in patient selection for treatment have been linked with worse colorectal
24 25	10	cancer survival within and between countries, with evidence of improved outcomes
26 27	11	when care is aligned with optimal pathways.(68) Eliminating inequalities could narrow
28 29	12	survival gaps within and between countries. These findings will interest policymakers,
30		
31 32	13	clinicians and researchers worldwide, as inequalities in cancer care and outcomes of
33 34	14	different socioeconomic groups have been recognised across healthcare jurisdictions.
35 36		
37	15	Additional Information
38 39		
40 41	16	Acknowledgements
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43 44	17	Not applicable.
45 46	18	Authors' Contributions
47	10	Authors Contributions
48 49	19	BPS – conceptualisation, developed search strategy, screening, data curation and formal
50	10	
51 52	20	analysis, project administration and writing – original draft.
53 54	21	KS – conceptualisation, screening, data curation and formal analysis, review of the
55	21	KS – conceptualisation, screening, data curation and formal analysis, review of the
56 57	22	manuscript
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59 60	23	MS – screening and review of the manuscript

- SG developed the search strategy and manuscript review.
- ML conceptualisation, supervision, review of the manuscript
- UM conceptualisation, developed search strategy, screening, data curation and formal
- analysis, supervision, and manuscript review.

Ethics Approval and Consent to Participate

- This systematic review synthesises previously published data and does not include new
- data that requires ethical approval and consent.

Consent for Publication

Not applicable.

Data Availability

- Ata ... his published article and its suppress or analysed during this study. Competing Interests The authors declare no conflict of interest. This published article and its supplementary information files include all data generated

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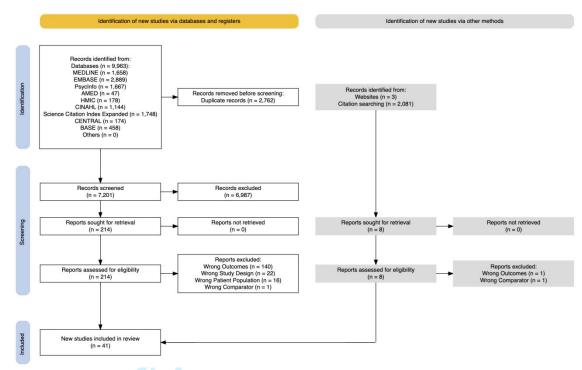
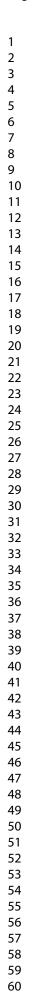


Figure 1: PRISMA flow diagram of included studies.

rf included studies.



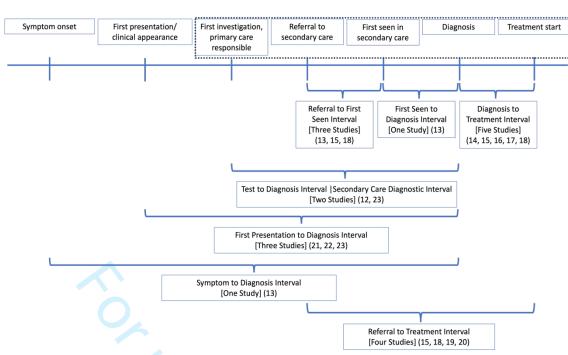


Figure 2: Time intervals evaluated in the included studies.

The blue dotted line indicates the system interval defined by the Aarhus statement.(4) Studies that included any aspect of this system interval were included, even if the interval commenced before the system interval defined here.



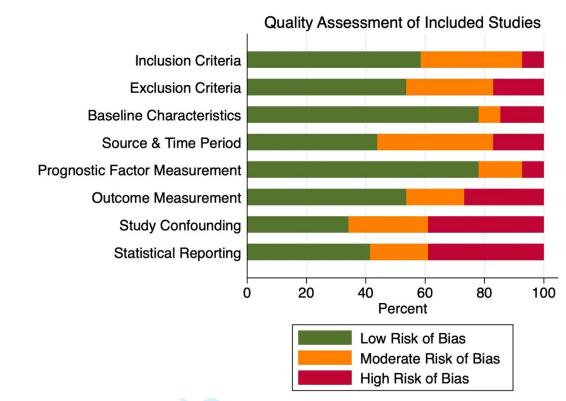


Figure 3: Risk of bias in the included studies. For each element the proportion of studies with high, moderate and low risk of bias is illustrated.

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Where are the inequalities in colorectal cancer care in a country with universal healthcare? A systematic review and narrative synthesis

Appendix

Benjamin Pickwell-Smith, Katie Spencer, Mahboobeh Haji Sadeghi, Sarah Greenley, Mike Lind, Una Macleod

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Appendix S1: PRISMA Statement Checklist¹

Section/topic	Item #	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			-
Abstract	2	As per PRISMA 2020 for Abstracts checklist	2-3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	5-6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6, Appendix S2
Search strategy	7	Present the full search strategies for all databases, registers, and websites, including any filters and limits used.	Appendix S3
Study selection	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Appendix S5
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Appendix S5

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Study risk of bias assessment	11 Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) 7 used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.		7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Appendix S5
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	7
-	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Appendix S5
-	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Appendix S5
-	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta- analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	7
-	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	7
RESULTS			1
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	8, Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A
Study characteristics	17	Cite each included study and present its characteristics.	8, Figure 2,Appendix S7
Risk of bias within studies	18	Present assessments of risk of bias for each included study.	8, Figure 3, Appendix S6
Results of individual	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and	8-15, Appendix S

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studies	udies (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.		813
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	8, Figure 3, Appendix S6
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	8-15, Appendix S8- S13
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	8-15, Table 1
DISCUSSION	· · · · · ·		1
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	18-22
	23b	Discuss any limitations of the evidence included in the review.	18-22
	23c	Discuss any limitations of the review processes used.	18-22
	23d	Discuss implications of the results for practice, policy, and future research.	18-22
Other Information			1
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	2, 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support 25 Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.		3,4	
Competing interests	26	Declare any competing interests of review authors.	23
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	23

2 3 4 5	Appendix S2: List of Hand-Searched Online Sources and Details of Citation Searches
6 7 8	The following websites were hand-searched on 30/03/2023:
9 10 11 12	 The National Cancer Registration and Analysis Service (<u>http://www.ncin.org.uk/home</u>)
13 14 15	• Cancer Research UK (<u>https://www.cancerresearchuk.org/</u>)
16 17	Macmillan Cancer Support (<u>https://www.macmillan.org.uk</u>)
18 19	• The King's Fund (<u>https://www.kingsfund.org.uk/</u>)
20 21 22 23 24 25	 Office for Health Improvement and Disparities (<u>https://www.gov.uk/government/organisations/office-for-health-improvement-and-disparities</u>)
26 27 28	• National Bowel Cancer Audit (<u>https://www.nboca.org.uk</u>)
29 30 31 32 33	 Bowel Cancer UK (<u>https://www.bowelcanceruk.org.uk</u>) National Health Service England (<u>https://www.england.nhs.uk/about/equality/equality-hub/</u>)
34 35 36 37 38 39	 The Association of Coloproctology of Great Britain & Ireland (<u>https://www.acpgbi.org.uk</u>)
40 41 42 43	 NHS Digital (<u>https://digital.nhs.uk</u>) Health Data Insight CIC (<u>https://healthdatainsight.org.uk</u>)
44 45	National Disease Registration Service (<u>https://www.ndrs.nhs.uk</u>)
46 47 48	The automated tool 'citationchaser' conducted forward and backward citation searches on thirty-nine included studies where a digital object identifier was available. ²⁻⁴⁰
49 50 51 52 53	These searches identified 838 unique records using backwards searching and 1,628 unique records using forwards searching. ⁴¹ These records were then screened by BPS in EndNote X9. ⁴²
54 55 56	The bibliographies of two systematic reviews were also examined for relevant articles. ^{43,44}

1

Appendix S3.1: Search Strategies – MEDLINE (OVID)

Initial searches were conducted on 31st August 2021. Repeat searches were conducted across

all databases on 26/01/2023, limited to date of database entry between 20/08/2021 to

26/01/2023.

Ovid MEDLINE(R) ALL <1946 to August 31, 2021>

1 exp Colorectal Neoplasms/

2 ((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)).mp

- 3 or/1-2 [cancer population of interest]
- 4 exp Socioeconomic Factors/
- 5 (socio-economic or socioeconomic or socio-demographic or sociodemographic).mp

- 6 exp Education, Continuing/ or Education/
- 7 exp Income/
- 8 exp Health Status/
- 9 exp Poverty/
- 10 (socio-economic position or socioeconomic position).mp.
- 11 inequalities.mp.
 - 12 exp Social Environment/
- 13 social factors.mp.
- 14 income.mp.
- 15 exp Residence Characteristics/
- 16 Social class.mp.
- 17 Education.mp.
 - 18 exp Health Status Disparities/
- 19 depriv*.mp.
- 20 (equity or equitable).mp.
- 21 (inequity or inequitable).mp.
- 22 inequities.mp.
- 23 disparit*.mp.
- 24 or/4-23 [inequality concept]
 - 25 surgery.mp.
 - 26 Treatment.mp.
- 27 exp Health Services Accessibility/
- 28 exp Healthcare Disparities/
- 29 treatment disparities.mp.
- 30 exp "Delivery of Health Care"/
- 3 31 exp Primary Health Care/
- 4 32 exp Drug Therapy/
- 33 chemotherapy.mp.
- ⁷ 34 Radiotherapy/ or Radiotherapy, Adjuvant/
- 8 35 radiotherapy.mp.
- 59 36 accessibility.mp.

Page 39 of 91

1 2		
3	27	
4	37	access.mp.
5	38	pattern\$.mp.
6	39	palliative care/ or Patient care/ or Primary Health care/
7	40	care.mp.
8 9	41	investigation.mp.
10	42	exp "Quality of Health Care"/
11	43	exp Patient Selection/ or exp Eligibility Determination/
12	44	exp "Referral and Consultation"/
13	45	Receipt.mp. or exp "Patient Acceptance of Health Care"/
14	46	Provision.mp.
15 16	47	Attendance.mp.
17	48	25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39
18	or 40	or 41 or 42 or 43 or 44 or 45 or 46 or 47 [treatment concept]
19	49	exp "Early Detection of Cancer"/
20	50	exp Delayed Diagnosis/
21	51	((patient* or present* or doctor* or physician* or practitioner* or hospital* or
22 23		m [*] or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pre-
23	-	ment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera*
25		eatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).ti,ab.
26	52	
27		(stage* adj5 (diagnosis or diagnostic)).ti,ab.
28	53	49 or 50 or 51 or 52 [interval filter]
29 30	54	exp United Kingdom/
31	55	(national health service* or NHS*).ti,ab,in.
32	56	(english not ((published or publication* or translat* or written or language* or
33		(* or literature or citation*) adj5 english)).ti,ab.
34	57	(gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united
35	•	om* or (england* not "new england") or northern ireland* or northern irish* or
36 37	scotla	and* or scottish* or ((wales or "south wales") not "new south wales") or
38	welsh	ı*).ti,ab,jw,in.
39	58	(bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*)
40	or bra	adford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or
41	"carli	sle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's"
42 43	not (r	nassachusetts* or boston* or harvard*)) or (canterbury not zealand*) or
43 44	("can	terbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or
45	chich	ester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not
46		lina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or
47	•	er's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or
48		ster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or
49 50		oln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not
51	•	south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not
52	•	rio* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new
53	•	wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or
54		vich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or
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56 57	-	reston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or
58	-	field or "sheffield's" or southampton or "southampton's" or st albans or stoke or
59		e's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's"
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or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*))))).ti,ab,in.

59 (bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's").ti,ab,in.

60 (aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's").ti,ab,in.

61 (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's").ti,ab,in.

62 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61

63 (exp africa/ or exp americas/ or exp Antarctic regions/ or exp arctic regions/ or exp asia/ or exp oceania/) not (exp great britain/ or europe/)

- 64 62 not 63 [NICE UK filter]
- 65 case reports.pt.
- 66 news.pt.

- 67 letter.pt.
 - 68 comment.pt.
- 69 exp animals/ not humans.sh.
- 70 65 or 66 or 67 or 68 or 69 [excluding animals and unwanted publication types]

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- 71 3 and 24 and 48
- 72 3 and 24 and 53
- 73 71 or 72
- 74 64 and 73
- 75 74 not 70

1					
2 3	A	- J'- S2 2. Second Starte - EMDASE (OVID)			
4	Appendix S3.2: Search Strategies – EMBASE (OVID)				
5 6	OVID	OVID Embase <1974 to 2021 August 31>			
7					
8	1	exp colorectal tumor/			
9 10	2	((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or			
10	malig	nan* or carcinoma* or metasta* or oncolog*)).mp.			
12	3	1 or 2 [cancer population of interest]			
13	4	exp socioeconomics/			
14	5	(socio-economic or socioeconomic or socio-demographic or sociodemographic).mp.			
15	6	exp education/			
16 17	7	exp income/			
18	8	exp health status/			
19	9	exp poverty/			
20	10	(socioeconomic position or socio-economic position).mp.			
21	11	inequalities.mp.			
22 23	12	exp social environment/			
25 24	13	social factors.mp.			
25	14	income.mp.			
26	15	exp demography/			
27	16	social class.mp.			
28	10	education.mp.			
29 30					
31	18	exp health disparity/			
32	19	depriv*.mp.			
33	20	(equity or equitable).mp.			
34	21	(inequity or inequitable).mp.			
35 36	22	inequities.mp.			
30	23	disparit*.mp.			
38	24	4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or			
39		21 or 22 or 23 or 23 [inequality concept]			
40	25	surgery.mp.			
41 42	26	treatment.mp.			
42	27	exp health care access/			
44	28	treatment.mp. exp health care access/ exp health care disparity/			
45	29	treatment disparities.mp.			
46	30	exp health care delivery/			
47 48	31	exp primary health care/			
40 49	32	exp drug therapy/			
50	33	chemotherapy.mp.			
51	34	adjuvant radiotherapy/ or radiotherapy/			
52	35	radiotherapy.mp.			
53	36	accessibility.mp.			
54 55	37	access.mp.			
56	38	pattern*.mp.			
57	39	palliative therapy/ or patient care/ or primary health care/			
58	40	care.mp.			
59	41	investigation.mp.			
60		- ·			

42 exp health care quality/

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- 43 exp patient selection/99092
- 44 exp patient referral/ or exp consultation/
- 45 receipt.mp. or exp "Patient attitude"/
- 46 provision.mp.
- 47 attendance.mp.

48 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 [treatment concept]

- 49 exp early cancer diagnosis/
- 50 exp delayed diagnosis/

51 ((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pretreatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).ti,ab.

- 52 (stage* adj5 (diagnosis or diagnostic)).ti,ab.
- 53 49 or 50 or 51 or 52 [interval filter]
- 54 exp United Kingdom/
 - 55 (national health service* or nhs*).ti,ab,in,ad.

56 (english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab.

57 (gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*).ti,ab,jx,in,ad.

58 (bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*))))).ti,ab,in,ad.

(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's").ti,ab,in,ad.

(aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's").ti,ab,in,ad.

(armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's").ti,ab,in,ad.

54 or 55 or 56 or 57 or 58 or 59 or 60 or 61

(exp "arctic and antarctic"/ or exp oceanic regions/ or exp western hemisphere/ or exp africa/ or exp asia/ or exp "australia and new zealand"/) not (exp united kingdom/ or europe/)

- 62 not 63 [NICE UK Filter]
- letter.pt.
- (animal* not human*).sh,hw.
- 65 or 66 [excluding animals and unwanted publication types]
- 3 and 24 and 48
- 3 and 24 and 53
- 68 or 69
- 64 and 70
 - 71 not 67
 - limit 72 to conference abstract status
 - limit 73 to dd=20200831-20210831 reliez oni
 - 72 not 73
 - 74 or 75

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Appendix S3.3: Search Strategies – PsycINFO (OVID)

OVID APA PsycInfo <1806 to August Week 4 2021>

1 ((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)).af. [cancer population of interest]

- 2 exp Socioeconomic Factors/
- 3 (socio-economic or socioeconomic or socio-demographic or sociodemographic).af.
- 4 exp Education/

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- 5 exp Income Level/ or exp "Income (Economic)"/
- 6 exp Health Status/
- 7 exp Poverty/
 - 8 (socio-economic position or socioeconomic position).af.
 - 9 inequalities.af.
 - 10 exp Social Environments/
- 11 social factors.af. 🧹
- 12 income.af.
- 13 exp Neighborhoods/ or exp Urban Environments/ or exp Housing/
 - 14 social class.af.
 - 15 education.af.
 - 16 exp Health Disparities/
 - 17 depriv*.af.
 - 18 (equity or equitable).af.
 - 19 (inequity or inequitable).af.
 - 20 inequities.af.
 - 21 disparit*.af.
 - 22 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18
 - or 19 or 20 or 21 [inequality concept]
 - 23 surgery.af.
 - 24 Treatment.af.
 - 25 exp Health Care Utilization/ or exp Health Care Delivery/ or exp Health Care Access/
 - or exp Treatment Barriers/
 - 26 treatment disparities.af.
- 27 exp Health Care Services/
 - 28 exp Primary Health Care/
- 29 exp Drug Therapy/
- 30 chemotherapy.af.
- 48 31 exp Radiation Therapy/
- 49 32 exp Chemotherapy/
- 51 33 radiotherapy.af.
- 52 34 accessibility.af.
 - 35 access.af.
 - 36 pattern\$.af.
- 55 37 exp Palliative Care/
- 57 38 care.af.
- ⁵⁸ 39 investigation.af.
- 40 exp "Quality of Care"/ or exp "Quality of Services"/

exp Patient Selection/

exp Decision Making/

receipt.af.

provision.af.

attendance.af.

23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37

((patient* or present* or doctor* or physician* or practitioner* or hospital* or

system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pre-

treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera*

or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).ti,ab.

(english not ((published or publication* or translat* or written or language* or

(gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united

(bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*)

or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 [treatment concept]

(stage* adj5 (diagnosis or diagnostic)).ti,ab.

(national health service* or NHS*).ti,ab,in.

speak* or literature or citation*) adj5 english)).ti,ab.

47 or 48 [interval concept]

kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or

welsh*).ti,ab,jx,in.

or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or

"stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*))))).ti,ab,in.

(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's").ti,ab,in.

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- 55 (aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's").ti,ab,in.
- 56 (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's").ti,ab,in.
- 57 50 or 51 or 52 or 53 or 54 or 55 or 56 [UK filter]
- 58 exp animals/ not humans.sh. [excluding animals]
- 59 1 and 22 and 46
- 60 1 and 22 and 49
- 61 59 or 60
- 62 57 and 61
- 63 62 not 58

2						
3	4	andia 52 4. Second Strategies AMED (OVID)				
4	Appe	Appendix S3.4: Search Strategies – AMED (OVID)				
5						
6	AME	AMED (Allied and Complementary Medicine) <1985 to August 2021>				
7						
8	1	exp Colorectal neoplasms/				
9 10	2	((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or				
10	malig	nan* or carcinoma* or metasta* or oncolog*)).mp.				
12	3	1 or 2				
13	4	exp Socioeconomic factors/				
14	5	(socio-economic or socioeconomic or socio-demographic or sociodemographic).mp.				
15	6	exp education/				
16	7	exp Income/				
17 18	8	exp Health status/				
10	9	exp Poverty/				
20	10					
21		(socio-economic position or socioeconomic position).mp.				
22	11	inequalities.mp.				
23	12	exp Social environment/				
24	13	social factors.mp.				
25 26	14	income.mp.				
20	15	exp Residence characteristics/				
28	16	Social class.mp.				
29	17	Education.mp.				
30	18	depriv*.mp.				
31	19	(equity or equitable).mp.				
32	20	(inequity or inequitable).mp.				
33 34	21	inequities.mp.				
35	22	disparit*.mp.				
36	23	4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or				
37		21 or 22				
38						
39	24	surgery.mp.				
40	25	Treatment.mp.				
41 42	26	exp Health services accessibility/				
43	27	treatment disparities.mp.				
44	28	exp Health services accessibility/ treatment disparities.mp. exp "Delivery of health care"/				
45	29	exp Primary health care/				
46	30	exp Drug therapy/				
47	31	chemotherapy.mp.				
48	32	exp Radiotherapy/				
49 50	33	radiotherapy.mp.				
50	34	accessibility.mp.				
52	35	access.mp.				
53	36	pattern\$.mp.				
54	37	exp palliative care/				
55	37	exp Patient care/				
56 57		•				
57 58	39	care.mp.				
58 59	40	investigation.mp.				
60	41	exp "Quality of health care"/				

- exp Patient assessment/
 - exp "Referral and consultation"/
 - exp "Patient acceptance of health care"/
 - receipt.mp.

- Provision.mp.
- Attendance.mp.
- 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47
- ((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pretreatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* o, Jelay¹ Joint or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).ti,ab.
- (stage* adj5 (diagnosis or diagnostic)).ti,ab.
- 49 or 50
- 3 and 23 and 48
- 3 and 23 and 51
- 52 or 53

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2 3					
4	Appe	Appendix S3.5: Search Strategies – HMIC (OVID)			
5 6	HMIC	HMIC Health Management Information Consortium <1979 to August 2021>			
7 8	1	our Colorectel concer/			
9	1	exp Colorectal cancer/			
10	2	((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or			
11	-	nan* or carcinoma* or metasta* or oncolog*)).af			
12	3	1 or 2			
13	4	exp Socioeconomic factors/			
14 15	5	(socio-economic or socioeconomic or socio-demographic or sociodemographic).af.			
16	6	exp education/			
17	7	exp Income/			
18	8	exp health status/			
19	9	exp Poverty/			
20	10	(socio-economic position or socioeconomic position).af.			
21 22	11	inequalities.af.			
22	12	exp Social conditions/			
24	13	social factors.af.			
25	14	income.af.			
26	15	social class.af.			
27	16	education.af.			
28 29	10	exp Health inequalities/			
30	18	depriv*.af.			
31					
32	19 20	(equity or equitable).af.			
33	20	(inequity or inequitable).af.			
34	21	inequities.af.			
35 36	22	disparit*.af.			
30 37	23	4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or			
38		21 or 22			
39	24	surgery.af.			
40	25	treatment.af.			
41	26	exp Access to health services/ treatment disparities.af. exp Service delivery/			
42 43	27	treatment disparities.af.			
45 44	28	exp Service delivery/			
45	29	exp primary care/			
46	30	exp Drug therapy/			
47	31	chemotherapy.af.			
48	32	exp Radiotherapy/			
49 50	33	radiotherapy.af.			
50 51	34	accessibility.af.			
52	35	access.af.			
53	36	pattern*.af.			
54	30	exp Palliative care/			
55	38	exp patient care/			
56 57					
57 58	39	care.af.			
59	40	investigation.af.			
60	41	exp "Quality of patient care"/			

- exp Patient selection/
- exp Patient eligibility/
- exp Patient referral/
- receipt.af.
- provision.af.
- attendance.af.

24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47

- exp Early diagnosis/
- exp Patient waiting time/

((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pretreatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).mp.

- (stage* adj5 (diagnosis or diagnostic)).ti,ab.
- 49 or 50 or 51 or 52
- 3 and 23 and 48
- 3 and 23 and 53
- 54 or 55

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2				
3	Appendix S3.6: Search Strategies – CENTRAL (The Cochrane Library)			
4 5				
6	Search	n Name: CENTRAL Search		
7	Last Sa	aved: 01/09/2021 17:45:46		
8				
9	ID	Search		
10	#1	MeSH descriptor: [Colorectal Neoplasms] explode all trees		
11	#1 #2	(((colon* or colorectal or rectal) NEAR/3 (cancer* or neoplas* or tumor* or tumour*		
12 13				
13		lignan* or carcinoma* or metasta* or oncolog*))):ti,ab,kw		
15	#3	#1 or #2		
16	#4	MeSH descriptor: [Socioeconomic Factors] explode all trees		
17	#5	((socio-economic or socioeconomic or socio-demographic or		
18		lemographic)):ti,ab,kw		
19	#6	MeSH descriptor: [Education] explode all trees		
20 21	#7	MeSH descriptor: [Income] explode all trees		
21	#8	MeSH descriptor: [Health Status] explode all trees		
23	#9	MeSH descriptor: [Poverty] explode all trees		
24	#10	((socio-economic position or socioeconomic position)):ti,ab,kw		
25	#11	(inequalities):ti,ab,kw		
26	#12	MeSH descriptor: [Social Environment] explode all trees		
27	#13	(social factors):ti,ab,kw		
28 29	#14	(income):ti,ab,kw		
30	#15	MeSH descriptor: [Residence Characteristics] explode all trees		
31				
32	#16	(Social class):ti,ab,kw		
33	#17	(education):ti,ab,kw		
34	#18	MeSH descriptor: [Health Status Disparities] explode all trees		
35	#19	(Depriv*):ti,ab,kw		
36 37	#20	((equity or equitable)):ti,ab,kw		
38	#21	((inequity or inequitable)):ti,ab,kw		
39	#22	(inequities):ti,ab,kw		
40	#23	(disparit*):ti,ab,kw		
41	#24	#4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or		
42	#17 or	r #18 or #19 or #20 or #21 or #22 or #23		
43 44	#25	(surgery):ti,ab,kw		
44 45	#26	(treatment):ti,ab,kw		
46	#27	MeSH descriptor: [Health Services Accessibility] explode all trees		
47	#28	MeSH descriptor: [Healthcare Disparities] explode all trees		
48	#29	(treatment disparities):ti,ab,kw		
49	#30	MeSH descriptor: [Delivery of Health Care] explode all trees		
50	#30 #31	MeSH descriptor: [Primary Health Care] explode all trees		
51 52				
53	#32 #22	MeSH descriptor: [Drug Therapy] explode all trees		
54	#33	(chemotherapy):ti,ab,kw		
55	#34	MeSH descriptor: [Radiotherapy] explode all trees		
56	#35	(radiotherapy):ti,ab,kw		
57	#36	(accessibility):ti,ab,kw		
58 50	#37	(access):ti,ab,kw		
59 60	#38	(pattern*):ti,ab,kw		

2 3 #49 MeSH descriptor: [Patient Care] explode all trees 4 #40 MeSH descriptor: [Palliative Care] explode all trees 5 #41 MeSH descriptor: [Primary Health Care] explode all trees 6 7 #42 (care or investigation):ti,ab,kw 8 MeSH descriptor: [Quality of Health Care] explode all trees #43 9 MeSH descriptor: [Patient Selection] explode all trees #44 10 #45 MeSH descriptor: [Eligibility Determination] explode all trees 11 MeSH descriptor: [Referral and Consultation] explode all trees #46 12 13 #47 MeSH descriptor: [Patient Acceptance of Health Care] explode all trees 14 #48 (receipt or provision or attendance):ti,ab,kw 15 #49 #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or 16 #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 17 18 #50 MeSH descriptor: [Early Detection of Cancer] explode all trees 19 #51 MeSH descriptor: [Delayed Diagnosis] explode all trees 20 #52 (((patient* or present* or doctor* or physician* or practitioner* or hospital* or 21 system* or (primary NEAR/1 care) or (secondary NEAR/1 care) or total or (help NEAR/3 22 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or 23 24 radiothera* or treatment* or diagnos*) NEAR/5 (delay* or interval* or time* or pathway* 25 or route*))):ti,ab,kw 26 ((stage* NEAR/5 (diagnosis or diagnostic))):ti,ab,kw #53 27 #54 #50 or #51 or #52 or #53 28 29 #55 MeSH descriptor: [United Kingdom] explode all trees 30 #56 ((national health service* or NHS*)):ti,ab,kw 31 #57 ((english not ((published or publication* or translat* or written or language* or 32 speak* or literature or citation*) NEAR/5 english))):ti,ab,kw 33 ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united #58 34 35 kingdom* or (england* not "new england") or northern ireland* or northern irish* or 36 scotland* or scottish* or ((wales or "south wales") not "new south wales") or 37 welsh*)):ti,ab,kw 38 ((bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) #59 39 or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or 40 41 "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" 42 not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or 43 ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or 44 chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not 45 46 (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or 47 "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or 48 lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or 49 ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not 50 (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not 51 52 (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new 53 south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or 54 "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or 55 "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston 56 or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or 57 58 sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or 59 "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" 60

1	
2	
3	or wells or westminster or "westminster's" or winchester or "winchester's" or
4	
5	wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or
6	harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not
7	("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or
8	ontario* or ont or toronto*)))))):ti,ab,kw
9	#60 ((bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph
10	
11	or "st asaph's" or st davids or swansea or "swansea's")):ti,ab,kw
12	#61 ((aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's"
13	or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*)
14	
15	or stirling or "stirling's")):ti,ab,kw
	#62 ((armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or
16	londonderry or "londonderry's" or derry or "derry's" or newry or "newry's")):ti,ab,kw
17	
18	#63 #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62
19	#64 MeSH descriptor: [Africa] explode all trees
20	
21	#65 MeSH descriptor: [Americas] explode all trees
22	#66 MeSH descriptor: [Antarctic Regions] explode all trees
	#67 MeSH descriptor: [Arctic Regions] explode all trees
23	
24	#68 MeSH descriptor: [Asia] explode all trees
25	#69 MeSH descriptor: [Oceania] explode all trees
26	#70 MeSH descriptor: [United Kingdom] explode all trees
27	
28	#71 MeSH descriptor: [Europe] explode all trees
29	#72 #64 or #65 or #66 or #67 or #68 or #69
30	#73 #70 or #71
31	
32	#74 #72 NOT #73
	#75 #63 NOT #74
33	#76 #3 and #24 and #49
34	
35	#77 #3 and #24 and #54
36	#78 #76 or #77
37	
38	#79 #78 and #75
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Appendix S3.7: Search Strategies – Science Citation Index Expanded

Science Citation Index Expanded via Web Of Science Core Collection 01/9/21.

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#9 AND #17	

#10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16

(TI=(armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's")) OR (AB=(armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's")) OR (AD=(armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's")) 15

(TI=(aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's")) OR (AB=(aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's")) OR (AD=(aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's"))

(TI=(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's")) OR (AB=(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's")) OR (AD=(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's"))

(TI=(bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or

2 3 "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st 4 albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or 5 wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or 6 "winchester's" or wolverhampton or "wolverhampton's" or (worcester not 7 (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or 8 9 boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) 10 or ("york's" not ("new york*" or ny or ontario* or ont or toronto*)))))) OR (AB=(bath or 11 "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford 12 or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or 13 "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or 14 15 ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not 16 zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester 17 or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or 18 "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely 19 or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or 20 "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or 21 22 "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not 23 (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or 24 ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or 25 toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or 26 nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or 27 nottingham or "nottingham's" or oxford or "oxford's" or peterborough or 28 29 "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or 30 preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or 31 "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st 32 albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or 33 wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or 34 "winchester's" or wolverhampton or "wolverhampton's" or (worcester not 35 36 (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or 37 boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) 38 or ("york's" not ("new york*" or ny or ontario* or ont or toronto*)))))) OR (AD=(bath or 39 "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford 40 or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or 41 42 "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or 43 ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not 44 zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester 45 or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or 46 "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely 47 or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or 48 49 "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or 50 "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not 51 (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or 52 ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or 53 toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or 54 nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or 55 56 nottingham or "nottingham's" or oxford or "oxford's" or peterborough or 57 "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or 58 preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or 59 "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st 60

"winchester's" or wolv (massachusetts* or bos boston* or harvard*)) o	d's" or wells or westminster or "westminster's" or winchest erhampton or "wolverhampton's" or (worcester not ston* or harvard*)) or ("worcester's" not (massachusetts* or or (york not ("new york*" or ny or ontario* or ont or toronto york*" or ny or ontario* or ont or toronto*))))))
(TI=(gb or "g.b." or brit kingdom* or (england* scotland* or scottish* of OR (AB=(gb or "g.b." or united kingdom* or (er irish* or scotland* or so welsh*)) OR (AD=(gb o "u.k." or united kingdom	cain* or (british* not "british columbia") or uk or "u.k." or un not "new england") or northern ireland* or northern irish* or ((wales or "south wales") not "new south wales") or welsh or britain* or (british* not "british columbia") or uk or "u.k." of ngland* not "new england") or northern ireland* or northern cottish* or ((wales or "south wales") not "new south wales") or "g.b." or britain* or (british* not "british columbia") or uk m* or (england* not "new england") or northern ireland* or land* or scottish* or ((wales or "south wales") not "new sou
(TI=(english not ((publ speak* or literature or	lished or publication* or translat* or written or language* or citation*) near/5 english))) OR (AB=(english not ((publishe t* or written or language* or speak* or literature or citation
((TI=((national health s OR AD=((national health	service* or NHS*))) OR AB=((national health service* or NH th service* or NHS*))
9 #7 OR #8	
8	
#1 AND #2 AND #6	
7	
#1 AND #2 AND #3	
6 #4 #5	
#4 or #5 5	
TS=(stage* near/5 (dia	anosis or diagnostic))
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	nt* or doctor* or physician* or practitioner* or hospital* or
system* or (primary ne seek) or pre-treatment or radiothera* or treatment pathway* or route*))	ear/1 care) or (secondary near/1 care) or total or (help near * or referr* or specialist* or consultant* or surg* or chemot ment* or diagnos*) near/5 (delay* or interval* or time* or
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or accessibility or acces attendance)	ent or "treatment disparities" or chemotherapy or radiother ss or pattern* or care or investigation or receipt or provision
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	socioeconomic or socio-demographic or sociodemographic

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or income or "social class" or education or depriv* or equity or equitable or inequity or inequitable or inequities or disparit*)

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(TS=(((colon* or colorectal or rectal) near/3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*))))

to beet teries only

Appendix S3.8: Search Strategies – CINAHL

CINAHL Searched via EBSCO 31/8/21

#	Query
S1	(MH "Colorectal Neoplasms+")
S2	TI ((colon* or colorectal or rectal) n3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)) or AB ((colon* or colorectal or rectal) n3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*))
S3	S1 OR S2
S4	(MH "Socioeconomic Factors+")
S5	TI (socio-economic or socioeconomic or socio-demographic or sociodemographic) or AB (socio-economic or socioeconomic or socio-demographic or sociodemographic)
S6	(MH "Education+")
S7	(MH "Income+")
S8	(MH "Health Status+")
S9	(MH "Poverty+")
S10	TI (socio-economic position or socioeconomic position) or AB (socio-economic position or socioeconomic position)
S11	TI inequalities or AB inequalities
S12	(MH "Social Environment+")
S13	TI (social factors) or AB (social factors)
S14	TI income or AB income
S15	(MH "Residence Characteristics+")
S16	TI (social class) or AB (social class)
S17	TI education or AB education
S18	(MH "Health Status Disparities")
S19	TI (depriv*) or AB (depriv*)
S20	TI (equity or equitable) or AB (equity or equitable)
S21	TI (inequity or inequitable) or AB (inequity or inequitable)
S22	TI inequities or AB inequities
S23	TI disparit* or AB disparit*
S24	(S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23)
S25	TI (surgery) or AB (surgery)
S26	TI (treatment) or AB (treatment)
S27	(MH "Health Services Accessibility+")

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1 2		
3	S28	(MH "Healthcare Disparities")
4 5	S29	TI (treatment disparities) or AB (treatment disparities)
6 7	S30	(MH "Health Care Delivery+")
8 9	S31	(MH "Primary Health Care")
10	S32	(MH "Drug Therapy+")
11 12	S33	TI (chemotherapy) or AB (chemotherapy)
13 14	S34	(MH "Radiotherapy, Adjuvant+") OR (MH "Radiotherapy+")
15 16	S35	TI (radiotherapy) or AB (radiotherapy)
17	S36	TI (accessibility) or AB (accessibility)
18 19	S37	TI (access) AB (access)
20 21	S38	TI (pattern*) or AB (pattern*)
22	S39	(MH "Patient Care+") or (MH "Palliative Care")
23 24	S40	TI (care) or AB (care)
25 26	S41	TI (investigation) or AB (investigation)
27 28	S42	(MH "Quality of Health Care+")
29	S43	(MH "Eligibility Determination") or (MH "Patient Selection")
30 31	S44	(MH "Referral and Consultation+")
32 33 34	S45	TI (("receipt") or ("patient acceptance of health care")) or AB (("receipt") or ("patient acceptance of health care"))
35 36	S46	TI (provision) or AB (provision)
37	S47	TI (attendance) or AB (attendance)
38 39 40 41	S48	S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47
42 43	S49	(MH "Early Detection of Cancer")
44	S50	(MH "Early Diagnosis+")
45 46 47 48 49 50 51 52	S51	TI (((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary n1 care) or (secondary n1 care) or total or (help n1 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) n5 (delay* or interval* or time* or pathway* or route*))) OR AB (((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary n1 care) or (secondary n1 care) or total or (help n1 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or treatment* or referr* or specialist* or interval* or total or (help n1 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) n5 (delay* or interval* or time* or pathway* or route*)))
53 54	S52	TI ((stage* n5 (diagnosis or diagnostic))) OR AB ((stage* n5 (diagnosis or diagnostic)))
55 56	S53	S49 OR S50 OR S51 OR S52
57 58 59	S54	(MH "Great Britain") OR (MH "United Kingdom+")
60		

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S57

S58

TI ((national health service* or NHS*)) OR AB ((national health service* or NHS*)) OR AF ((national health service* or NHS*))

TI ((english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) n5 english))) OR AB ((english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) n5 english)))

TI ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*)) OR AB ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*)) OR AF ((gb or "g.b." or britain* or (british* not "british columbia") or welsh*)) OR AF ((gb or "g.b." or britain* or (british* not "new south wales") or welsh*)) OR AF ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or ((wales or "south wales") not "new south wales") or welsh*)) OR AF ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern irish* or scotland* or scottish* or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern irish* or scotland* or scottish* or ((wales or "south wales") or welsh*))

TI ((bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*)))))) OR AB ((bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*)))))) OR AF ((bath or "bath's"

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4		or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not
5		(massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or
6		harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or
7		"chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or
8 9		"coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not
10		(carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or
11		"leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new
12		south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario*
13		or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or
14 15		"manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south
16		wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or
17		"portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or
18		salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st
19		albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or
20 21		"wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or
21		harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new
23		york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or
24		ont or toronto*)))))))
25		TI ((bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st
26 27		asaph's" or st davids or swansea or "swansea's")) OR AB ((bangor or "bangor's" or cardiff or
28		"cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's")) OR AF ((bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's"
29	S59	or st asaph or "st asaph's" or st davids or swansea or "swansea's"))
30		
31		TI ((aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or
32 33		stirling or "stirling's")) OR AB ((aberdeen or "aberdeen's" or dundee or "dundee's" or
34		edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or
35		("perth's" not australia*) or stirling or "stirling's")) OR AF ((aberdeen or "aberdeen's" or
36	S60	dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's"))
37 38	300	
39		TI ((armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or
40		"londonderry's" or derry or "derry's" or newry or "newry's")) OR AB ((armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or
41		"derry's" or newry or "newry's")) OR AF ((armagh or "armagh's" or belfast or "belfast's" or
42		lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or
43 44	S61	"newry's"))
45	S62	S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61
46 47		((MH "Africa+") OR (MH "America+") OR (MH "North America+") OR (MH "Latin
47 48		America") OR (MH "Central America+") OR (MH "Antarctic Regions") OR (MH "Arctic
49		Regions") OR (MH "Asia+") OR (MH "Asia, Western+") OR (MH "Asia, Central+") OR (MH
50	S63	"Australia+") OR (MH "New Zealand")) NOT ((MH "Europe+") OR (MH "Great Britain") OR (MH "United Kingdom+"))
51 52		
52 53	S64	S62 NOT S63
54 55	S65	PT case report or case study
56	S66	PT letter
57 59		(((MH "Animals+") OR (MH "Animal Studies") OR (TI "animal model*")) NOT (MH
58 59	S67	"human"))
60	S68	S65 OR S66 OR S67

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S69	S3 AND S24 AND S48
S70	S3 AND S24 AND S53
S71	S69 OR S70
S72	S64 AND S71
S73	S72 NOT S68

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Appendix S3.9: Search Strategies – Others

NICE Evidence Search (<u>https://www.evidence.nhs.uk</u>) -

Colorectal cancer and inequal* Colorectal cancer and depriv* NB. The repeat searches did not utilise NICE Evidence Search due to the website's closure.

Base search (https://www.base-search.net)

Limits placed - Content providers as United Kingdom and Document Type set to: Text (all) and Dataset and Unknown. This meant excluding: Musical Notation, Map, Audio, Software and Image/Video.

Colorectal cancer and inequal*

Colorectal cancer and depriv*

Google Advanced Search (https://www.google.com/advanced_search)

Colorectal cancer and inequal* Colorectal cancer and depriv*

Limited to the first 5 pages of results unless the search still appeared relevant, in which case the search would have continued.

Appendix S4: Development and Validation of the Search Strategy and Record Management

The search was developed in MEDLINE using free-text words and subject indexing terms and subsequently adapted for the other databases. Briefly, the search strategies combined different concepts:

- Colorectal cancer and socioeconomic inequalities and system interval and the UK
- Or, colorectal cancer and socioeconomic inequalities and treatment and the UK

Search filters were used to focus on UK-based studies and exclude non-human studies to improve specificity.^{45,46} The search strategy was reviewed by SG using the Peer Review of Electronic Search Strategies for systematic reviews guideline.⁴⁷

Two systematic reviews provided the initial search strategy for the treatment, interval and socioeconomic inequality concepts.^{48,49} Further search terms were identified from search filters.⁵⁰⁻⁵² Thirty-five potentially relevant studies were subsequently used to identify further search terms using MeSH Analyzer, a word frequency analysis tool.⁵³

The search strategy was tested against a set of the 35 known, potentially relevant records. The results of the draft MEDLINE search strategy found 31 of 35 potentially relevant articles. The search was subsequently refined and was able to capture one further article. However, no other changes to the strategy were possible due to a lack of possible candidate search terms in the title/abstract or subject indexing terms of the remaining three uncaptured articles.

The authors of the current systematic review also conducted an almost identical systematic review about ovarian cancer. For this reason, some of the studies used in the development process were about ovarian cancer. However, this development process enhanced the search strategy for both systematic reviews. The potentially relevant studies are referenced here. Not all were necessarily deemed eligible for inclusion in either of the final two systematic reviews. *4,6-10,12-15,17-20,23-26,28,29,34-39,54-62*

Search results were imported into EndNote X9,⁴² and duplicates were removed using adapted EndNote de-duplication methods published by Bramer et al., 2016.⁶³ The remaining search results were transferred to Covidence systematic review software.⁶⁴

Appendix S5: Data items and effect measures

The following data were extracted: first author, year of publication, data source, region/country, years of diagnosis, site (colon vs rectal), stage, size of the analytical cohort, measure of socioeconomic status, and the number of socioeconomic groups. Assumptions about missing or unclear information were clearly stated.

For all included studies, data for the following outcomes were extracted:

- Measures of the system interval length, including precise definitions of the time intervals.
 - Effects of socioeconomic factors on the system interval were assessed using coefficients from regression analyses.
 - Or else rates of patients meeting targets were extracted. The odds of meeting targets amongst patients from the most deprived group compared to the least deprived group were calculated. 95% confidence intervals were calculated using RevMan 5.4.⁶⁵
- Cancer-directed therapy received, including the timescale and definitions of treatment. The extracted effect measures were:
 - Adjusted estimates for the likelihood of a particular treatment for the most deprived socioeconomic groups, with 95% confidence intervals. Details of confounding variables were also extracted.
 - If unavailable, unadjusted rates were extracted. The odds of treatment amongst patients from the most deprived group compared to the least deprived group were calculated. 95% confidence intervals were calculated using RevMan 5.4.⁶⁵
 Statistical tests of association were reported when available.

Appendix S6: Study Risk of Bias Assessment

	Selection I	bias			Prognostic factor measurement	Outcome measurement	Study confounding	Statistical reporting	Strength
First author (Date published)	Inclusion criteria	Exclusion criteria	Baseline characteristics adequately described	Source and time period adequate and described	Clear and valid definition of socioeconomic status, measurement and categorisation	Clear definition and methods for the outcome	Important potential confounding factors appropriately accounted for	Appropriate analysis and all outcomes reported	of Evidence
Bailey (2002)	High	High	Moderate	High	High	High	High	High	Weak
Bharathan (2011)	Moderate	Moderate	Low	Moderate	Moderate	High	High	High	Weak
Benitez Majano (2022) [1]	Low	Low	Low	Moderate	Low	Low	Low	Low	Strong
Benitez Majano (2022) [2]	Low	Low	Low	Moderate	Low	Low	Low	Low	Strong
Boyle (2020)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Campbell (2002)	High	High	Low	High	Low	Moderate	Moderate	High	Weak
Crawford (2012)	Moderate	Moderate	High	Moderate	Moderate	High	Moderate	High	Weak
Di Girolamo (2018)	Low	Low	Low	Low	Low	Low	Moderate	Low	Strong
Fenton (2019)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Fenton (2020)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Harris (2009)	Moderate	High	Low	High	Low	High	High	High	Weak
Hassan (2023)	Low	Low	Low	Low	Low	Low	Moderate	Low	Strong
Hayes (2019)	Low	Moderate	Low	Moderate	Low	Moderate	Low	Low	Strong
Hayes (2021)	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Strong
Hole (2002)	Moderate	High	Low	Moderate	Moderate	High	High	High	Weak
Jones (2008)	Moderate	Moderate	High	Moderate	Moderate	High	Moderate	Moderate	Weak

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First author (Date published)	Selection b	ias			Prognostic factor measurement	Outcome measurement	Study confounding	Statistical reporting	
	Inclusion Exclusion criteria criteria		Baseline characteristics adequately described	Source and time period adequate and described	Clear and valid definition of socioeconomic status, measurement and categorisation	Clear definition and methods for the outcome	Important potential confounding factors appropriately accounted for	Appropriate analysis and all outcomes reported	Strength of Evidenc
Lejeune (2010)	Low	Low	Low	Low	Low	High	Moderate	Moderate	Moderat
McLeod (1999)	Moderate	Moderate	High	Moderate	Low	Low	High	High	Weak
Morris (2008)	Low	Low	Low	Low	Low	Low	Moderate	Low	Strong
Morris (2010)	Low	Moderate	Low	Low	Low	Low	Low	Low	Strong
Morris (2016)	Moderate	High	Low	Low	Low	Low	High	High	Weak
National Cancer Intelligence Network (2011)	Low	Low	High	Low	High	Low	High	High	Weak
NCRAS (2018)	Low	Low	Low	Low	Low	Low	High	Moderate	Moderat
Neal (2005)	High	High	High	Moderate	Low	High	High	Moderate	Weak
Nicholson (2012)	Moderate	Moderate	Low	High	High	Moderate	Moderate	High	Weak
Paterson (2014)	Moderate	Moderate	Low	Moderate	Low	High	Moderate	High	Weak
Pearson (2019)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Pitchforth (2002)	Low	Low	Low	Moderate	Moderate	Moderate	High	Moderate	Moderat
Pollock and Vickers (1998)	Moderate	Moderate	High	High	Low	Moderate	High	High	Weak
Price (2020)	Low	Low	Moderate	Low	Low	Low	Moderate	Low	Strong

Appendix S6: Study Risk of Bias Assessment - CONTINUED

Appendix S6: Study Risk of Bias Assessment - CONTINUED

	Selection b	ias			Prognostic factor measurement	Outcome measurement	Study confounding	Statistical reporting	
First author (Date published)	Inclusion criteria	Exclusion criteria	Baseline characteristics adequately described	Source and time period adequate and described	Clear and valid definition of socioeconomic status, measurement and categorisation	Clear definition and methods for the outcome	Important potential confounding factors appropriately accounted for	Appropriate analysis and all outcomes reported	Strength of Evidence
Radwan (2016)	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High	Weak
Raine (2010)	Low	Low	Low	Moderate	Low	Moderate	High	High	Weak
Redanial (2014)	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Strong
Saito (2019) [1]	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Saito (2021) [2]	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Shack (2009)	Low	Low	Low	Moderate	Low	Moderate	Low	Moderate	Strong
Smith (2006)	Moderate	Moderate	Low	High	Low	High	High	High	Weak
Taylor (2021)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Tilney (2008)	Moderate	High	Low	Moderate	Low	Low	High	Moderate	Weak
Tilney (2009)	Moderate	Moderate	Low	High	Low	Low	High	High	Weak
Vallance (2018)	Low	Low	Low	Low	Low	Low	Low	Low	Strong

Appendix S7: Characteristics of Included Studies

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Bailey (2002)	Patients enrolled from six study centres.	England (Not Specified)	Colorectal	Dukes' C	Not recorded	Economic Resources Domain - OARS OMFAQ (2)	Chemotherapy
Benitez Majano [1] (2022)	Cancer Registration Data, CPRD, HES.	England	Colon	All stages	Diagnosed 2011-2015	IMD 2015 (5)	System Interval
Benitez Majano [2] (2022)	Cancer Registration Data, CPRD, HES.	England	Colorectal	All stages	Diagnosed 2011-2015	IMD 2015 (5)	System Interval
Bharathan (2011)	Colorectal Cancer Audit Group Database.	Northern England	Colorectal	All stages	Admitted/Referred to Surgical Unit 1998-2002	IMD 2004 – without health (5)	Surgery
Boyle (2020)	NBOCA, HES, SACT.	England	Colon	Stage III	Diagnosed 2014-2017	IMD (5)	Chemotherapy
Campbell (2002)	Case notes. Scottish Cancer Registry.	North/Northeast Scotland	Colorectal	All stages	Diagnosed 1995-1996	Carstairs Index 1991 (5)	Chemotherapy Radiotherapy Surgery System Interval
Crawford (2012)	Northern and Yorkshire Cancer Registry.	Northern England	Colorectal	All stages	Diagnosed 1994-2002	IMD - without access to services (4)	Any Treatment Chemotherapy
Di Girolamo (2018)	Cancer Registration Data, NBOCA, CWT.	England	Colorectal	All stages	Diagnosed 2009-2013	IMD Assumed 2007 - Income Domain (5)	System Interval
Fenton (2019)	CORECT-R, Cancer Registration Data, HES.	England	Colorectal	All stages	Major resection for CRC in 2005-2012	IMD 2010 – Income Domain (5)	Liver Resection

Appendix S7: Characteristics of Included Studies - CONTINUED

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Fenton (2021)	CORECT-R, Cancer Registration Data, HES.	England	Colorectal	All stages	Major resection for CRC in 2005-2013	IMD 2010 – Income Domain (5)	Pulmonary Resection
Harris (2009)	Database of patients at an MDT	Birmingham, England	Rectal	Assumed all stages	Diagnosed 2000-2007	IMD 2004 - Assumed Income Domain (5)	Surgery
Hassan (2023)	Cancer Registration Data, ONS, SACT.	England	Colon	Stage III	Diagnosed 2012-2017	IMD 2015 & 2019 (5)	Combination Chemotherapy
Hayes (2019)	Northern and Yorkshire Cancer Registry, HES.	Northern England	Colon	All stages	Diagnosed 1999-2010	IMD - Income Domain (5)	Chemotherapy Surgery
Hayes (2021)	Northern and Yorkshire Cancer Registry, HES.	Northern England	Colorectal	All stages	Diagnosed 2001-2010	IMD 2007 & 2010 - Income Domain (5)	System Interval
Hole (2002)	Audit in eight hospitals.	Central Scotland	Colorectal	All stages	Resection in 1991-1994	Carstairs Index 1991 (3)	Chemotherapy
Jones (2008)	Yorkshire Registry and Northern and Yorkshire Cancer Registry.	Northern England	Colorectal	All stages	Diagnosed 1994-2002	IMD 2004 – without access domain (scored 0-80)	Chemotherapy Radiotherapy Surgery
Lejeune (2010)	Northern and Yorkshire Cancer Registry, TCR, ECRIC.	England	Colorectal	All stages	Diagnosed 1997-2000	Townsend Index 2001 (5)	Any Treatment System Interval
McLeod (1999)	Hospital Discharge Data (SMR1).	Scotland	Colorectal	All stages (assumed)	First Inpatient Treatment For CRC 1990-1994	Carstairs Index 1999 (4)	Chemotherapy

Appendix S7: Characteristics of Included Studies - CONTINUED

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Morris (2008)	Cancer Registration Data, HES.	England	Rectal	All stages who had APER or AR	Diagnosed 1998-2004	IMD 2004 – Income Domain (5)	APER vs AR
Morris (2010)	Cancer Registration Data, HES.	England	Colorectal	All stages	Major resection for CRC in 1998-2004	IMD 2004 – Income Domain (5)	Liver Resection
Morris (2016)	Cancer Registration Data, HES, RTDS.	England	Rectal	All stages post major resection	Diagnosed 2009 2010	IMD – Income Domain (5)	Radiotherapy
Neal (2005)	National Survey of NHS Patients: Cancer	England (Not Specified)	Colorectal	Not recorded	Not recorded	Occupation (8)	System Interval
NCIN (2011)	Cancer Registration Data, HES.	England	Colorectal	All stages	Diagnosed 2004-2006	IMD – assumed (5)	Surgery
NCRAS (2018)	Cancer Registration Data, HES, SACT.	England	Colorectal	All stages	Diagnosed 2013-2015	IMD 2015 – Income Domain (5)	Chemotherapy Radiotherapy Surgery
Nicholson (2012)	Clinical Audit Database.	West of Scotland	Rectal	All stages	Surgery in 2001-2005	Not recorded	APER vs AR
Paterson (2014)	Southeast Scotland Cancer Network Database.	Southeast Scotland	Colorectal	All stages	Diagnosed 2003-2009	Scottish Index of Multiple Deprivation (5)	Chemotherapy Radiotherapy Surgery System Interval

Appendix S7: Characteristics of Included Studies - CONTINUED

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Pearson (2019)	Cancer Registration Data, CWT, DID, HES, RtD.	England	Colorectal	All stages	Diagnosed 2014-2015	IMD 2015 – Income Domain (5)	System Interval
Pitchforth (2002)	Scottish Cancer Registration, SMR1.	Scotland	Colorectal	All stages (Assumed)	Diagnosed 1992-1996	Carstairs Index (4)	Chemotherapy
Pollock (1998)	HES, ONS.	Thames Region, England	Colorectal	Not recorded	Inpatient FCE with a CRC diagnosis in the financial years 1992-1995	Townsend Score (10)	Surgery
Price (2020)	CPRD, Cancer Registration Data, ONS.	England	Colorectal	All stages (Assumed)	Diagnosed 2006-2017	Townsend Score 2001 (5)	System Interval
Radwan (2016)	Swansea Pelvic Oncology Group Database.	Swansea, Wales	Rectal	All stages	Pelvic exenteration in 2006-2014	Welsh Index of Multiple Deprivation (4)	Chemo – radiotherapy TPE vs PPE
Raine (2010)	HES	England	Rectal	All stages (Assumed)	Admission for rectal cancer surgery 1999-2006	IMD 2004 (5)	AR vs APER
Redanial (2014)	Northern and Yorkshire and South West Offices.	England	Colorectal	Dukes' Stages A/B	Diagnosed 1996-2009	IMD 2007 – Income Domain (5)	System Interval
Saito [1] (2019)	Cancer Registration Data, HES, NBOCA.	England	Colorectal	All stages	Diagnosed 2010-2013	IMD 2010 – Income Domain (5)	Surgery
Saito [2] (2021)	Cancer Registration Data, HES, NBOCA.	England	Colon	All stages	Diagnosed 2010-2013	IMD 2010 – Income Domain (5)	System Interva

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Shack (2009)	Northwest and Merseyside and Cheshire Cancer Registries, HES.	Northwest England	Colorectal	All stages	Diagnosed 1997-2004	IMD 2001 – Income Domain (5)	Chemotherapy Surgery Radiotherapy
Smith (2006)	ACPGBI Bowel Cancer Database	England	Colorectal	All stages	Diagnosed 2001-2002	Townsend Score 2001 (4)	APER vs AR
Taylor (2021)	CORECT-R, HES, SACT.	England	Colorectal	Stage II-III	Diagnosed 2014-2015	IMD 2010 – Income Domain (5)	Chemotherapy
Tilney (2008)	HES.	England	Colorectal	Not recorded	APER or AR surgery in 1996-2004	IMD 2004 (5)	APER vs AR
Tilney (2009)	ACPGBI Bowel Cancer Database	England	Rectal	Dukes' A-C	Diagnosed in 2000-2005	IMD 2004 (5)	APER vs AR
Vallance (2018)	HES, NBOCA.	England	Colorectal	Stage IV	Diagnosed 2011-2015 with synchronous liver-limited metastases	IMD (5)	Liver resection

Appendix S7: Characteristics of Included Studies - CONTINUED

Abbreviations: ACPGBI Association of Coloproctology of Great Britain and Ireland, APER Abdominoperineal Resection, AR Anterior Resection, CORECT-R Colorectal Cancer Data Repository, CRC Colorectal Cancer, CPRD Clinical Practice Research Datalink, CWT National Cancer Waiting Times Dataset, DID Diagnostic Imaging Dataset, ECRIC Eastern Cancer Registration and Information Centre, FCE Finished Consultant Episode, HES hospital episode statistics, IMD index of multiple deprivation, NBOCA National Bowel Cancer Audit, NCIN National Cancer Intelligence Network, NCRAS National Cancer Registration and Analysis Service, OARS The Duke Older Americans Resources and Services Instrument, OMFAQ The OARS Multidimensional Functional Assessment Questionnaire, ONS Office for National Statistics, PPE Partial Pelvic Exenteration, RtD Routes to Diagnosis, RTDS Radiotherapy Dataset, SACT systematic anti-cancer therapy dataset, SES socioeconomic status, SMR1 Scottish Morbidity Record-1, TCR Thames Cancer Registry, TPE Total Pelvic Exenteration.

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First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds ratio (95% CI) or other measure	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence	
Benitez Majano (2022) [1]	2,115	Age Comorbidities GP Visits Sex Symptoms	First presentation to diagnosis interval	Quantile Regression - 50 th centile* Ref adj interval 126.0 (94.5,157.5) † MD adj interval 204.1 days (151.0,257.3) p=0.04	1	Strong	
	C: 3,215	Age Comorbidities Sex Symptoms Test Type		Test to diagnosis interval	Quantile Regression - 50 th centile* LD ref group MD adj coef 0.7 (-2.7,4.1) p=0.729	=	
Benitez Majano		Age Comorbidities Sex Symptoms	First presentation to diagnosis interval	Quantile Regression - 50 th centile* LD ref group MD adj coef 91.0 (21.0,161.0) p=0.028	ſ	Strong	
(2022) [2]	R: 1,621	Age Comorbidities Sex Symptoms Test Type	Test to diagnosis Interval	Quantile Regression - 50 th centile* LD ref group MD adj coef 0.0 (-4,0.4) p=1.00	=	Strong	
		Age Comorbidities Sex Symptoms First presentation to diagnosis interval		Quantile Regression - 50^{th} centile* LD ref group MD adj coef 78.8 $(14.8,142.7) \mid p=0.258$ =			

Appendix S8: Results of studies reporting variations in the system interval – CONTINUED

First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds ratio (95% CI) or other measure	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
Campbell (2002)	653	Distance Presentation Stage	Referral to treatment interval	Cox Regression LD HR 1.0 MD adjusted HR 1.24 (0.93,1.67)	=	Weak
	50,955		Referral to first seen interval [Within 2 weeks Y/N]	(Derived) LD OR 1.0 MD OR 0.80 (0.70-0.91)	1	
Di Girolamo (2018)	46,702	No adjustment	Referral to treatment interval [Within 62 days Y/N]	(Derived) LD OR 1.0 MD OR 1.02 (0.95-1.10)	=	Strong
-	116,177		Diagnosis to treatment interval [Within 31 days Y/N]	(Derived) LD OR 1.0 MD OR 1.28 (1.14-1.44)	Ļ	
	19,798 Age Site Stage		Referral to first seen interval [Within 2 weeks Y/N]	LD OR 1.0 MD adjusted OR 0.95 (0.87,1.03)	=	
Hayes (2021)	29,445	Age First Treatment Sex Stage	Diagnosis to treatment interval [Within 31 days Y/N]	LD OR 1.0 MD adjusted OR 0.91 (0.84,0.98)	1	Strong
	17,622	Age First Treatment Stage Others	Referral to treatment interval [Within 62 days Y/N]	LD OR 1.0 MD adjusted OR 0.82 (0.74,0.91)	1	
	71,917		Diagnosis to treatment interval [Within 1 week Y/N]	LD OR 1.0 MD adjusted OR 0.78 (0.72,0.84)	↑	
Lejeune			Diagnosis to treatment interval [Within 1 month Y/N]	LD OR 1.0 MD adjusted OR 0.84 (0.78,0.90)	1	
(2010)		Age Stage	Age Stage [Within 2-3 months Y/N]		↑	Moderate
			Diagnosis to treatment interval [Within 4-6 months Y/N]	LD OR 1.0 MD adjusted OR 1.07 (0.96,1.18)	=	

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Appendix S8: Results of studies reporting variations in the system interval - CONTINUED

First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds ratio (95% CI) or other measure	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
			Symptom to diagnosis interval	Generalised linear modelling Nonsignificant result	=	
Neal (2005)	Neal (2005) 15,891 A	Age Ethnicity Marital Status Sex	Referral to first seen interval	Generalised linear modelling Nonsignificant result	=	Weak
			First seen to diagnosis interval	Generalised linear modelling $F(7) = 2.247$, p=0.028	ο	
Paterson (2014)	4,915	Unadjusted	Referral to treatment interval [Within 62 days Y/N]	(Derived) LD OR 1.0 MD OR 1.14 (0.93-1.39)	=	Weak
Pearson (2019)	63,958	Age Comorbidities Ethnicity Investigations Presentation Sex Stage	Secondary care diagnostic interval [Interval longer than the median Y/N]	LD OR 1.0 MD adjusted OR 1.07 (1.00,1.13)	=	Strong
			First presentation to diagnosis	Pre-post difference-in-differences MD coef 0.1 (-0.03,0.2, p=0.147)	=	Strong
Price (2020)	ee (2020) Unknown Age Sex Time Perio			Event-study difference-in- differences MD coef 0.069 (0.002,0.136, p=0.043)	ſ	
			Semiparametric varying-coefficient analyses Significant association	1		
Redanial (2014)	46,511	Age Ethnicity Grade Morphology Region Sex Site Stage Time Period	Diagnosis to Treatment Interval [Amongst patients who had a resection within 62 days of diagnosis]	Linear Regression LD coef 0.00 MD adj coef 0.21 (-0.55,0.98)	=	Strong

Appendix S8: Results of studies reporting variations in the system interval - CONTINUED

First Author (Year)	Number	Adjusted for	_	Outcome of Interest	Odds ratio (95% CI measure) or other	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
Saito (2021) [2]	28,452	Age Comorbidities Gra Morphology Presentati Sex Site Stage Year Diagnosis	on [Time	osis to Treatment Interval e from diagnosis to major n amongst patients who had elective surgery]	Linear Regress LD adjusted coeffic MD adjusted coeffic (0.97,1.02)	ient 1.00	=	Strong
Abbreviation	s: Adj adjusted	, C colon, Coef coefficient,	GP general pra	ctitioner, LD least deprived,	MD most deprived, R recta	ıl, Ref referen	ce group.	
	presented for t ce group was m owel habit.		in the least depr	ived group with no recorded	comorbidities or mental he	ealth morbidit	ies and who had rectal ble	eeding or
↑ I	Increased likelil	nood ↓ Decreas	ed likelihood	= No significant differ	ence between groups	° Significa	nt association observed	
		For pee	r review only -	http://bmjopen.bmj.com/sit	e/about/guidelines.xhtml			4

Appendix S9: Results – Likelihood of receipt of surgery

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Surgery	Strength of Evidence
Bharathan (2011)	Not recorded	8,159	Unadjusted	Receipt of surgery [NS] (assumed part of primary treatment)	(Derived) LD OR 1.0 MD OR 0.71	(Derived) 0.51-0.97	Ļ	Weak
Campbell (2002)	1 year of diagnosis	653	Age Distance Stage	Receipt of surgery [NS] (assumed part of primary treatment)	LD OR 1.0 MD OR 0.52	0.14-1.87	=	Weak
Fenton (2019)	3 years of primary colorectal resection	157,383	Age Comorbidities Sex Site Liver Centre Stage Year of Resection	Receipt of Liver Resection	LD OR 1.0 MD OR 0.76	0.70-0.83	Ļ	Strong
Fenton (2021)	3 years of primary colorectal resection	80,869	Age Comorbidities Sex Site Thoracic Centre Stage Year of Resection	Receipt of Pulmonary Resection	LD OR 1.0 MD OR 1.04	0.89-1.22	=	Strong
Harris (2009)	Received during the study period (assumed)	477	Unadjusted	Receipt of surgery [NS] (assumed part of primary treatment)	(Derived) LD OR 1.0 MD OR 0.32	(Derived) 0.13-0.72	Ļ	Weak
Hayes (2019)	12 months of diagnosis (assumed)	31,910	Age Comorbidities Sex Stage Year of Diagnosis	Receipt of surgery [NS] (assumed part of primary treatment)	LD OR 1.0 MD OR 0.62	0.55-0.70	\downarrow	Strong

Appendix S9: Results – Likelihood of receipt of surgery - CONTINUED

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Surgery	Strength of Evidence
Lance (2009)	Received during	C: 16,850	Age Sex Stage	Receipt of surgery [NS]	C: OR 0.99 (for a 1 unit increase in IMD)	C: 0.99-1.0	\downarrow	Weak
Jones (2008)	the study period (assumed)	R: 11,406	Time to Hospital	(assumed part of primary treatment)	R: OR 0.99 (for a 1 unit increase in IMD)	R: 0.98-0.99	\downarrow	w cak
Morris (2010)	3 years of primary colorectal resection	114,155	Age Comorbidities Sex Site Stage Year of Resection	Receipt of Liver Resection	LD OR 1.0 MD OR 0.70	0.61-0.80	Ļ	Strong
NCIN (2011)	30 days before diagnosis to 6 months after	80,690	Unadjusted	Receipt of major resection	(Derived) LD OR 1.0 MD OR 0.84	(Derived) 0.80-0.88	Ļ	Weak
NCD 45 (2019)	C: 30 days before diagnosis to 6 months after	75,552	Inclusted	Receipt of major	C: (Derived) LD OR 1.0 MD OR 0.76	C: (Derived) 0.72-0.80	Ļ	Moderate
NCRAS (2018)	R: 30 days before diagnosis to 12 months after	28,136	Unadjusted	resection	R: (Derived) LD OR 1.0 MD OR 0.66	R: (Derived) 0.61-0.72	Ļ	woderate
Paterson (2014)	Not recorded	4,915	Age Region Sex Site Stage	Receipt of surgery [NS] (assumed part of primary treatment)	LD OR 1.23 MD OR 1.0	0.96-1.58	=	Weak

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Appendix S9: Results – Likelihood of receipt of surgery - CONTINUED

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Surgery	Strength of Evidence
Pollock and Vickers (1998)	Received during the study period	25,304 (assumed)	Age Sex	Finished consultant episode that included therapeutic or palliative surgery (assumed part of primary treatment)	LD OR 1.0 MD OR 0.88	0.78-1.00	=	Weak
	(2019) [1] 30 days before diagnosis to 180 days after	C: 38,624	Age Comorbidities Grade Histology	Receipt of major resection	C: LD OR 1.0 MD OR 0.96	C: 0.87-1.07	=	
Saito (2019) [1]		R: 22,630	Presentation Sex Site Stage Year of Diagnosis	[Odds of <i>not</i> receiving major surgery]	C: LD OR 1.0 MD OR 1.35	R: 1.22-1.49	Ļ	Strong
Shack (2009)	6 months of diagnosis	29,563	Age Comorbidities Sex Site Stage	Receipt of major resection	LD OR 1.0 MD OR 1.63	1.17-2.26	1	Strong
Vallance (2018)	1 year of CRC diagnosis	13,656	Age Comorbidities Presentation Sex Site Liver Centre Stage	Receipt of Liver Resection	LD OR 1.42 MD OR 1.0	1.18-1.70	Ļ	Strong
	C colon cancer, CI	confidence in	terval, CRC colorectal car	ncer, LD least deprived, MD	most deprived, NS no	ot specified, OR oc	lds ratio, R rectal cano	cer.
Legend						7		
↑ Inc	creased likelihood	↓ [Decreased likelihood	= No significant difference	e between groups			

Appendix S10: Results – Likelihood of surgical variation

First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of APER vs AR unless otherwise stated	Strength of Evidence
Morris (2008)	26,097	Age Sex Year of Diagnosis Stage Surgeon Workload Presentation	Abdominoperineal Excision vs Anterior Resection	LD OR 1.0 MD OR 1.37	1.24-1.50	↑	Strong
Nicholson (2012)	1,574	Age Stage Sex Surgeon Workload Presentation Year of Diagnosis Others	Abdominoperineal Excision vs Anterior Resection	LD OR 1.0 MD OR 0.62	0.36-1.06	=	Weak
Radwan (2016)	120	Unadjusted	Total Pelvic Exenteration vs Partial Pelvic Exenteration	(Derived) LD OR 1.0 MD OR 1.75	(Derived) 0.55-5.68	= [odds of TPE]	Weak
Raine (2010)	29,214	Age Presentation Sex Year of Resection	Anterior Resection vs Abdominoperineal Excision	LD OR 1.34 MD OR 1.0	1.22-1.47	↑	Weak
Smith (2006)	2,389	Unadjusted	Anterior Resection vs Abdominoperineal Excision	(Derived) LD OR 1.0 MD OR 1.39	(Derived) 1.04-1.86	ſ	Weak
Tilney (2008)	52,643	Age Presentation Sex Year of Resection	Abdominoperineal Excision vs Anterior Resection	LD OR 1.0 MD OR 1.59	1.45-1.74	1	Weak
Tilney (2009)	12,128	Neoadjuvant Therapy Sex Year	Abdominoperineal Excision vs Anterior Resection	LD OR 1.0 MD OR 1.64	1.36-1.97	↑	Weak
Abbreviations: Exenteration.	APER Abd	ominoperineal Excision, AR Anterior	Resection, CI confidence interve	al, LD least depriv	ved, MD most d	eprived, OR odds ratio, TPE T	otal Pelvic
Legend							
↑ Inc	reased likel	ihood ↓ Decreased likelih	ood = No significant dif	ference between g	groups		

Appendix S11:	Results – Likelihood	d of receipt of chemotherapy	r
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First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Chemotherapy	Strength of Evidence
Bailey (2002)	Not recorded	119	Age Social Resources Rating	Receipt of adjuvant chemotherapy	Excellent/good economic resources OR 1.0 Mild/total impairment OR 2.13	0.62-7.31	=	Weak
Boyle (2020)	4 months of surgery	11,932	Access Age ASA Comorbidities Fitness Readmission Sex Stage Others	Receipt of adjuvant chemotherapy	LD OR 1.36 MD OR 1.0	1.15-1.60	Ļ	Strong
Campbell (2002)	1 year of diagnosis	653	Age Distance Presentation Region Stage	Receipt of chemotherapy	LD OR 1.0 MD OR 0.49	0.22-1.10	=	Weak
	6 months of	Unknown	Age Sex Stage	Receipt of chemotherapy in stage IV disease	C: LD OR 1.0 MD OR 0.45	C: 0.27-0.77	\downarrow	W7 1
Crawford (2012)	diagnosis				R: LD OR 1.0 MD OR 0.73	R: 0.36-1.50	=	Weak
Hassan (2023)	4 months of surgery	8,750	Age Ethnicity No. nodes Sex Size Year of Diagnosis	Receipt of combination vs single agent chemotherapy	LD OR 1.0 MD OR 0.50	0.42-0.59	Ļ	Strong
Hayes (2019)	12 months of	24,263	Age Comorbidities	Chemotherapy in surgical patients	LD OR 1.0 MD OR 0.72	0.65-0.80	\downarrow	Strong
11ayes (2019)	diagnosis (assumed)	7,647	Sex Stage Year of Diagnosis	Chemotherapy in non-surgical patients	LD OR 1.0 MD OR 0.44	0.36-0.55	\downarrow	Strong

Appendix S11: Results – Likelihood of receipt of chemotherapy - CONTINUED

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Chemotherapy	Strength of Evidence			
Hole (2002)	Received during the study period (assumed)	2,269	Unadjusted	Receipt of adjuvant therapy (presumed chemotherapy)	(Derived) LD OR 1.0 MD OR 0.31	(Derived) 0.09-0.91	Ļ	Weak			
Lange (2009)	Received during	C: 16,850	Age Sex Stage	Receipt of	C: OR 0.99 (for a 1 unit increase in IMD)	C: 0.98-0.99	Ļ	West			
Jones (2008)	the study period (assumed)	R: 11,406	Time to Hospital	chemotherapy	R: OR 0.99 (for a 1 unit increase in IMD)	R: 0.99-1.0	Ļ	Weak			
McLeod (1999)	6 months from the first admission	7,852	Age Comorbidities Death Marital Status Presentation Rural Sex Others	Receipt of chemotherapy	LD OR 1.0 MD OR 0.73	0.55-0.96	Ļ	Weak			
	31 days before diagnosis to 12 months after				C: 75,552	The directed	Receipt of	C: (Derived) LD OR 1.0 MD OR 0.85	0.81-0.89	Ļ	Moderate
NCRAS (2018)		R: 28,136	Unadjusted	chemotherapy	R: (Derived) LD OR 1.0 MD OR 1.03	0.95-1.11	=	woderate			
Paterson (2014)	Not recorded	4,915	Age Metastatic Disease Region Sex Site	Receipt of chemotherapy	LD OR 1.46 MD OR 1.0	1.16-1.83	Ļ	Weak			

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Appendix S11: Results – Likelihood of receipt of chemotherapy - CONTINUED

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Chemotherapy	Strength of Evidence
Pitchforth (2002)	6 months from the first admission	7,303	Age Comorbidities Death Presentation Rural Sex Cancer Centre	Receipt of chemotherapy	LD OR 1.0 MD OR 0.55	0.20-0.90	Ļ	Weak
Shack (2009)	6 months of diagnosis	29,563	Age Comorbidities Sex Site Stage	Receipt of chemotherapy	LD OR 1.0 MD OR 0.84	0.74-0.94	\downarrow	Strong
Taylor (2021)	6 months of surgery	23,402	Age Comorbidities Sex Stage	Receipt of adjuvant chemotherapy	LD OR 1.0 MD OR 0.75	0.67-0.85	\downarrow	Strong

Abbreviations: ASA American Society of Anaesthesiologists grade, CI confidence interval, C colon, LD least deprived, MD most deprived, OR odds ratio, R rectum.

Legend

↑ Increased likelihood

 \downarrow Decreased likelihood

= No significant difference between groups

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Appendix S12: Results – Likelihood of receipt of radiotherapy

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Radiotherapy	Strength of Evidence
Campbell (2002)	1 year of diagnosis	653	Age Distance Site Stage	Receipt of radiotherapy	LD OR 1.0 MD OR 0.85	0.38-1.91	=	Weak
Jones (2008)	Received during the study period (assumed)	11,406	Age Sex Stage Time to Hospital	Receipt of radiotherapy (rectal cancer cohort)	OR 0.99 (for a 1 unit increase in IMD)	0.99-1.0	=	Weak
Morris (2016)	1 year of surgery	9,201	Unadjusted	Receipt of radiotherapy	(Derived) LD OR 1.0 MD OR 1.39	(Derived) 1.21-1.60	1	Weak
NCRAS (2018)	31 days before diagnosis to 12 months after	28,136	Unadjusted	Receipt of radiotherapy	(Derived) LD OR 1.0 MD OR 1.33	(Derived) 1.23-1.44	Ť	Moderate
Paterson (2014)	Not recorded	1,345	Unadjusted	Receipt of neoadjuvant radiotherapy	(Derived) LD OR 1.0 MD OR 1.15	(Derived) 0.79-1.67	=	Weak
Radwan (2016)	Received during the study period (assumed)	120	Unadjusted	Receipt of neoadjuvant chemoradiotherapy	(Derived) LD OR 1.0 MD OR 1.0	N/A	=	Weak
Shack (2009)	6 months of diagnosis	29,563	Age Comorbidities Sex Stage	Receipt of radiotherapy	LD OR 1.0 MD OR 0.90	0.77-1.04	=	Strong

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Abbreviations: CI confidence interval, LD least deprived, MD most deprived, OR odds ratio.

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↑ Increased likelihood	↓ Decreased likelihood	= No significant difference between groups

Appendix S13: Results – Likelihood of receipt of any treatment

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Any Treatment	Strength of Evidence
Cuertand (2012)	6 months of	C: 11,163	A co Sou Stoco	Receipt of any treatment (chemotherapy,	C: LD OR 1.0 MD OR 0.54	C: 0.39-0.76	\downarrow	Weak
Crawford (2012)	diagnosis	R: 7,058	Age Sex Stage	radiotherapy, surgery NS)	R: LD OR 1.0 MD OR 0.54	R: 0.34-0.84	\downarrow	weak
Lejeune (2010)	6 months of first contact with NHS	71,917	Age Stage	Receipt of any treatment (presumed surgery, chemotherapy, radiotherapy NS)	LD OR 1.0 MD OR 0.87	0.82-0.92	Ļ	Moderate
Legend	reased likelihood	↓ D	ecreased likelihood	= No significant difference b	between groups			
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1	Where are the inequalities in colorectal cancer care in
2	a country with universal healthcare? A systematic
3	review and narrative synthesis
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1 Abstract

Objective

Patients diagnosed with colorectal cancer living in more deprived areas experience
worse survival than those in more affluent areas. Those living in more deprived areas
face barriers to accessing timely, quality healthcare. These barriers may contribute to
socioeconomic inequalities in survival. We evaluated the literature for any association
between socioeconomic group, hospital delay, and treatments received among patients
with colorectal cancer in the United Kingdom, a country with universal healthcare.

9 Design

10 MEDLINE, EMBASE, CINAHL, CENTRAL, SCIE, AMED and PsycINFO were

11 searched from inception to January 2023. Grey literature, including HMIC, BASE, and

12 Google Advanced Search, and forward and backward citation searches were conducted.

13 Two reviewers independently reviewed titles, abstracts, and full-text articles.

14 Observational UK-based studies were included if they reported socioeconomic

15 measures and an association with either hospital delay or treatments received. The

16 QUIPS tool assessed bias risk, and a narrative synthesis was conducted. The review is

17 reported to PRISMA 2020 and registered with PROSPERO [CRD42022347652].

Results

19 Forty-one of the 7,209 identified references were included. Twelve studies evaluated

20 seven different hospital intervals. There was a significant association between area-level

21 deprivation and a longer time from first presentation in primary care to diagnosis.

22 Thirty-two studies evaluated treatments received. There were socioeconomic

23 inequalities in surgery and chemotherapy but not radiotherapy.

24 Conclusion

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1	Patients with colorectal cancer face inequalities across the cancer care continuum.
2	Further research is needed to understand why and what evidence-based actions can
3	reduce these inequalities in treatment. Qualitative research of patients and clinicians
4	conducted across various settings would provide a rich understanding of the complex
5	factors that drive these inequalities. Further research should also consider using a causal
6	approach to future studies to considerably strengthen the interpretation. Clinicians can
7	try and mitigate some potential causes of colorectal cancer inequalities, including
8	signposting to financial advice and patient transport schemes.
9	Trial registration
10	PROSPERO [CRD42022347652].
11	Strengths and limitations
12	• The searches were extensive – conducted across eight databases, supplemented
13	with citation searching and hand-searching websites.
14	The search strategy was validated.
15	• The inclusion of non-peer-reviewed literature was a key strength.
16	• Due to heterogeneous methods, meta-analysis was not possible.
17	Funding
18	This work was funded in whole by Yorkshire Cancer Research (award reference number
19	HEND405). Yorkshire Cancer Research has not been involved in any other aspect of the
20	project, such as the design, data collection, analysis, or interpretation.
21	Competing interests

22 The authors declare no conflict of interest.

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1 Introductio	n
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Colorectal cancer is the second most common cause of cancer-related death in the
United Kingdom (UK).(1) Survival has improved since the 1990s but lags behind
comparable countries.(2) There are also survival gradients within countries, including
those with universal healthcare, such as the UK and Australia.(3) In particular, patients
living in more deprived areas experience significantly worse survival outcomes.(1, 3)
Healthcare systems can contribute to these inequalities, as treatment differences likely
compound differential outcomes across populations.(2)

9 Timely diagnosis and treatment are also essential, with delays associated with worse

10 outcomes. The Aarhus statement suggested a framework for measuring these delays,

11 categorising the patient journey into patient, doctor and system intervals.(4)

12 Specifically, the system interval was defined as the period from primary care-initiated

13 investigations or referral to the commencement of treatment.(4) Socioeconomic

14 circumstances can impact this interval and yet is comparatively under-researched.

15 Existing inequalities have been exacerbated by the COVID-19 pandemic, with

16 vulnerable patient groups disproportionately affected by suboptimal care.(5) The

17 evolution of precision medicine and the development of new technologies and surgical

18 approaches will likely worsen existing inequalities, a process described as the "inverse

19 equity law".(6) Worryingly, disparities in access to precision oncology are already well

20 documented.(7) Understanding where inequalities are in the pathways of care for

21 patients with colorectal cancer is essential to inform policy and identify areas of further

22 research to target evidence-based action.

We evaluated the literature for any association between socioeconomic group, system
interval, and treatment amongst patients with colorectal cancer in the UK. By focusing

exclusively on studies conducted within a single country with a universal healthcare

1	system, our systematic review homogenised the healthcare infrastructure, policy, and
2	patient population, ensuring a more interpretable analysis of disparities in cancer care
3	with greater scope for policy impact.
4	Methods
5	This systematic review was registered with PROSPERO (CRD42022347652). The
6	review is reported according to the PRISMA 2020 statement (Appendix S1).(8)
7	Patient and public involvement
8	This study was discussed with Involve Hull, a patient and public involvement group
9	affiliated with the author's institution. The review was considered necessary by all
10	members of the group.
11	Eligibility criteria
12	Published and grey-literature observational studies were considered for inclusion if
13	relevant outcomes of patients with a primary diagnosis of colorectal cancer (ICD10
14	C18-C20) in the UK were reported.
15	Outcomes were only included if they had been analysed by a measure of socioeconomic
16	status [e.g., an area-based measure such as the Index of Multiple Deprivation (IMD) or
17	individual measures such as occupation]. The relevant outcomes were defined as
18	follows:
19	• The association between socioeconomic status and the length of the system interval,
20	as defined by the Aarhus statement.(4) Any part of the system interval could have
21	been measured.
22	• Or receipt of cancer-directed treatment. Studies evaluating palliative or supportive
23	care only were excluded.
24	Information sources

1		
1 2 3	1	The following bibliographic databases were searched from inception to 26/01/2023:
4 5	2	MEDLINE, EMBASE, AMED and PsycINFO, CINAHL, CENTRAL and Science
6 7	3	Citation Index Expanded.
8 9 10	4	The grey literature was searched using HMIC, BASE, NICE Evidence Search and
11 12	5	Google Advanced Search on 26/01/2023. In addition, twelve websites were
13 14	6	systematically hand-searched, and backwards and forward citation searches were
15 16 17	7	conducted on 30/03/2023 (details in Appendix S2).
17 18 19 20	8	Search strategy
21 22	9	The search strategies are listed in Appendix S3. The search strategy was developed and
23 24 25	10	validated in conjunction with SG, an information specialist (details in Appendix S4).
26 27	11	BPS and another reviewer (MS or KS) independently screened all titles and abstracts
28 29	12	against the pre-determined eligibility criteria. The full texts of eligible titles and
30 31 32	13	abstracts were obtained and independently screened for inclusion. Conflicts were
33 34	14	resolved by consensus.
35 36 37	15	Data Collection Process
38 39 40	16	One researcher (BPS) extracted information from the included studies, collating the
41 42	17	relevant data onto a data extraction form. A second author (KS) checked the extracted
43 44	18	data, and discrepancies were reconciled by consensus. The data items and effect
45 46 47	19	measures that were sought for extraction are detailed in Appendix S5.
47 48 49 50	20	Study risk of bias assessment
51 52	21	Two researchers (BPS and KS) independently evaluated the study risk of bias against
53 54 55	22	domains adapted from the Quality in Prognosis Studies tool (QUIPS).(9) Each domain
55 56 57	23	was judged to have a high, moderate, or low risk of bias, with the evaluations collated
58 59 60	24	onto a pre-prepared form (Appendix S6).

2	1	Risk of bias assessments informed the narrative synthesis, with greater weight given to
4 5	2	studies with a lower risk of bias. A study's evidence was considered "strong" if there
6 7	3	were no high risk of bias categories, "moderate" if there was a high risk of bias in one
8 9	4	category, and "weak" if there were two or more categories at high risk of bias.
10 11	5	However, studies were not excluded based on this.
12 13 14	C	Sunth anis mother de
14 15 16	6	Synthesis methods
17 18	7	A narrative synthesis was conducted, according to the synthesis without meta-analysis
19 20	8	in systematic reviews reporting guideline.(10) An overall assessment of the association
21 22	9	between socioeconomic status and each outcome was made, considering the consistency
23 24	10	and strength of supporting evidence from each study. Coefficients were extracted based
25 26	11	on multivariable models. Given the inherent methodological heterogeneity, diverse
27 28	12	patient populations, varying measures of deprivation, and significant statistical
29 30	13	heterogeneity observed across the included studies, a meta-analysis was deemed
31 32		
33 34	14	inappropriate as it could yield misleading or oversimplified results. While a meta-
35 36	15	analysis was not conducted, forest plots were generated to visually illustrate the
37 38 39	16	observed outcomes in individual studies.
40 41	17	Results
42 43		Study Selection
44 45	18	Study Selection
46 47	19	The database searches yielded 7,201 studies, 214 of which were retrieved for full-text
48 49	20	screening. An additional six studies were identified from the grey literature. Overall,
50 51	21	forty-one studies were included (Figure 1).(11)
52 53	22	Study Characteristics
54 55	22	Study Churacteristics
56 57 58	23	The characteristics of the included studies are summarised in Appendix S7. The system
58 59 60	24	interval was examined in twelve studies, with seven different time points evaluated,
00	25	summarised in Figure 2.(12-23) Fifteen studies reported the receipt of surgery,(19, 20,

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1	24-36) seven studies evaluated surgical variation,(37-43) fourteen studies reported the
2	receipt of chemotherapy,(19, 20, 24-27, 44-51) seven reported the receipt of
3	radiotherapy,(19, 20, 25-27, 43, 52) and two reported the receipt of any treatment.(17,
4	46)
5	Thirty-two of the forty-one studies adjusted or stratified for at least one other factor.(12-
6	26, 32-41, 44-49, 51) The remaining nine studies provided unadjusted rates.(27-31, 42,
7	43, 50, 52)
8	Risk of bias in studies
9	Assessments of the risk of bias are summarised in Figure 3 and Appendix S6. The
10	domain most at risk of bias was study confounding, with sixteen studies at high risk of
11	bias.(13, 27-31, 39-43, 47-50, 52) Although some of these studies conducted adjusted
12	analyses, important factors such as stage were unaccounted for.
13	Results of studies reporting variations in the system interval
13 14	Results of studies reporting variations in the system interval <i>Referral to first-seen interval</i>
14	Referral to first-seen interval
14 15	Referral to first-seen interval Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies
14 15 16	<i>Referral to first-seen interval</i> Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies estimated the odds of being seen by a specialist within two weeks of referral; one
14 15 16 17	<i>Referral to first-seen interval</i> Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies estimated the odds of being seen by a specialist within two weeks of referral; one demonstrated reduced unadjusted odds (OR 0.80, 95% CI 0.70-0.91),(18) while there
14 15 16 17 18	<i>Referral to first-seen interval</i> Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies estimated the odds of being seen by a specialist within two weeks of referral; one demonstrated reduced unadjusted odds (OR 0.80, 95% CI 0.70-0.91),(18) while there was no significant association in the other (OR 0.95, 95% CI 0.87-1.03) after adjusting
14 15 16 17 18 19	<i>Referral to first-seen interval</i> Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies estimated the odds of being seen by a specialist within two weeks of referral; one demonstrated reduced unadjusted odds (OR 0.80, 95% CI 0.70-0.91),(18) while there was no significant association in the other (OR 0.95, 95% CI 0.87-1.03) after adjusting for age, stage and site (colon vs rectal).(15) (Appendix S8)
14 15 16 17 18 19 20	Referral to first-seen interval Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies estimated the odds of being seen by a specialist within two weeks of referral; one demonstrated reduced unadjusted odds (OR 0.80, 95% CI 0.70-0.91),(18) while there was no significant association in the other (OR 0.95, 95% CI 0.87-1.03) after adjusting for age, stage and site (colon vs rectal).(15) (Appendix S8) Another study used generalised linear modelling to estimate the association between
14 15 16 17 18 19 20 21	Referral to first-seen interval Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies estimated the odds of being seen by a specialist within two weeks of referral; one demonstrated reduced unadjusted odds (OR 0.80, 95% CI 0.70-0.91),(18) while there was no significant association in the other (OR 0.95, 95% CI 0.87-1.03) after adjusting for age, stage and site (colon vs rectal).(15) (Appendix S8) Another study used generalised linear modelling to estimate the association between occupation and the number of days to see a specialist after referral, adjusting for age,
14 15 16 17 18 19 20 21 22	Referral to first-seen interval Three studies evaluated the referral to first-seen interval.(13, 15, 18) Two studies estimated the odds of being seen by a specialist within two weeks of referral; one demonstrated reduced unadjusted odds (OR 0.80, 95% CI 0.70-0.91),(18) while there was no significant association in the other (OR 0.95, 95% CI 0.87-1.03) after adjusting for age, stage and site (colon vs rectal).(15) (Appendix S8) Another study used generalised linear modelling to estimate the association between occupation and the number of days to see a specialist after referral, adjusting for age, marital status and ethnicity.(13) This study reported no significant association

1	First seen to diagnosis interval
2	One study estimated the association between occupation and the number of days from
3	the first hospital appointment to communication of diagnosis.(13) A significant
4	association was demonstrated (p=0.028), but no magnitude or direction of effect was
5	provided. The evidence was, therefore, inconclusive. (Table 1; Appendix S8)
6	Diagnosis to treatment interval
7	Five studies evaluated the diagnosis to treatment interval.(14-18) Two estimated the
8	number of days from diagnosis to major surgery, adjusting for; stage, sex, age, grade
9	and morphology.(14, 16) No significant associations were demonstrated (coefficient
10	0.99, 95% CI 0.97-1.02)(14) (coefficient 0.21, 95% CI -0.55-0.98).(16) (Appendix S8)
11	Two studies evaluated the likelihood of commencing treatment within 31 days from the
12	date a treatment plan was agreed upon.(15, 18) One study demonstrated increased
13	unadjusted odds (OR 1.28, 95% CI 1.14-1.44),(18) while the other presented reduced
14	adjusted odds of patients from the most deprived areas commencing treatment within 31
15	days (OR 0.91, 95% CI 0.84-0.98).(15) (Appendix S8)
16	Another study calculated the likelihood of treatment for the most deprived quintile
17	across several time points. They demonstrated reduced adjusted odds of treatment
18	within one week (OR 0.78, 95% CI 0.72-0.84), one month (OR 0.84, 95% CI 0.78-0.90)
19	and two to three months (OR 0.91, 95% CI 0.85-0.98) but non-reduced odds at four to
20	six months (OR 1.07, 95% CI 0.96-1.18) after the first contact with the health
21	system.(17) (Appendix S8)
22	Overall, the evidence for an association between deprivation and length of the diagnosis
23	to treatment interval was inconclusive. (Table 1; Appendix S8)
24	Test to diagnosis interval / secondary care diagnostic interval

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1	One study evaluated the secondary care diagnostic interval (SCDI), defined as the
2	period between the date of the first interaction with secondary care to the date of
3	diagnosis.(12) This study evaluated the factors associated with an interval greater than
4	the median, adjusting for sex, age, stage, comorbidities, ethnicity, route to diagnosis and
5	additional diagnostic tests.(12) The odds of a longer interval were not significantly
6	increased for patients from the most deprived quintile (OR 1.07, 95% CI 1.00-1.13).
7	(Appendix S8)
8	Another study evaluated the time from the first investigation to cancer diagnosis.(23)
9	The authors conducted quantile regression, adjusting for age, comorbidities, sex, test
10	type and symptom category, focussing on the median and 75 th centiles.(23) There was
11	no significant association between deprivation and interval length (coefficient 0.7, 95%
12	CI -2.7-4.1). (Appendix S8)
13	Overall, there was no evidence of a prolonged SCDI or test-to-diagnosis interval for
14	patients from the most deprived background. (Table 1; Appendix S8)
15	First presentation to diagnosis interval
16	Three studies evaluated the time from the first symptom or feature of colorectal cancer
17	in primary care records to diagnosis.(21-23) One study demonstrated an association
18	between deprivation and a longer interval in two of three econometric analyses (pre-to-
19	post difference-in-differences 95% CI -0.03-0.2 & p=0.147 event-study difference-in-
20	differences 95% CI 0.002-0.136 & p=0.043 semiparametric varying-coefficient
21	analysis significance stated but not reported).(21) The other two studies conducted
22	quantile regression, focusing on the median and 75th centiles, adjusting for age,
23	comorbidities, sex and type of symptom.(22, 23) Both studies demonstrated an
24	association between the most deprived quintile and a longer first presentation to
25	diagnosis interval for patients with colon cancer (e.g. adjusted median interval of 204

1	versus 126 days, p=0.04).(22) Meanwhile, there was no such association among patients
2	with rectal cancer,(23) possibly reflecting that patients with rectal cancer are more
3	likely to present with localising symptoms. (Appendix S8)
4	Overall, three robust studies provided evidence that patients from the most deprived
5	quintile experienced a longer first presentation to diagnosis interval. (Table 1; Appendix
6	S8
7	Symptom to diagnosis interval
8	One study estimated the effect of occupation on the time between a patient's first
9	symptom and diagnosis.(13) No significant effect was demonstrated, adjusting for
10	ethnicity, age, marital status and sex (p>0.05).(13) (Table 1; Appendix S8)
11	Referral to treatment interval
12	Four studies evaluated the time from referral to treatment.(15, 18-20) Two studies
13	demonstrated no significant association between deprivation and the likelihood of
14	commencing treatment within 62 days of referral (range of ORs 1.02-1.07).(18, 19)
15	Another study demonstrated reduced odds of patients commencing treatment within 62
16	days of referral, adjusted for age, stage, referral interval and first treatment received
17	(OR 0.82, 95% CI 0.74-0.91).(15) (Appendix S8)
18	Meanwhile, one study estimated hazard ratios for the time between referral and first
19	treatment, adjusting for stage, distance and presentation.(20) There was no significant
20	association between deprivation and time to treatment (HR 1.24, 95% CI 0.93-1.67).
21	(Appendix S8)
22	Overall, the association between deprivation and this interval was inconclusive. (Table
23	1; Appendix S8)

24 Results of studies reporting treatment inequalities

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1	Results of studies reporting likelihood of receipt of primary surgery
2	The outcome of interest was primary surgery in eleven studies, here defined as resection
3	of the tumour.(19, 20, 24-31, 36) Five studies clearly defined the outcome as a tumour
4	resection,(25, 27-29, 36) while the received surgical procedure was not identified in the
5	other six studies.(19, 20, 24, 26, 30, 31) (Appendix S9)
6	Across seven studies, adjustment was made for different factors: age,(19, 20, 24-26, 29,
7	36) stage,(19, 20, 24-26, 36) sex,(19, 24-26, 29, 36) comorbidity,(24, 25, 36) site (colon
8	vs rectum),(19, 25, 36) distance or time to hospital,(20, 26) year of diagnosis,(24, 36)
9	region,(19) and histology, grade and presentation.(36) Meanwhile, four studies provided
10	only rates of patients receiving surgery.(27, 28, 30, 31) (Appendix S9)
11	Six studies presented reduced odds of surgery for patients from the most deprived
12	background (range of ORs 0.32-0.99).(24, 26-28, 30, 31) One study presented increased
13	odds of not receiving surgery amongst the most deprived patients with rectal cancer
14	(OR 1.35, 95% CI 1.22-1.49) but no significant association among patients with colon
15	cancer (OR 0.96, 95% CI 0.87-1.07).(36) Meanwhile, three studies demonstrated no
16	association (range of ORs 0.52-0.88).(19, 20, 29)
17	One study revealed a higher likelihood of surgery for patients from the most deprived
18	background (OR 1.63, 95% CI 1.17-2.26).(25) Additionally, the study reported
19	increased odds of surgery in older age groups. These findings, which were unexpected,
20	were confirmed by consulting the author. However, it is important to note that this
21	analysis was based on regional data from a historical cohort of colorectal cancers
22	diagnosed between 1997 and 2004. While the reported methodology appears robust, the
23	results of this small study are opposed to other studies (see Figure 4) and cautious
24	interpretation is required.

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Figure 4 displays a forest plot, which provides an overview of the findings from
multiple studies investigating the likelihood of undergoing surgery for colorectal cancer.
The plot reveals that a majority of studies considering primary surgery (10/12) indicate
a decrease in the likelihood of surgical intervention among patients belonging to the
most deprived group. Overall, the evidence strongly supports the hypothesis that
patients from the most deprived group are less likely to receive surgery. (Table 1;
Appendix S9)

8 Results of studies reporting likelihood of receipt of surgery for oligometastatic disease

9 Four studies examined the receipt of surgery in presumed oligometastatic disease, all adjusted for age, stage, comorbidity, and site (colon vs. rectal).(32-35) Three studies 10 examined the receipt of liver resection, demonstrating significantly reduced odds of 11 resection for patients from the most deprived group (range of ORs 0.70-0.76).(32-34) 12 One study examined the receipt of pulmonary resection, with no significant association 13 14 demonstrated between deprivation and the likelihood of resection (OR 1.04, 95% CI 0.89-1.22).(35) (Table 1; Appendix S9) Figure 4 displays a forest plot, providing an 15 overview of the findings from these studies, each highlighted with an asterisk. 16

17 Results of studies reporting likelihood of surgical variation

Seven studies evaluated variations in surgery.(37-43) Six reported rates or odds of 18 abdominoperineal resection (APER) or anterior resection (AR).(37-42) Five studies 19 adjusted for variables, including age,(37-40) sex,(37-41) stage,(37, 38) year of diagnosis 20 or resection, (37-41) surgeon workload, (37, 38) and admission type. (37-40) Appendix 21 S10 displays a forest plot, providing an overview of the findings from these studies. 22 Five of the seven studies demonstrated that APER was significantly more likely than 23 AR for patients from the most deprived areas (range of ORs 1.37-1.64).(37, 39-42) 24 (Table 1; Appendix S11) 25

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2	1	Meanwhile, one study of 120 patients presented unadjusted rates of total pelvic
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5	2	exenteration (TPE) compared with partial pelvic exenteration (PPE).(43) There was a
6	3	non-significant association between deprivation and the unadjusted odds of TPE (OR
7	5	non-signmeant association between deprivation and the unadjusted odds of TTE (OK
8 9	4	1.75, 95% CI 0.55-5.68). (Table 1; Appendix S11)
10	•	1.70, 9070 01 0.00 0.00). (Tuble 1, Appendix 011)
11		
12	5	Results of studies reporting likelihood of receipt of chemotherapy
13		
14 15	6	Thirteen studies examined whether patients received any chemotherapy, (19, 20, 24-27,
16	-	
17	7	44-50) eleven of which conducted adjusted analyses.(19, 20, 24-26, 44-49) Six studies
18		
19	8	evaluated the use of adjuvant chemotherapy.(24, 44, 45, 49-51) Two studies evaluated
20 21		
22	9	the use of palliative chemotherapy.(24, 46) Meanwhile, the intent of chemotherapy was
23		
24	10	unknown in the remaining seven studies.(19, 20, 25-27, 47, 48)
25		
26 27	4.4	Amendia S12 displays a first plat maxiding on assertions of the findings from the
28	11	Appendix S12 displays a forest plot, providing an overview of the findings from the
29	12	studies. Eight studies demonstrated reduced adjusted odds of chemotherapy for patients
30	12	studies. Eight studies demonstrated reduced adjusted odds of chemotherapy for patients
31	13	from the most deprived group (range of ORs 0.44-0.99).(19, 24-26, 44, 45, 47, 48) One
32	12	from the most deprived group (range of OKs 0.44-0.39).(19, 24-20, 44, 45, 47, 46) One
33 34	14	study demonstrated reduced adjusted odds for patients from the most deprived group
35	± 1	study demonstrated reduced adjusted odds for patients from the most depitted group
36	15	with colon (OR 0.45, 95% CI 0.27-0.77) but not rectal cancer (OR 0.73, 95% CI 0.36-
37	20	
38	16	1.50).(46) Two studies did not show a significant association between deprivation and
39 40	-	
40	17	receipt of chemotherapy (range of ORs 0.49-2.13).(20, 49) (Appendix S13)
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44	18	Meanwhile, two studies presented unadjusted rates.(27, 50) One demonstrated reduced
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46 47	19	odds of chemotherapy for the most deprived patients with colorectal cancer (OR 0.31,
48	20	0.50/CI(0.00, 0.01)(50) The other demonstrated reduced odds of share other any for the
49	20	95% CI 0.09-0.91).(50) The other demonstrated reduced odds of chemotherapy for the
50	21	most deprived patients with colon (OR 0.85, 95% CI 0.81-0.89) but not rectal cancer
51	21	most deprived patients with colon (OK 0.85, 95% CI 0.81-0.89) but not rectai cancer
52 53	22	(OR 1.03, 95% CI 0.95-1.11).(27) (Appendix S13)
54	22	(OK 1.05, 9570 CI 0.95-1.11).(27) (Appendix 515)
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56	23	One study examined the receipt of combination versus single-agent chemotherapy,
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58	24	adjusting for age, sex, ethnicity, tumour size, lymph node yield and year of
59 60		
	25	diagnosis.(51) However, no adjustment was made for co-morbidity. Patients from the

1	most deprived area had significantly reduced odds of receiving combination
2	chemotherapy (OR 0.50, 95% CI 0.42-0.59).(51) (Appendix S13)
3	Five of the six studies evaluating the use of adjuvant chemotherapy demonstrated
4	inequalities.(24, 44, 45, 50, 51) Meanwhile, both studies evaluating the use of palliative
5	chemotherapy demonstrated similar inequalities.(24, 46) Overall, the evidence strongly
6	supports the hypothesis that patients from the most deprived group are less likely to
7	receive chemotherapy or combination adjuvant chemotherapy. (Table 1; Appendix S13)
8	Results of studies reporting likelihood of receipt of radiotherapy
9	Seven studies reported receipt of radiotherapy by socioeconomic group.(19, 20, 25-27,
10	43, 52) Two studies evaluated the use of neoadjuvant radiotherapy.(19, 43) One study
11	evaluated patterns of pre and post-operative radiotherapy.(52) The intent of
12	radiotherapy was unknown in four studies.(20, 25-27)
13	Three studies conducted analyses that adjusted for important factors, including; age,(20,
14	25, 26) stage,(20, 25, 26) sex,(25, 26) distance or journey time,(20, 26) tumour site
15	(colon vs rectum),(20) and comorbidity.(25) None of these studies demonstrated a
16	significant association between deprivation group and radiotherapy (range of ORs 0.85-
17	0.99). Appendix S14 presents a forest plot, providing an overview of the findings from
18	these studies. The remaining four studies reported unadjusted rates of radiotherapy.(19,
19	27, 43, 52) Two of these studies demonstrated increased odds of radiotherapy for
20	patients from the most deprived group (range of ORs 1.33-1.39).(27, 52) The other two
21	studies looked at rates of neoadjuvant radiotherapy specifically and did not show a
22	significant association between deprivation and odds of treatment (range of ORs 1.00-
23	1.15).(19, 43) (Appendix S15)
24	Overall, there was no evidence to support an association between socioeconomic status
25	and receipt of radiotherapy. (Table 1; Appendix S15) This conclusion may depend on

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the intent of radiotherapy and would, therefore, have been stronger if all outcomes were

- differentiated by intent (e.g. neoadjuvant or palliative).
- Results of studies reporting receipt of any treatment
- Two studies evaluated the likelihood of any treatment by deprivation quintile, adjusting
- for age, (17, 46) sex(46) and stage. (17, 46) It was assumed this meant receiving surgery,
- radiotherapy, or chemotherapy. However, these outcomes needed to be more clearly
- defined. For the most socioeconomically deprived quintile, both studies reported
- significantly reduced odds of any treatment within six months of diagnosis(46) or six
- with the months of the first contact with the NHS (range of ORs 0.54-0.87).(17) (Table 1;
- Appendix S16)

Specific outcome reported	Overall assessment/conclusion	No. studies (no. subjects)	Studies demonstrating adverse effect of deprivation	Studies demonstrating protective effect of deprivation	Studies demonstrating no impact of deprivation	Further information
Referral to first seen interval	Inconclusive impact of deprivation on the length of the referral to first seen interval	3 (86,644)	1 Strong(18)	-	1 Strong(15) 1 Weak(13)	
First seen to diagnosis interval	Inconclusive impact of deprivation on the length of the first seen to diagnosis interval	1 (15,891)	-	1 Weak(13)	-	
Referral to treatment interval	Inconclusive impact of deprivation on the length of the referral to treatment interval	4 (69,892)	1 Strong(15)	-	1 Strong(18) 2 Weak(19, 20)	
Diagnosis to treatment interval	Inconclusive impact of deprivation on the length of the diagnosis to treatment interval	5 (292,502)	1 Strong(15) 1 Moderate(17)	1 Strong(18)	2 Strong(14, 16)	Appendix S8: Results of studies reporting variations in the system
Test to diagnosis / secondary care diagnostic interval	No impact of deprivation on the length of the test to diagnosis/secondary care diagnostic interval	2 (68,794)	-	-	2 Strong(12, 23)	interval
First presentation to diagnosis interval	Deprivation associated with increased length of the first presentation to diagnosis interval	3 (at least 6,951)	3 Strong*(21-23)	-	1 Strong*(23)	
Symptom to diagnosis interval	Inconclusive impact of deprivation on the length of the symptom to diagnosis interval	1 (15,891)	9	-	1 Weak(13)	

Table 1: Narrative synthesis – assessment of the relationship between deprivation, the system interval and treatment received

Specific outcome reported	Overall assessment/conclusion	No. studies (no. subjects)	Studies demonstrating adverse effect of deprivation	Studies demonstrating protective effect of deprivation	Studies demonstrating no impact of deprivation	Further information
Likelihood of receipt of surgery	Strong evidence for reduced surgery with increasing deprivation.	11 (374,869)	2 Strong*(24, 36) 1 Moderate(27) 4 Weak(26, 28, 30, 31)	1 Strong(25)	1 Strong*(36) 3 Weak(19, 20, 29)	Appendix S9: Results – Likelihoo of receipt of surgery
Likelihood of receipt of liver resection	Strong evidence for reduced liver resection with increasing deprivation	3 (285,194)	3 Strong(32-34)	-	-	Appendix S9: Results – Likelihoo of receipt of surgery
Likelihood of receipt of pulmonary resection	No impact of deprivation on / likelihood of pulmonary resection	1 (80,869)	-	-	1 Strong(35)	Appendix S9: Results – Likelihoo of receipt of surgery
Likelihood of receipt of APER	Strong evidence for increased likelihood of APER vs. AR with increasing deprivation	6 (128,946)	1 Strong(37) 4 Weak(39-42)	-	1 Weak(38)	Appendix S11: Results – Likelihood of surgical variation
Likelihood of receipt of TPE	No impact of deprivation on likelihood of TPE vs. PPE with increasing deprivation	1 (120)	101	-	1 Weak(43)	Appendix S11: Results – Likelihood of surgical variation
Likelihood of receipt of chemotherapy	Strong evidence for reduced chemotherapy with increasing deprivation	13 (251,862)	4 Strong(24, 25, 44, 45) 2 Moderate*(27, 47) 5 Weak*(19, 26, 46, 48, 50)	-	1 Moderate*(27) 3 Weak*(20, 46, 49)	Appendix S13: Results – Likelihood of receipt of chemotherapy
Likelihood of receipt of combination chemotherapy	Strong evidence for reduced use of combination chemotherapy with increasing deprivation	1 (8,750)	1 Strong(51)	0	-	Appendix S13: Results – Likelihood of receipt of chemotherapy
Likelihood of receipt of radiotherapy	No impact of deprivation on likelihood of radiotherapy	7 (79,053)	-	1 Moderate(27) 1 Weak(52)	1 Strong(25) 4 Weak(19, 20, 26, 43)	Appendix S15: Results – Likelihood of receipt of radiotherapy
Likelihood of receipt of any treatment	Moderate evidence for reduced any treatment with increasing deprivation	2 (90,138)	1 Moderate(17) 1 Weak(46)	-	-	Appendix S16: Results – Likelihood of receipt of any treatment

Discussion

2 Main Findings

3 This is the first systematic review to evaluate what is already known about the

- 4 relationship between socioeconomic status, the system interval, and the treatment that
- 5 patients with colorectal cancer receive.

6 Diagnostic and treatment delays

There were seven intervals evaluated. The evidence for system delays was generally inconclusive, given substantial heterogeneity in methods and outcomes. However, there was substantial evidence that the first presentation to diagnosis interval was longer for patients from the most deprived background, depending on the underlying site. The underlying reasons require further elucidation using qualitative studies. This would help us understand the extent to which these delays are driven by patient or healthcare factors and how these can be addressed. Possible causes include missed appointments due to competing demands such as employment or care responsibilities. (53, 54) Other reasons might include complex transport and travel arrangements causing difficulties in attending appointments. (53, 54)

17 Surgery in the management of colorectal cancer

There was strong evidence for inequalities in primary surgery. However, most studies
had limitations; few adjusted for stage, most combined colon and rectal cancers, and
many included patients diagnosed before 2010.

21 There was also strong and consistent evidence that patients from the most deprived

- areas were less likely to undergo a liver resection and were more likely to undergo an
- 23 APER than anterior resection. APER is associated with a worse quality of life and is
- 24 generally considered less preferable if a less deforming surgery is possible.

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1	Despite adjustment, socioeconomic inequalities were frequently observed. This suggests
2	the presence of uncaptured factors such as co-morbidity or frailty. There may also have
3	been variations in access to specialist care, financial and employment factors, patient
4	choice, health-seeking behaviours and health literacy, all of which warrant further
5	investigation.(55-57)
6	Chemotherapy in the management of colorectal cancer
7	There was strong evidence that patients from more deprived areas were less likely to
8	receive chemotherapy or combination adjuvant chemotherapy. Trust in clinicians,
9	financial and employment factors, social support, adequate communication and
10	provision of information are critical in influencing the use of chemotherapy.(58-61)
11	These, amongst other uncaptured factors such as comorbidity or frailty, could be
12	responsible for the observed inequalities.
13	Radiotherapy in the management of rectal cancer
14	There was no evidence that patients from more deprived areas were less likely to
15	receive radiotherapy. The absence of observed inequalities could reflect the nature of
16	this outpatient treatment and the availability of patient transport. This is compared with,
17	for example, surgery, which necessitates hospital admission and prolonged time away
18	from work and social support. A lung cancer study similarly demonstrated a greater
19	likelihood of radiotherapy but a reduced likelihood of surgery amongst less affluent
20	patients.(62)
21	Strengths and weaknesses
22	This systematic review identified many studies and employed a robust methodology.
23	The process of identifying search terms was thorough, and the search was validated.
24	The searches were extensive, conducted across eight databases, supplemented with

citation searching and a thorough examination of the grey literature. These additional

1	search methods identified six studies.(27, 28, 35, 36, 44, 52) Inclusion of non-peer-
2	reviewed literature was also a key strength of this review.(25, 27, 28, 36)
3	The included studies were, however, heterogeneous in the methodology and populations
4	studied. Out of forty-one studies, only fifteen included patients diagnosed after
5	2010.(12, 14, 18, 21-23, 27, 32, 33, 35, 36, 43-45, 51) Of the six studies evaluating the
6	system interval in patients diagnosed since 2010, four demonstrated some
7	inequalities.(18, 21-23) Meanwhile, seven out of the nine studies that evaluated
8	inequalities in treatments amongst patients diagnosed after 2010 demonstrated the
9	presence of inequalities.(27, 32, 33, 36, 44, 45, 51) Therefore, although most studies
10	included patients from over a decade ago, inequalities persisted in recent cohorts despite
11	a national focus on reducing inequalities.
12	Another limitation was that studies frequently analysed colorectal cancer as a single
13	disease despite differences in presentation and management. Significantly, no study
14	utilised causal inference approaches, exemplified by an absence of reported directed
15	acyclic graphs.(63) The methods used could have introduced a bias known as the "table
16	2 fallacy", whereby estimates from regression models are mistakenly interpreted.(63)
17	Using a causal approach to future studies would considerably strengthen the
18	interpretation and, thus, meaningfully impact policy.(64)
19	Implications for policy and practice
20	Due to significant heterogeneity across studies, we could not firmly conclude whether
21	patients from more deprived backgrounds systematically experience longer system
22	intervals. However, COVID-19 detrimentally impacted cancer diagnostic activity for
23	most patients, especially those in deprived areas.(5) It is important to ensure measures
24	are in place to monitor the system interval for patients most at risk of delays.(5)

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1 2 2	1	There was strong evidence of socioeconomic inequalities in surgery and chemotherapy.
3 4 5	2	Some inequalities may partly be due to wording in clinical guidelines. For example, the
6 7	3	National Institute for Health and Care Excellence advises that primary surgery for
8 9	4	colorectal cancer is "offered" (a strong recommendation); the same guideline advises
10 11 12	5	liver resection be "considered" (less certain benefit).(65) Similarly, adjuvant
12 13 14	6	chemotherapy can be estimated to reduce the risk of death in stage III disease by 10-
15 16	7	15%. However, there is a significant risk of long-term toxicity. Patients must carefully
17 18	8	weigh the potential harms and benefits of these less strongly recommended treatments.
19 20	9	Shared-decision making is vital. Inequalities will result when some patients experience
21 22 23	10	better shared-decision making and can cover the costs of additional treatment, such as
23 24 25	11	time off work.(66)
26 27	11	
28 29	12	Clinicians can mitigate some of the effects of deprivation. Such strategies may include
30 31	13	referring patients for pre-rehabilitation, tailored communication, and ensuring patients
32 33	14	are aware of appropriate financial support and transport schemes.(66)
34 35 36	15	Further studies are needed to evaluate for inequalities in novel treatments. In the era of
37 38	16	precision oncology and an ever-increasing armamentarium of novel treatments, the
39 40	17	marginal benefits of new therapies mustn't just be experienced by the most affluent. A
41 42	18	prostate cancer study exemplified this, demonstrating that patients from more deprived
43 44	19	backgrounds living at greater distances from specialist centres were significantly less
45 46 47	20	likely to receive robotic prostatectomy.(67) If we accept the benefit of newer surgical
47 48 49	21	technology and techniques, such as robotic surgery, these should be available for all
50 51	22	patients no matter where they live.
52 53	22	patients no matter where they rive.
54 55	23	Future research
56 57 58	24	Further research evaluating the whole of the system interval is needed. Further research
58 59	25	should also aim to understand why deprivation is associated with a reduced likelihood

should also aim to understand why deprivation is associated with a reduced likelihood 25

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1 of chemotherapy and surgery. In particular, observational research of recent cohorts

- 2 should utilise causal inference. Beyond this, qualitative research will be of great value
- 3 in gaining a richer insight into the causes and drivers of these inequalities.

4 Conclusions

- 5 Despite a healthcare system that provides free healthcare at the point of access, there
- 6 were unexplained socioeconomic inequalities in surgery, chemotherapy and aspects of
- 7 the system interval. Further research is needed to understand the variations in treatment
- 8 between socioeconomic groups.
- 9 Differences in patient selection for treatment have been linked with worse colorectal
- 10 cancer survival within and between countries, with evidence of improved outcomes
- 11 when care is aligned with optimal pathways.(68) Eliminating inequalities could narrow
- 12 survival gaps within and between countries. These findings will interest policymakers,
- 13 clinicians and researchers worldwide, as inequalities in cancer care and outcomes of
- 14 different socioeconomic groups have been recognised across healthcare jurisdictions.

15 Figure Captions

- 16 Figure 1: PRISMA flow diagram of included studies.
- Figure 2: Time intervals evaluated in the included studies. The blue dotted line indicates
 the system interval defined by the Aarhus statement. Studies that included any aspect of
 this system interval were included, even if the interval commenced before the system
 interval defined here.
- Figure 3: Risk of bias in the included studies. For each element the proportion of studieswith high, moderate and low risk of bias is illustrated.
- Figure 4: Forest plot demonstrating the odds of receipt of surgery in the most deprivedversus the least deprived patient group.
- 25 Additional Information

26 Acknowledgements

27 Not applicable.

1 2 3	1	Authors' Contributions
4 5 6	2	BPS - conceptualisation, developed search strategy, screening, data curation and formal
7 8	3	analysis, project administration and writing – original draft.
9 10 11	4	KS – conceptualisation, screening, data curation and formal analysis, review of the
12 13	5	manuscript
14 15 16	6	MS – screening and review of the manuscript
17 18 19	7	SG – developed the search strategy and manuscript review.
20 21 22	8	ML – conceptualisation, supervision, review of the manuscript
23 24	9	UM – conceptualisation, developed search strategy, screening, data curation and formal
25 26 27	10	analysis, supervision, and manuscript review.
28 29 30	11	Ethics Approval and Consent to Participate
31 32 33	12	This systematic review synthesises previously published data and does not include new
34 35	13	data that requires ethical approval and consent.
36 37 38	14	Consent for Publication
39 40 41	15	Not applicable.
42 43 44	16	Not applicable. Data Availability
45 46 47	17	This published article and its supplementary information files include all data generated
48 49 50	18	or analysed during this study.
50 51 52 53	19	Competing Interests
54 55	20	The authors declare no conflict of interest.
56 57 58 59	21	
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of directed acyclic graphs (DAGs) to identify confounders in applied health research:

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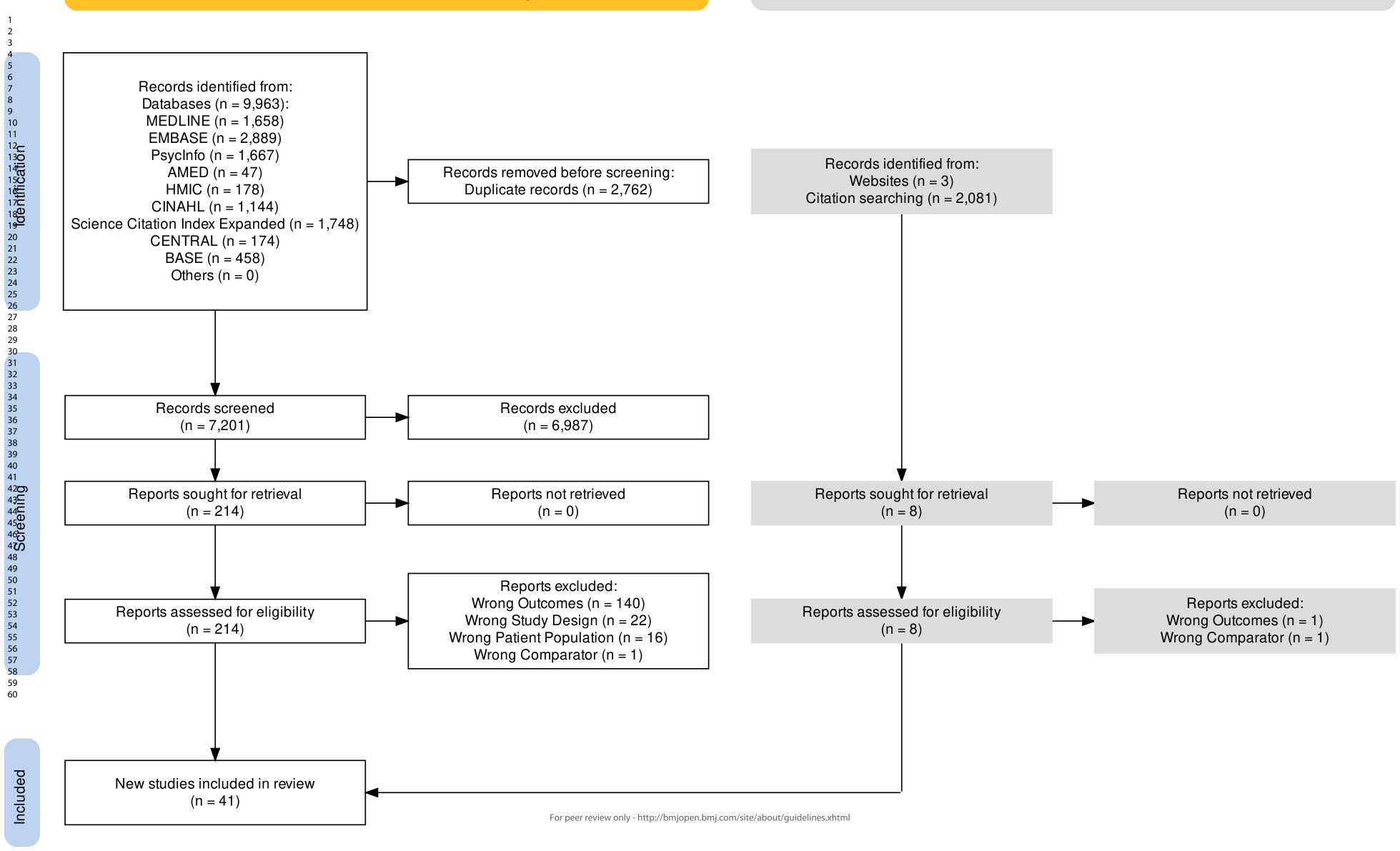
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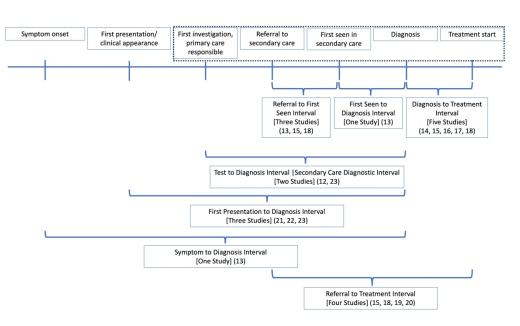
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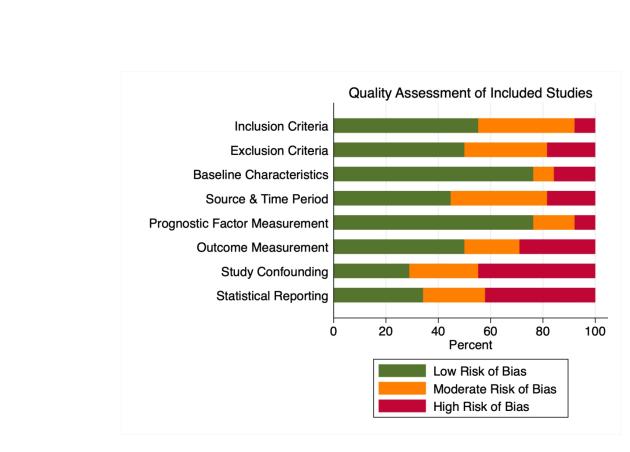
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Time intervals evaluated in the included studies. The blue dotted line indicates the system interval defined by the Aarhus statement.(4) Studies that included any aspect of this system interval were included, even if the interval commenced before the system interval defined here.

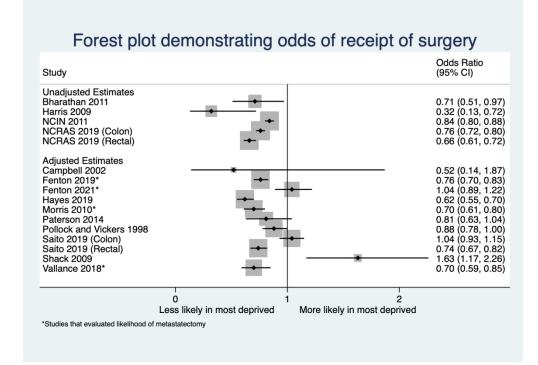
331x190mm (300 x 300 DPI)



Risk of bias in the included studies. For each element the proportion of studies with high, moderate and low risk of bias is illustrated.

297x215mm (144 x 144 DPI)

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml



Forest plot demonstrating the odds of receipt of surgery in the most deprived versus the least deprived patient group.

297x215mm (144 x 144 DPI)

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Where are the inequalities in colorectal cancer care in a country with universal healthcare? A systematic review and narrative synthesis

Appendix

Benjamin Pickwell-Smith, Katie Spencer, Mahboobeh Haji Sadeghi, Sarah Greenley, Mike Lind, Una Macleod

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Appendix S1: PRISMA Statement Checklist¹

Section/topic	Item #	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	As per PRISMA 2020 for Abstracts checklist	2-3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	5-6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6, Appendix S2
Search strategy	7	Present the full search strategies for all databases, registers, and websites, including any filters and limits used.	Appendix S3
Study selection	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Appendix S5
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Appendix S5

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 BMJ Open

Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Appendix S5
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Appendix S5
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Appendix S5
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta- analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	7
RESULTS			1
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	8, Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A
Study characteristics	17	Cite each included study and present its characteristics.	8, Figure 2,Appendix S7
Risk of bias within studies	18	Present assessments of risk of bias for each included study.	8, Figure 3, Appendix S6
Results of individual	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and	8-15, Appendix S

studies		(b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	S13
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	8, Figure 3, Appendix S6
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	8-15, Appendix S8 S13
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	8-15, Table 1
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	18-22
	23b	Discuss any limitations of the evidence included in the review.	18-22
	23c	Discuss any limitations of the review processes used.	18-22
	23d	Discuss implications of the results for practice, policy, and future research.	18-22
Other Information			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	2, 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	3,4
Competing interests	26	Declare any competing interests of review authors.	23
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	23

 disparities) National Bowel Cancer Audit (https://www.nboca.org.uk) Bowel Cancer UK (https://www.bowelcanceruk.org.uk) National Health Service England (https://www.england.nhs.uk/about/equality/equality-hub/) The Association of Coloproctology of Great Britain & Ireland (https://www.acpgbi.org.uk) NHS Digital (https://digital.nhs.uk) Health Data Insight CIC (https://healthdatainsight.org.uk) National Disease Registration Service (https://www.ndrs.nhs.uk) The automated tool 'citationchaser' conducted forward and backward citation searcher thirty-nine included studies where a digital object identifier was available.²⁻⁴⁰ These searches identified 838 unique records using backwards searching and 1,628 ur 	The fo	ollowing websites were hand-searched on 30/03/2023:
 Cancer Research UK (https://www.cancerresearchuk.org/) Macmillan Cancer Support (https://www.macmillan.org.uk) The King's Fund (https://www.kingsfund.org.uk/) Office for Health Improvement and Disparities (https://www.gov.uk/government/organisations/office-for-health-improvement disparities) National Bowel Cancer Audit (https://www.nboca.org.uk) Bowel Cancer UK (https://www.bowelcanceruk.org.uk) National Health Service England (https://www.england.nhs.uk/about/equality/equality-hub/) The Association of Coloproctology of Great Britain & Ireland (https://www.acpgbi.org.uk) NHS Digital (https://digital.nhs.uk) Health Data Insight CIC (https://healthdatainsight.org.uk) National Disease Registration Service (https://www.ndrs.nhs.uk) The automated tool 'citationchaser' conducted forward and backward citation searcher thirty-nine included studies where a digital object identifier was available.²⁻⁴⁰ These searches identified 838 unique records using backwards searching and 1,628 unique 	•	The National Cancer Registration and Analysis Service
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 (https://www.gov.uk/government/organisations/office-for-health-improvement disparities) National Bowel Cancer Audit (https://www.nboca.org.uk) Bowel Cancer UK (https://www.bowelcanceruk.org.uk) National Health Service England (https://www.england.nhs.uk/about/equality/equality-hub/) The Association of Coloproctology of Great Britain & Ireland (https://www.acpgbi.org.uk) NHS Digital (https://digital.nhs.uk) Health Data Insight CIC (https://healthdatainsight.org.uk) National Disease Registration Service (https://www.ndrs.nhs.uk) The automated tool 'citationchaser' conducted forward and backward citation searcher thirty-nine included studies where a digital object identifier was available.²⁻⁴⁰ 	•	The King's Fund (https://www.kingsfund.org.uk/)
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• National Disease Registration Service (<u>https://www.ndrs.nhs.uk</u>) The automated tool 'citationchaser' conducted forward and backward citation searcher thirty-nine included studies where a digital object identifier was available. ²⁻⁴⁰ These searches identified 838 unique records using backwards searching and 1,628 un	•	NHS Digital (<u>https://digital.nhs.uk</u>)
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thirty-nine included studies where a digital object identifier was available. ²⁻⁴⁰ These searches identified 838 unique records using backwards searching and 1,628 ur	•	National Disease Registration Service (<u>https://www.ndrs.nhs.uk</u>)
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These searches identified 838 unique records using backwards searching and 1,628 un records using forwards searching. ⁴¹ These records were then screened by BPS in Endl	thirty-	nine included studies where a digital object identifier was available. ²⁻⁴⁰
records using forwards searching. ⁴¹ These records were then screened by BPS in Endl		
X9. ⁴²		s using forwards searching. ⁴¹ These records were then screened by BPS in EndNo
	The bi	bliographies of two systematic reviews were also examined for relevant articles.

Appendix S3.1: Search Strategies – MEDLINE (OVID)

Initial searches were conducted on 31st August 2021. Repeat searches were conducted across

all databases on 26/01/2023, limited to date of database entry between 20/08/2021 to

26/01/2023.

Ovid MEDLINE(R) ALL <1946 to August 31, 2021>

exp Colorectal Neoplasms/

((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)).mp

- or/1-2 [cancer population of interest]
- exp Socioeconomic Factors/
- (socio-economic or socioeconomic or socio-demographic or sociodemographic).mp
- exp Education, Continuing/ or Education/
- exp Income/
- exp Health Status/
- exp Poverty/
- Junic F (socio-economic position or socioeconomic position).mp.
- inequalities.mp.
 - exp Social Environment/
- social factors.mp.
- income.mp.
- exp Residence Characteristics/
- Social class.mp.
- Education.mp.
 - exp Health Status Disparities/
- depriv*.mp.
- (equity or equitable).mp.
- (inequity or inequitable).mp.
- inequities.mp.
- disparit*.mp.
- or/4-23 [inequality concept]
- surgery.mp.
- Treatment.mp.
- exp Health Services Accessibility/
- exp Healthcare Disparities/
- treatment disparities.mp.
- exp "Delivery of Health Care"/
- exp Primary Health Care/
- exp Drug Therapy/
- chemotherapy.mp.
- Radiotherapy/ or Radiotherapy, Adjuvant/
- radiotherapy.mp.
- accessibility.mp.

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access.mp. pattern\$.mp. palliative care/ or Patient care/ or Primary Health care/ care.mp. investigation.mp. exp "Quality of Health Care"/ exp Patient Selection/ or exp Eligibility Determination/ exp "Referral and Consultation"/ Receipt.mp. or exp "Patient Acceptance of Health Care"/ Provision.mp. Attendance.mp. 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 [treatment concept] exp "Early Detection of Cancer"/ exp Delayed Diagnosis/ ((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).ti,ab. (stage* adj5 (diagnosis or diagnostic)).ti,ab. 49 or 50 or 51 or 52 [interval filter] exp United Kingdom/ (national health service* or NHS*).ti,ab,in. (english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab. (gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*).ti,ab,jw,in. (bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's"

or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*))))).ti,ab,in.

59 (bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's").ti,ab,in.

60 (aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's").ti,ab,in.

61 (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's").ti,ab,in.

62 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61

63 (exp africa/ or exp americas/ or exp Antarctic regions/ or exp arctic regions/ or exp asia/ or exp oceania/) not (exp great britain/ or europe/)

- 64 62 not 63 [NICE UK filter]
- 65 case reports.pt.
- 66 news.pt.

- 67 letter.pt.
 - 68 comment.pt.
- 69 exp animals/ not humans.sh.
 - 70 65 or 66 or 67 or 68 or 69 [excluding animals and unwanted publication types]

eliez on

- 71 3 and 24 and 48
- 72 3 and 24 and 53
- 73 71 or 72
- 74 64 and 73
- 75 74 not 70

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3	Appendix S3.2: Search Strategies – EMBASE (OVID)					
4						
5 6	OVID Embase <1974 to 2021 August 31>					
7						
8	1	exp colorectal tumor/				
9	2	((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or				
10		nan* or carcinoma* or metasta* or oncolog*)).mp.				
11	3	1 or 2 [cancer population of interest]				
12 13						
14	4	exp socioeconomics/				
15	5	(socio-economic or socioeconomic or socio-demographic or sociodemographic).mp.				
16	6	exp education/				
17	7	exp income/				
18	8	exp health status/				
19	9	exp poverty/				
20	10	(socioeconomic position or socio-economic position).mp.				
21 22	11	inequalities.mp.				
22	12	exp social environment/				
24	13	social factors.mp.				
25	14	income.mp.				
26	15	exp demography/				
27	16	social class.mp.				
28						
29	17	education.mp.				
30 31	18	exp health disparity/				
32	19	depriv*.mp.				
33	20	(equity or equitable).mp.				
34	21	(inequity or inequitable).mp.				
35	22	inequities.mp.				
36	23	disparit*.mp.				
37	24	4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or				
38 39	20 or 2	21 or 22 or 23 or 23 [inequality concept]				
40	25	surgery.mp.				
41	26					
42	27	treatment.mp. exp health care access/ exp health care disparity/				
43	28	exp health care disparity/				
44	29	treatment disparities mp				
45		treatment disparities.mp.				
46 47	30	exp health care delivery/				
48	31	exp primary health care/				
49	32	exp drug therapy/				
50	33	chemotherapy.mp.				
51	34	adjuvant radiotherapy/ or radiotherapy/				
52	35	radiotherapy.mp.				
53	36	accessibility.mp.				
54 55	37	access.mp.				
55 56	38	pattern*.mp.				
57	39	palliative therapy/ or patient care/ or primary health care/				
58	40	care.mp.				
59	41	investigation.mp.				
60						

42 exp health care quality/

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- 43 exp patient selection/ 99092
- 44 exp patient referral/ or exp consultation/
- 45 receipt.mp. or exp "Patient attitude"/
- 46 provision.mp.
- 47 attendance.mp.

48 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 [treatment concept]

- 49 exp early cancer diagnosis/
- 50 exp delayed diagnosis/

51 ((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pretreatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).ti,ab.

- 52 (stage* adj5 (diagnosis or diagnostic)).ti,ab.
- 53 49 or 50 or 51 or 52 [interval filter]
- 54 exp United Kingdom/
 - 55 (national health service* or nhs*).ti,ab,in,ad.

56 (english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab.

57 (gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*).ti,ab,jx,in,ad.

58 (bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*))))).ti,ab,in,ad.

- (bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's").ti,ab,in,ad.
 - (aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's").ti,ab,in,ad.
 - (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's").ti,ab,in,ad.
 - 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61
- (exp "arctic and antarctic"/ or exp oceanic regions/ or exp western hemisphere/ or exp africa/ or exp asia/ or exp "australia and new zealand"/) not (exp united kingdom/ or europe/)
 - 62 not 63 [NICE UK Filter]
 - letter.pt.
 - (animal* not human*).sh,hw.
- 65 or 66 [excluding animals and unwanted publication types]
- 3 and 24 and 48
- 3 and 24 and 53
 - 68 or 69
 - 64 and 70
 - 71 not 67
 - limit 72 to conference abstract status
 - limit 73 to dd=20200831-20210831
 - 72 not 73
 - 74 or 75

Appendix S3.3: Search Strategies – PsycINFO (OVID)

OVID APA PsycInfo <1806 to August Week 4 2021>

1 ((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)).af. [cancer population of interest]

- 2 exp Socioeconomic Factors/
- 3 (socio-economic or socioeconomic or socio-demographic or sociodemographic).af.
- 4 exp Education/

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- 5 exp Income Level/ or exp "Income (Economic)"/
- 6 exp Health Status/
- 7 exp Poverty/
 - 8 (socio-economic position or socioeconomic position).af.
 - 9 inequalities.af.
 - 10 exp Social Environments/
- 11 social factors.af. 🧹
- 12 income.af.
- 13 exp Neighborhoods/ or exp Urban Environments/ or exp Housing/
 - 14 social class.af.
 - 15 education.af.
 - 16 exp Health Disparities/
 - 17 depriv*.af.
 - 18 (equity or equitable).af.
 - 19 (inequity or inequitable).af.
 - 20 inequities.af.
 - 21 disparit*.af.
 - 22 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 [inequality concept]
 - 23 surgery.af.
 - 24 Treatment.af.
 - 25 exp Health Care Utilization/ or exp Health Care Delivery/ or exp Health Care Access/
 - or exp Treatment Barriers/
 - 26 treatment disparities.af.
- 27 exp Health Care Services/
 - 28 exp Primary Health Care/
- 29 exp Drug Therapy/
- 30 chemotherapy.af.
- 48 49 31 exp Radiation Therapy/
- 49 31 exp Radiation merup 50 32 exp Chemotherapy/
- 51 33 radiotherapy.af. 52 34 accessibility af
- 52 34 accessibility.af.
 - 35 access.af.
 - 36 pattern\$.af.
- 55 37 exp Palliative Care/
- 57 38 care.af.
- ⁵⁸ 39 investigation.af.
- 40 exp "Quality of Care"/ or exp "Quality of Services"/

 receipt.af. provision.af.

attendance.af.

23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 [treatment concept]

((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pretreatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).ti,ab.

- (stage* adj5 (diagnosis or diagnostic)).ti,ab.
- 47 or 48 [interval concept]

exp Patient Selection/

exp Decision Making/

(national health service* or NHS*).ti,ab,in.

(english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab.

(gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*).ti,ab,jx,in.

(bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*))))).ti,ab,in.

(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's").ti,ab,in.

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55 (aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's").ti,ab,in.

56 (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's").ti,ab,in.

- 57 50 or 51 or 52 or 53 or 54 or 55 or 56 [UK filter]
- 58 exp animals/ not humans.sh. [excluding animals]
- 59 1 and 22 and 46
- 60 1 and 22 and 49
- 61 59 or 60

- 62 57 and 61
- 63 62 not 58

2						
3	Annor	div S2 4: Soorah Stratagiag AMED (OVID)				
4	Appendix S3.4: Search Strategies – AMED (OVID)					
5	ARAED (Allied and Complementary, Martine), (1995) - A					
6	AIVIED	(Allied and Complementary Medicine) <1985 to August 2021>				
7						
8 9	1	exp Colorectal neoplasms/				
10	2	((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or				
11	malign	an* or carcinoma* or metasta* or oncolog*)).mp.				
12	3	1 or 2				
13	4	exp Socioeconomic factors/				
14	5	(socio-economic or socioeconomic or socio-demographic or sociodemographic).mp.				
15 16	6	exp education/				
10	7	exp Income/				
18	8	exp Health status/				
19	9	exp Poverty/				
20	10	(socio-economic position or socioeconomic position).mp.				
21	10	inequalities.mp.				
22	12					
23		exp Social environment/				
24 25	13	social factors.mp.				
26	14	income.mp.				
27	15	exp Residence characteristics/				
28	16	Social class.mp.				
29	17	Education.mp.				
30	18	depriv*.mp.				
31	19	(equity or equitable).mp.				
32 33	20	(inequity or inequitable).mp.				
34	21	inequities.mp.				
35	22	disparit*.mp.				
36	23	4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or				
37		21 or 22				
38	24	surgery.mp.				
39 40	25	Treatment.mp.				
40 41	26					
42		trootmont disperities rep				
43	27	exp Health services accessibility/ treatment disparities.mp. exp "Delivery of health care"/				
44	28	exp "Delivery of health care"/				
45	29	exp Primary health care/				
46	30	exp Drug therapy/				
47 48	31	chemotherapy.mp.				
49	32	exp Radiotherapy/				
50	33	radiotherapy.mp.				
51	34	accessibility.mp.				
52	35	access.mp.				
53	36	pattern\$.mp.				
54	37	exp palliative care/				
55 56	38	exp Patient care/				
57	39	care.mp.				
58	40	investigation.mp.				
59	40 41	exp "Quality of health care"/				
60	71	cxp quality of health care /				

- exp Patient assessment/
 - exp "Referral and consultation"/
 - exp "Patient acceptance of health care"/
 - receipt.mp.
 - Provision.mp.
 - Attendance.mp.
 - 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47
 - ((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or preo, delay* .r diagnost. treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).ti,ab.
 - (stage* adj5 (diagnosis or diagnostic)).ti,ab.
 - 49 or 50
 - 3 and 23 and 48
 - 3 and 23 and 51
 - 52 or 53

1		
2 3 4	Арре	endix S3.5: Search Strategies – HMIC (OVID)
5	HMIC	CHealth Management Information Consortium <1979 to August 2021>
7 8	4	
9	1	exp Colorectal cancer/
10	2	((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or
11		nan* or carcinoma* or metasta* or oncolog*)).af
12	3	1 or 2
13 14	4	exp Socioeconomic factors/
15	5	(socio-economic or socioeconomic or socio-demographic or sociodemographic).af.
16	6	exp education/
17	7	exp Income/
18 19	8	exp health status/
20	9	exp Poverty/
21	10	(socio-economic position or socioeconomic position).af.
22	11	inequalities.af.
23	12	exp Social conditions/
24 25	13	social factors.af.
26	14	income.af.
27	15	social class.af.
28	16	education.af.
29	17	exp Health inequalities/
30 31	18	depriv*.af.
32	19	(equity or equitable).af.
33	20	(inequity or inequitable).af.
34	21	inequities.af.
35	22	disparit*.af.
36 37	23	4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or
38		21 or 22
39	24	surgery.af.
40	25	treatment.af.
41	26	exp Access to health services/
42 43	27	exp Access to health services/ treatment disparities.af. exp Service delivery/
44	28	exp Service delivery/
45	29	exp primary care/
46	30	exp Drug therapy/
47	31	chemotherapy.af.
48 49	32	exp Radiotherapy/
50	33	radiotherapy.af.
51	34	accessibility.af.
52	35	access.af.
53	36	pattern*.af.
54 55	37	exp Palliative care/
56	38	exp patient care/
57	39	care.af.
58	40	investigation.af.
59 60	41	exp "Quality of patient care"/
00		

24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38

((patient* or present* or doctor* or physician* or practitioner* or hospital* or

system* or (primary adj care) or (secondary adj care) or total or (help adj3 seek) or pre-

treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera*

or treatment* or diagnos*) adj5 (delay* or interval* or time* or pathway* or route*)).mp.

exp Patient selection/

exp Patient eligibility/

or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47

(stage* adj5 (diagnosis or diagnostic)).ti,ab.

exp Patient referral/

exp Early diagnosis/

49 or 50 or 51 or 52

3 and 23 and 48

3 and 23 and 53

54 or 55

exp Patient waiting time/

receipt.af.

provision.af.

attendance.af.

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Appendix S3.6: Search Strategies – CENTRAL (The Cochrane Library) Search Name: CENTRAL Search Last Saved: 01/09/2021 17:45:46 ID Search MESH descriptor: [Colorectal Neoplasms] explode all trees (((colon* or colorectal or rectal) NEAR/3 (cancer* or neoplas* or tumor* or	tumour*
 Appendix S3.0. Search Strategies – CENTRAL (The Countrale Library) Search Name: CENTRAL Search Last Saved: 01/09/2021 17:45:46 ID Search ID Search #1 MeSH descriptor: [Colorectal Neoplasms] explode all trees 	tumour*
5 6 Search Name: CENTRAL Search 7 Last Saved: 01/09/2021 17:45:46 8 9 9 ID 10 #1 #1 MeSH descriptor: [Colorectal Neoplasms] explode all trees	tumour*
6 Search Name: CENTRAL Search 7 Last Saved: 01/09/2021 17:45:46 8 9 9 ID Search 10 #1 MeSH descriptor: [Colorectal Neoplasms] explode all trees	tumour*
 Last Saved: 01/09/2021 17:45:46 ID Search #1 MeSH descriptor: [Colorectal Neoplasms] explode all trees 	tumour*
 8 9 ID Search 10 #1 MeSH descriptor: [Colorectal Neoplasms] explode all trees 	tumour*
10 10 Search 11 #1 MeSH descriptor: [Colorectal Neoplasms] explode all trees	tumour*
10 11 #1 MeSH descriptor: [Colorectal Neoplasms] explode all trees	tumour*
	tumour*
12 #2 (((color of colorectal of rectal) NEAR/S (caller of reopias of turnor of	tumour
15 TIOL TZ	
16 #4 MeSH descriptor: [Socioeconomic Factors] explode all trees	
17 #5 ((socio-economic or socioeconomic or socio-demographic or	
18 sociodemographic)):ti,ab,kw	
19 #6 MeSH descriptor: [Education] explode all trees	
20#7MeSH descriptor: [Income] explode all trees2121	
48 MeSH descriptor: [Health Status] explode all trees	
23 #9 MeSH descriptor: [Poverty] explode all trees	
24 #10 ((socio-economic position or socioeconomic position)):ti,ab,kw	
²⁵ #11 (inequalities):ti,ab,kw	
26 #12 MeSH descriptor: [Social Environment] evolode all trees	
28 #13 (social factors):ti,ab,kw 29 #14 (income):ti,ab,kw	
³⁰ #15 MeSH descriptor: [Residence Characteristics] explode all trees	
32 #10 (30clai class).cl,ab,kw	
³² #17 (education):ti,ab,kw	
34#18MeSH descriptor: [Health Status Disparities] explode all trees	
35 #19 (Depriv*):ti,ab,kw	
36 #20 ((equity or equitable)):ti,ab,kw 37 #24 ((incoming the balance in the balance i	
38 #21 ((inequity or inequitable)):ti,ab,kw	
39 #22 (inequities):ti,ab,kw	
40 #23 (disparit*):ti,ab,kw	
41 #24 #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or	#16 or
⁴² #17 or #18 or #19 or #20 or #21 or #22 or #23	
43 44 #25 (surgery):ti,ab,kw	
45 #26 (treatment):ti,ab,kw	
46 #27 MeSH descriptor: [Health Services Accessibility] explode all trees	
47 #28 MeSH descriptor: [Healthcare Disparities] explode all trees	
48 #29 (treatment disparities):ti,ab,kw	
49 H20 Macul descriptory [Delivery of Health Care] synlade all tracs	
= $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$	
 #34 MeSH descriptor: [Radiotherapy] explode all trees 55 #34 MeSH descriptor: [Radiotherapy] explode all trees 	
56 #35 (radiotherapy):ti,ab,kw	
57 #36 (accessibility):ti,ab,kw	
⁵⁸ #37 (access):ti,ab,kw	
59 #38 (pattern*):ti,ab,kw	

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2 3 #49 MeSH descriptor: [Patient Care] explode all trees 4 #40 MeSH descriptor: [Palliative Care] explode all trees 5 #41 MeSH descriptor: [Primary Health Care] explode all trees 6 #42 (care or investigation):ti,ab,kw 8 MeSH descriptor: [Quality of Health Care] explode all trees #43 9 #44 MeSH descriptor: [Patient Selection] explode all trees 10 #45 MeSH descriptor: [Eligibility Determination] explode all trees 11 #46 MeSH descriptor: [Referral and Consultation] explode all trees 12 13 #47 MeSH descriptor: [Patient Acceptance of Health Care] explode all trees 14 #48 (receipt or provision or attendance):ti,ab,kw 15 #49 #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or 16 #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 17 18 #50 MeSH descriptor: [Early Detection of Cancer] explode all trees 19 #51 MeSH descriptor: [Delayed Diagnosis] explode all trees 20 #52 (((patient* or present* or doctor* or physician* or practitioner* or hospital* or 21 system* or (primary NEAR/1 care) or (secondary NEAR/1 care) or total or (help NEAR/3 22 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or 23 24 radiothera* or treatment* or diagnos*) NEAR/5 (delay* or interval* or time* or pathway* 25 or route*))):ti,ab,kw 26 ((stage* NEAR/5 (diagnosis or diagnostic))):ti,ab,kw #53 27 #54 #50 or #51 or #52 or #53 28 29 #55 MeSH descriptor: [United Kingdom] explode all trees 30 #56 ((national health service* or NHS*)):ti,ab,kw 31 #57 ((english not ((published or publication* or translat* or written or language* or 32 speak* or literature or citation*) NEAR/5 english))):ti,ab,kw 33 ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united #58 34 35 kingdom* or (england* not "new england") or northern ireland* or northern irish* or 36 scotland* or scottish* or ((wales or "south wales") not "new south wales") or 37 welsh*)):ti,ab,kw 38 ((bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) #59 39 or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or 40 41 "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" 42 not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or 43 ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or 44 chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not 45 46 (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or 47 "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or 48 lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or 49 ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not 50 (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not 51 52 (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new 53 south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or 54 "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or 55 "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston 56 57 or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or 58 sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or 59 "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" 60

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4	or wells or westminster or "westminster's" or winchester or "winchester's" or
5	wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or
	harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not
6	
7	("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or
8	ontario* or ont or toronto*)))))):ti,ab,kw
9	#60 ((bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph
10	
11	or "st asaph's" or st davids or swansea or "swansea's")):ti,ab,kw
12	#61 ((aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's"
13	or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*)
14	or stirling or "stirling's")):ti,ab,kw
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16	#62 ((armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or
17	londonderry or "londonderry's" or derry or "derry's" or newry or "newry's")):ti,ab,kw
18	#63 #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62
19	
20	#64 MeSH descriptor: [Africa] explode all trees
20	#65 MeSH descriptor: [Americas] explode all trees
22	#66 MeSH descriptor: [Antarctic Regions] explode all trees
	#67 MeSH descriptor: [Arctic Regions] explode all trees
23	
24	#68 MeSH descriptor: [Asia] explode all trees
25	#69 MeSH descriptor: [Oceania] explode all trees
26	#70 MeSH descriptor: [United Kingdom] explode all trees
27	#71 MeSH descriptor: [Europe] explode all trees
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29	#72 #64 or #65 or #66 or #67 or #68 or #69
30	#73 #70 or #71
31	#74 #72 NOT #73
32	#75 #63 NOT #74
33	
34	#76 #3 and #24 and #49
35	#77 #3 and #24 and #54
36	#78 #76 or #77
37	
38	#79 #78 and #75
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Appendix S3.7: Search Strategies – Science Citation Index Expanded

Science Citation Index Expanded via Web Of Science Core Collection 01/9/21.

AND #17	
0 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16	
(=(armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" of adonderry or "londonderry's" or derry or "derry's" or newry or "newry's") (adonderry or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" of adonderry or "londonderry's" or derry or "derry's" or newry or "newry's") (adonderry or "londonderry's" or belfast or "belfast's" or lisburn or "lisburn's" of (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" of (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" of (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" of (armagh or "londonderry's" or derry or "derry's" or newry or "newry's")) OR or) OR or
(=(aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edin glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" stralia*) or stirling or "stirling's")) OR (AB=(aberdeen or "aberdeen's" or d undee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverr erth not australia*) or ("perth's" not australia*) or stirling or "stirling's")) O D=(aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edin glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" stralia*) or stirling or "stirling's"))	not undee or ness or DR inburgh's"
(=(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" of "st asaph's" or st davids or swansea or "swansea's")) OR (AB=(bangor or ") cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" of swansea or "swansea's")) OR (AD=(bangor or "bangor's" or cardiff or "card wport or "newport's" or st asaph or "st asaph's" or st davids or swansea or wansea's"))	bangor's" or st davids diff's" or
(bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" clisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harva ambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury s aland*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or "chester's" or chichester or "chichester's" or coventry or "coventry's" or de erby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or n "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or ereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicest icester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liver ew south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) ondon not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or onto*)) or manchester or "manchester's" or (newcastle not (new south wa w)) or ("newcastle's" not (new south wales* or nsw)) or or "norwich or "norwich or "norwich")	" or ard*)) or not r chester erby or nc)) or ely ter or pool not or t or ales* or

nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or

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"salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (vork not ("new york*" or ny or ontario* or ont or toronto*)) 10 or ("york's" not ("new york*" or ny or ontario* or ont or toronto*)))))) OR (AB=(bath or 11 "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford 12 or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or 13 "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or 14 15 ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not 16 zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester 17 or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or 18 "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely 19 or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or 20 "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or 21 22 "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not 23 (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or 24 ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or 25 toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or 26 nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or 27 nottingham or "nottingham's" or oxford or "oxford's" or peterborough or 28 29 "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or 30 preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or 31 "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st 32 albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or 33 wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or 34 "winchester's" or wolverhampton or "wolverhampton's" or (worcester not 35 36 (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or 37 boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) 38 or ("york's" not ("new york*" or ny or ontario* or ont or toronto*)))))) OR (AD=(bath or 39 "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford 40 or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or 41 42 "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or 43 ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not 44 zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester 45 or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or 46 "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely 47 or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or 48 49 "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or 50 "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not 51 (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or 52 ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or 53 toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or 54 nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or 55 56 nottingham or "nottingham's" or oxford or "oxford's" or peterborough or 57 "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or 58 preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or 59 "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st 60

wakefield or "wakefield's" or "winchester's" or wolverham (massachusetts* or boston* boston* or harvard*)) or (yo or ("york's" not ("new york*	or sunderland or "sunderland's" or truro or "truro's" of r wells or westminster or "westminster's" or wincheste npton or "wolverhampton's" or (worcester not or harvard*)) or ("worcester's" not (massachusetts* of ork not ("new york*" or ny or ontario* or ont or toronto " or ny or ontario* or ont or toronto*))))))
kingdom* or (england* not " scotland* or scottish* or ((w OR (AB=(gb or "g.b." or brita united kingdom* or (england irish* or scotland* or scottisl welsh*)) OR (AD=(gb or "g.b "u.k." or united kingdom* or northern irish* or scotland* wales") or welsh*))	or (british* not "british columbia") or uk or "u.k." or un new england") or northern ireland* or northern irish* vales or "south wales") not "new south wales") or welsh in* or (british* not "british columbia") or uk or "u.k." o d* not "new england") or northern ireland* or northern h* or ((wales or "south wales") not "new south wales") ." or britain* or (british* not "british columbia") or uk (england* not "new england") or northern ireland* or or scottish* or ((wales or "south wales") not "new south
speak* or literature or citatic publication* or translat* or v near/5 english)))	l or publication* or translat* or written or language* or on*) near/5 english))) OR (AB=(english not ((publishe written or language* or speak* or literature or citation*
OR AD=((national health ser	ce* or NHS*))) OR AB=((national health service* or NHS vice* or NHS*))
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#7 OR #8 8	
#1 AND #2 AND #6	
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#1 AND #2 AND #3	
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#4 or #5	
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TS=(stage* near/5 (diagnosi	s or diagnostic))
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system* or (primary near/1 seek) or pre-treatment* or re or radiothera* or treatment* pathway* or route*))	doctor* or physician* or practitioner* or hospital* or care) or (secondary near/1 care) or total or (help near eferr* or specialist* or consultant* or surg* or chemoth or diagnos*) near/5 (delay* or interval* or time* or
3	
	"treatment disparities" or chemotherapy or radiother pattern* or care or investigation or receipt or provisior
2	peconomic or socio-demographic or sociodemographic

or income or "social class" or education or depriv* or equity or equitable or inequity or inequitable or inequities or disparit*)

(TS=(((colon* or colorectal or rectal) near/3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*))))

for beer teries only

Appendix S3.8: Search Strategies – CINAHL

CINAHL Searched via EBSCO 31/8/21

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Querv 10 **S**1 (MH "Colorectal Neoplasms+") 11 TI ((colon* or colorectal or rectal) n3 (cancer* or neoplas* or tumor* or tumour* or 12 malignan* or carcinoma* or metasta* or oncolog*)) or AB ((colon* or colorectal or 13 rectal) n3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or 14 S2 metasta* or oncolog*)) 15 16 S3 S1 OR S2 17 18 S4 (MH "Socioeconomic Factors+") 19 TI (socio-economic or socioeconomic or socio-demographic or sociodemographic) or 20 S5 AB (socio-economic or socioeconomic or socio-demographic or sociodemographic) 21 22 S6 (MH "Education+") 23 24 S7 (MH "Income+") 25 **S**8 (MH "Health Status+") 26 27 S9 (MH "Poverty+") 28 29 TI (socio-economic position or socioeconomic position) or AB (socio-economic position 30 S10 or socioeconomic position) 31 32 S11 TI inequalities or AB inequalities 33 S12 (MH "Social Environment+") 34 35 S13 TI (social factors) or AB (social factors) 36 37 S14 TI income or AB income 38 S15 (MH "Residence Characteristics+") 39 40 S16 TI (social class) or AB (social class) 41 42 S17 TI education or AB education 43 S18 (MH "Health Status Disparities") 44 45 S19 TI (depriv*) or AB (depriv*) 46 47 TI (equity or equitable) or AB (equity or equitable) S20 48 49 S21 TI (inequity or inequitable) or AB (inequity or inequitable) 50 TI inequities or AB inequities S22 51 52 S23 TI disparit* or AB disparit* 53 54 (S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 55 S24 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23) 56 S25 TI (surgery) or AB (surgery) 57 58 S26 TI (treatment) or AB (treatment) 59 60

BMJ Open

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3 4	S27	(MH "Health Services Accessibility+")
5 6	S28	(MH "Healthcare Disparities")
7	S29	TI (treatment disparities) or AB (treatment disparities)
8 9	S30	(MH "Health Care Delivery+")
10 11	S31	(MH "Primary Health Care")
12	S32	(MH "Drug Therapy+")
13 14	S33	TI (chemotherapy) or AB (chemotherapy)
15 16	S34	(MH "Radiotherapy, Adjuvant+") OR (MH "Radiotherapy+")
17 18	S35	TI (radiotherapy) or AB (radiotherapy)
19	S36	TI (accessibility) or AB (accessibility)
20 21	S37	TI (access) AB (access)
22 23	S38	TI (pattern*) or AB (pattern*)
24	S39	(MH "Patient Care+") or (MH "Palliative Care")
25 26	S40	TI (care) or AB (care)
27 28	S41	TI (investigation) or AB (investigation)
29 30	S42	(MH "Quality of Health Care+")
31	S43	(MH "Eligibility Determination") or (MH "Patient Selection")
32 33	S44	(MH "Referral and Consultation+")
34 35 36	S45	TI (("receipt") or ("patient acceptance of health care")) or AB (("receipt") or ("patient acceptance of health care"))
37	S46	TI (provision) or AB (provision)
38 39	S47	TI (attendance) or AB (attendance)
40 41 42	S48	S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47
43 44	S49	(MH "Early Detection of Cancer")
45 46	S50	(MH "Early Diagnosis+")
47 48 49 50 51 52 53 54	054	TI (((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary n1 care) or (secondary n1 care) or total or (help n1 seek) or pre- treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) n5 (delay* or interval* or time* or pathway* or route*))) OR AB (((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary n1 care) or (secondary n1 care) or total or (help n1 seek) or pre- treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera*
55 56	S51	or treatment* or diagnos*) n5 (delay* or interval* or time* or pathway* or route*))) TI ((stage* n5 (diagnosis or diagnostic))) OR AB ((stage* n5 (diagnosis or
57 58	S52	diagnostic)))
59 60	S53	S49 OR S50 OR S51 OR S52

BMJ Open

S56

S57

S54	(NILL "Croat Dritain")	(MH "United Kingdom+")
334		

TI ((national health service* or NHS*)) OR AB ((national health service* or NHS*))S55OR AF ((national health service* or NHS*))

TI ((english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) n5 english))) OR AB ((english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) n5 english)))

TI ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*)) OR AB ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*)) OR AF ((gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*))

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38 39 40 41 42 43 44 45 46	S60	TI ((aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's")) OR AB ((aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's")) OR AF ((aberdeen or "aberdeen's")) OR AF ((aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's")) OR AF (aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's"))
47 48 49 50 51 52	S61	TI ((armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's")) OR AB ((armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's")) OR AF ((armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's")) OR AF ((armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or
53 54	S62	S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61
54 55 56 57 58 59	S63	((MH "Africa+") OR (MH "America+") OR (MH "North America+") OR (MH "Latin America") OR (MH "Central America+") OR (MH "Antarctic Regions") OR (MH "Arctic Regions") OR (MH "Asia+") OR (MH "Asia, Western+") OR (MH "Asia, Central+") OR (MH "Australia+") OR (MH "New Zealand")) NOT ((MH "Europe+") OR (MH "Great Britain") OR (MH "United Kingdom+"))
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(((MH "Animals+") OR (MH "Animal Studies") OR (TI "animal model*")) NOT (MH

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Appendix S3.9: Search Strategies – Others

NICE Evidence Search (https://www.evidence.nhs.uk) -

Colorectal cancer and inequal* Colorectal cancer and depriv* NB. The repeat searches did not utilise NICE Evidence Search due to the website's closure.

Base search (<u>https://www.base-search.net</u>)

Limits placed - Content providers as United Kingdom and Document Type set to: Text (all) and Dataset and Unknown. This meant excluding: Musical Notation, Map, Audio, Software and Image/Video.

Colorectal cancer and inequal*

Colorectal cancer and depriv*

Google Advanced Search (https://www.google.com/advanced_search)

Colorectal cancer and inequal* Colorectal cancer and depriv*

Limited to the first 5 pages of results unless the search still appeared relevant, in which case the search would have continued.

Appendix S4: Development and Validation of the Search Strategy and Record Management

The search was developed in MEDLINE using free-text words and subject indexing terms and subsequently adapted for the other databases. Briefly, the search strategies combined different concepts:

- Colorectal cancer and socioeconomic inequalities and system interval and the UK
- Or, colorectal cancer and socioeconomic inequalities and treatment and the UK

Search filters were used to focus on UK-based studies and exclude non-human studies to improve specificity.^{45,46} The search strategy was reviewed by SG using the Peer Review of Electronic Search Strategies for systematic reviews guideline.⁴⁷

Two systematic reviews provided the initial search strategy for the treatment, interval and socioeconomic inequality concepts.^{48,49} Further search terms were identified from search filters.⁵⁰⁻⁵² Thirty-five potentially relevant studies were subsequently used to identify further search terms using MeSH Analyzer, a word frequency analysis tool.⁵³

The search strategy was tested against a set of the 35 known, potentially relevant records. The results of the draft MEDLINE search strategy found 31 of 35 potentially relevant articles. The search was subsequently refined and was able to capture one further article. However, no other changes to the strategy were possible due to a lack of possible candidate search terms in the title/abstract or subject indexing terms of the remaining three uncaptured articles.

The authors of the current systematic review also conducted an almost identical systematic review about ovarian cancer. For this reason, some of the studies used in the development process were about ovarian cancer. However, this development process enhanced the search strategy for both systematic reviews. The potentially relevant studies are referenced here. Not all were necessarily deemed eligible for inclusion in either of the final two systematic reviews, *4*,*6*-10,12-15,17-20,23-26,28,29,34-39,54-62

Search results were imported into EndNote X9,⁴² and duplicates were removed using adapted EndNote de-duplication methods published by Bramer et al., 2016.⁶³ The remaining search results were transferred to Covidence systematic review software.⁶⁴

Appendix S5: Data items and effect measures

The following data were extracted: first author, year of publication, data source, region/country, years of diagnosis, site (colon vs rectal), stage, size of the analytical cohort, measure of socioeconomic status, and the number of socioeconomic groups. Assumptions about missing or unclear information were clearly stated.

For all included studies, data for the following outcomes were extracted:

- Measures of the system interval length, including precise definitions of the time intervals.
 - Effects of socioeconomic factors on the system interval were assessed using coefficients from regression analyses.
 - Or else rates of patients meeting targets were extracted. The odds of meeting targets amongst patients from the most deprived group compared to the least deprived group were calculated. 95% confidence intervals were calculated using RevMan 5.4.⁶⁵
- Cancer-directed therapy received, including the timescale and definitions of treatment. The extracted effect measures were:
 - Adjusted estimates for the likelihood of a particular treatment for the most deprived socioeconomic groups, with 95% confidence intervals. Details of confounding variables were also extracted.
 - If unavailable, unadjusted rates were extracted. The odds of treatment amongst patients from the most deprived group compared to the least deprived group were calculated. 95% confidence intervals were calculated using RevMan 5.4.⁶⁵
 Statistical tests of association were reported when available.

Appendix S6: Study Risk of Bias Assessment

	Selection b	oias			Prognostic factor measurement	Outcome measurement	Study confounding	Statistical reporting	Strength of Evidence
First author (Date published)	Inclusion criteria	Exclusion criteria	Baseline characteristics adequately described	Source and time period adequate and described	Clear and valid definition of socioeconomic status, measurement and categorisation	Clear definition and methods for the outcome	Important potential confounding factors appropriately accounted for	Appropriate analysis and all outcomes reported	
Bailey (2002)	High	High	Moderate	High	High	High	High	High	Weak
Bharathan (2011)	Moderate	Moderate	Low	Moderate	Moderate	High	High	High	Weak
Benitez Majano (2022) [1]	Low	Low	Low	Moderate	Low	Low	Low	Low	Strong
Benitez Majano (2022) [2]	Low	Low	Low	Moderate	Low	Low	Low	Low	Strong
Boyle (2020)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Campbell (2002)	High	High	Low	High	Low	Moderate	Moderate	High	Weak
Crawford (2012)	Moderate	Moderate	High	Moderate	Moderate	High	Moderate	High	Weak
Di Girolamo (2018)	Low	Low	Low	Low	Low	Low	Moderate	Low	Strong
Fenton (2019)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Fenton (2020)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Harris (2009)	Moderate	High	Low	High	Low	High	High	High	Weak
Hassan (2023)	Low	Low	Low	Low	Low	Low	Moderate	Low	Strong
Hayes (2019)	Low	Moderate	Low	Moderate	Low	Moderate	Low	Low	Strong
Hayes (2021)	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Strong
Hole (2002)	Moderate	High	Low	Moderate	Moderate	High	High	High	Weak
Jones (2008)	Moderate	Moderate	High	Moderate	Moderate	High	Moderate	Moderate	Weak

 BMJ Open

First author (Date published)	Selection b	ias			Prognostic factor measurement	Outcome measurement	Study confounding	Statistical reporting	
	Inclusion criteria	Exclusion criteria	Baseline characteristics adequately described	Source and time period adequate and described	Clear and valid definition of socioeconomic status, measurement and categorisation	Clear definition and methods for the outcome	Important potential confounding factors appropriately accounted for	Appropriate analysis and all outcomes reported	Strengtl of Evidenc
Lejeune (2010)	Low	Low	Low	Low	Low	High	Moderate	Moderate	Moderat
McLeod (1999)	Moderate	Moderate	High	Moderate	Low	Low	High	High	Weak
Morris (2008)	Low	Low	Low	Low	Low	Low	Moderate	Low	Strong
Morris (2010)	Low	Moderate	Low	Low	Low	Low	Low	Low	Strong
Morris (2016)	Moderate	High	Low	Low	Low	Low	High	High	Weak
National Cancer Intelligence Network (2011)	Low	Low	High	Low	High	Low	High	High	Weak
NCRAS (2018)	Low	Low	Low	Low	Low	Low	High	Moderate	Moderat
Neal (2005)	High	High	High	Moderate	Low	High	High	Moderate	Weak
Nicholson (2012)	Moderate	Moderate	Low	High	High	Moderate	Moderate	High	Weak
Paterson (2014)	Moderate	Moderate	Low	Moderate	Low	High	Moderate	High	Weak
Pearson (2019)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Pitchforth (2002)	Low	Low	Low	Moderate	Moderate	Moderate	High	Moderate	Moderat
Pollock and Vickers (1998)	Moderate	Moderate	High	High	Low	Moderate	High	High	Weak
Price (2020)	Low	Low	Moderate	Low	Low	Low	Moderate	Low	Strong

Annondiv S6. Study Rick of Rigg Assossment - CONTINUED

Appendix S6: Study Risk of Bias Assessment - CONTINUED

	Selection b	ias			Prognostic factor measurement	Outcome measurement	Study confounding	Statistical reporting	
First author (Date published)	Inclusion criteria	Exclusion criteria	Baseline characteristics adequately described	Source and time period adequate and described	Clear and valid definition of socioeconomic status, measurement and categorisation	Clear definition and methods for the outcome	Important potential confounding factors appropriately accounted for	Appropriate analysis and all outcomes reported	Strength of Evidence
Radwan (2016)	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High	Weak
Raine (2010)	Low	Low	Low	Moderate	Low	Moderate	High	High	Weak
Redanial (2014)	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Strong
Saito (2019) [1]	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Saito (2021) [2]	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Shack (2009)	Low	Low	Low	Moderate	Low	Moderate	Low	Moderate	Strong
Smith (2006)	Moderate	Moderate	Low	High	Low	High	High	High	Weak
Taylor (2021)	Low	Low	Low	Low	Low	Low	Low	Low	Strong
Tilney (2008)	Moderate	High	Low	Moderate	Low	Low	High	Moderate	Weak
Tilney (2009)	Moderate	Moderate	Low	High	Low	Low	High	High	Weak
Vallance (2018)	Low	Low	Low	Low	Low	Low	Low	Low	Strong

Appendix S7: Characteristics of Included Studies

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Bailey (2002)	Patients enrolled from six study centres.	England (Not Specified)	Colorectal	Dukes' C	Not recorded	Economic Resources Domain - OARS OMFAQ (2)	Chemotherapy
Benitez Majano [1] (2022)	Cancer Registration Data, CPRD, HES.	England	Colon	All stages	Diagnosed 2011-2015	IMD 2015 (5)	System Interval
Benitez Majano [2] (2022)	Cancer Registration Data, CPRD, HES.	England	Colorectal	All stages	Diagnosed 2011-2015	IMD 2015 (5)	System Interval
Bharathan (2011)	Colorectal Cancer Audit Group Database.	Northern England	Colorectal	All stages	Admitted/Referred to Surgical Unit 1998-2002	IMD 2004 – without health (5)	Surgery
Boyle (2020)	NBOCA, HES, SACT.	England	Colon	Stage III	Diagnosed 2014-2017	IMD (5)	Chemotherapy
Campbell (2002)	Case notes. Scottish Cancer Registry.	North/Northeast Scotland	Colorectal	All stages	Diagnosed 1995-1996	Carstairs Index 1991 (5)	Chemotherapy Radiotherapy Surgery System Interval
Crawford (2012)	Northern and Yorkshire Cancer Registry.	Northern England	Colorectal	All stages	Diagnosed 1994-2002	IMD - without access to services (4)	Any Treatment Chemotherapy
Di Girolamo (2018)	Cancer Registration Data, NBOCA, CWT.	England	Colorectal	All stages	Diagnosed 2009-2013	IMD Assumed 2007 - Income Domain (5)	System Interval
Fenton (2019)	CORECT-R, Cancer Registration Data, HES.	England	Colorectal	All stages	Major resection for CRC in 2005-2012	IMD 2010 – Income Domain (5)	Liver Resection

Appendix S7: Characteristics of Included Studies - CONTINUED

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Fenton (2021)	CORECT-R, Cancer Registration Data, HES.	England	Colorectal	All stages	Major resection for CRC in 2005-2013	IMD 2010 – Income Domain (5)	Pulmonary Resection
Harris (2009)	Database of patients at an MDT	Birmingham, England	Rectal	Assumed all stages	Diagnosed 2000-2007	IMD 2004 - Assumed Income Domain (5)	Surgery
Hassan (2023)	Cancer Registration Data, ONS, SACT.	England	Colon	Stage III	Diagnosed 2012-2017	IMD 2015 & 2019 (5)	Combination Chemotherapy
Hayes (2019)	Northern and Yorkshire Cancer Registry, HES.	Northern England	Colon	All stages	Diagnosed 1999-2010	IMD - Income Domain (5)	Chemotherapy Surgery
Hayes (2021)	Northern and Yorkshire Cancer Registry, HES.	Northern England	Colorectal	All stages	Diagnosed 2001-2010	IMD 2007 & 2010 - Income Domain (5)	System Interval
Hole (2002)	Audit in eight hospitals.	Central Scotland	Colorectal	All stages	Resection in 1991-1994	Carstairs Index 1991 (3)	Chemotherapy
Jones (2008)	Yorkshire Registry and Northern and Yorkshire Cancer Registry.	Northern England	Colorectal	All stages	Diagnosed 1994-2002	IMD 2004 – without access domain (scored 0-80)	Chemotherapy Radiotherapy Surgery
Lejeune (2010)	Northern and Yorkshire Cancer Registry, TCR, ECRIC.	England	Colorectal	All stages	Diagnosed 1997-2000	Townsend Index 2001 (5)	Any Treatment System Interval
McLeod (1999)	Hospital Discharge Data (SMR1).	Scotland	Colorectal	All stages (assumed)	First Inpatient Treatment For CRC 1990-1994	Carstairs Index 1999 (4)	Chemotherapy

Appendix S7: Characteristics of Included Studies - CONTINUED

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Morris (2008)	Cancer Registration Data, HES.	England	Rectal	All stages who had APER or AR	Diagnosed 1998-2004	IMD 2004 – Income Domain (5)	APER vs AR
Morris (2010)	Cancer Registration Data, HES.	England	Colorectal	All stages	Major resection for CRC in 1998-2004	IMD 2004 – Income Domain (5)	Liver Resection
Morris (2016)	Cancer Registration Data, HES, RTDS.	England	Rectal	All stages post major resection	Diagnosed 2009 2010	IMD – Income Domain (5)	Radiotherapy
Neal (2005)	National Survey of NHS Patients: Cancer	England (Not Specified)	Colorectal	Not recorded	Not recorded	Occupation (8)	System Interval
NCIN (2011)	Cancer Registration Data, HES.	England	Colorectal	All stages	Diagnosed 2004-2006	IMD – assumed (5)	Surgery
NCRAS (2018)	Cancer Registration Data, HES, SACT.	England	Colorectal	All stages	Diagnosed 2013-2015	IMD 2015 – Income Domain (5)	Chemotherapy Radiotherapy Surgery
Nicholson (2012)	Clinical Audit Database.	West of Scotland	Rectal	All stages	Surgery in 2001-2005	Not recorded	APER vs AR
Paterson (2014)	Southeast Scotland Cancer Network Database.	Southeast Scotland	Colorectal	All stages	Diagnosed 2003-2009	Scottish Index of Multiple Deprivation (5)	Chemotherapy Radiotherapy Surgery System Interval

Appendix S7: Characteristics of Included Studies - CONTINUED

First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Pearson (2019)	Cancer Registration Data, CWT, DID, HES, RtD.	England	Colorectal	All stages	Diagnosed 2014-2015	IMD 2015 – Income Domain (5)	System Interval
Pitchforth (2002)	Scottish Cancer Registration, SMR1.	Scotland	Colorectal	All stages (Assumed)	Diagnosed 1992-1996	Carstairs Index (4)	Chemotherapy
Pollock (1998)	HES, ONS.	Thames Region, England	Colorectal	Not recorded	Inpatient FCE with a CRC diagnosis in the financial years 1992-1995	Townsend Score (10)	Surgery
Price (2020)	CPRD, Cancer Registration Data, ONS.	England	Colorectal	All stages (Assumed)	Diagnosed 2006-2017	Townsend Score 2001 (5)	System Interva
Radwan (2016)	Swansea Pelvic Oncology Group Database.	Swansea, Wales	Rectal	All stages	Pelvic exenteration in 2006-2014	Welsh Index of Multiple Deprivation (4)	Chemo – radiotherapy TPE vs PPE
Raine (2010)	HES	England	Rectal	All stages (Assumed)	Admission for rectal cancer surgery 1999-2006	IMD 2004 (5)	AR vs APER
Redanial (2014)	Northern and Yorkshire and South West Offices.	England	Colorectal	Dukes' Stages A/B	Diagnosed 1996-2009	IMD 2007 – Income Domain (5)	System Interva
Saito [1] (2019)	Cancer Registration Data, HES, NBOCA.	England	Colorectal	All stages	Diagnosed 2010-2013	IMD 2010 – Income Domain (5)	Surgery
Saito [2] (2021)	Cancer Registration Data, HES, NBOCA.	England	Colon	All stages	Diagnosed 2010-2013	IMD 2010 – Income Domain (5)	System Interva

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First Author (Year)	Data Source	Region/Country	Site	Stage	Years Studied	Measure of SES (No. Groups)	Broad Outcome
Shack (2009)	Northwest and Merseyside and Cheshire Cancer Registries, HES.	Northwest England	Colorectal	All stages	Diagnosed 1997-2004	IMD 2001 – Income Domain (5)	Chemotherapy Surgery Radiotherapy
Smith (2006)	ACPGBI Bowel Cancer Database	England	Colorectal	All stages	Diagnosed 2001-2002	Townsend Score 2001 (4)	APER vs AR
Taylor (2021)	CORECT-R, HES, SACT.	England	Colorectal	Stage II-III	Diagnosed 2014-2015	IMD 2010 – Income Domain (5)	Chemotherapy
Tilney (2008)	HES.	England	Colorectal	Not recorded	APER or AR surgery in 1996-2004	IMD 2004 (5)	APER vs AR
Tilney (2009)	ACPGBI Bowel Cancer Database	England	Rectal	Dukes' A-C	Diagnosed in 2000-2005	IMD 2004 (5)	APER vs AR
Vallance (2018)	HES, NBOCA.	England	Colorectal	Stage IV	Diagnosed 2011-2015 with synchronous liver-limited metastases	IMD (5)	Liver resectio

Appendix S7: Characteristics of Included Studies - CONTINUED

Abbreviations: ACPGBI Association of Coloproctology of Great Britain and Ireland, APER Abdominoperineal Resection, AR Anterior Resection, CORECT-R Colorectal Cancer Data Repository, CRC Colorectal Cancer, CPRD Clinical Practice Research Datalink, CWT National Cancer Waiting Times Dataset, DID Diagnostic Imaging Dataset, ECRIC Eastern Cancer Registration and Information Centre, FCE Finished Consultant Episode, HES hospital episode statistics, IMD index of multiple deprivation, NBOCA National Bowel Cancer Audit, NCIN National Cancer Intelligence Network, NCRAS National Cancer Registration and Analysis Service, OARS The Duke Older Americans Resources and Services Instrument, OMFAQ The OARS Multidimensional Functional Assessment Questionnaire, ONS Office for National Statistics, PPE Partial Pelvic Exenteration, RtD Routes to Diagnosis, RTDS Radiotherapy Dataset, SACT systematic anti-cancer therapy dataset, SES socioeconomic status, SMR1 Scottish Morbidity Record-1, TCR Thames Cancer Registry, TPE Total Pelvic Exenteration.

 .et, SACT systematic ant. .vic Exenteration.

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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds ratio (95% CI) or other measure	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
Benitez Majano (2022) [2]Age Comorbidities Sex Symptoms Test TypeTest to diagnosis intervalQuantile Regression - 50th centile* LD ref group MD adj coef 0.7 (-2.7,4.1) p=0.729=Benitez Majano (2022) [2]Age Comorbidities Sex Symptoms Test TypeFirst presentation to diagnosis intervalQuantile Regression - 50th centile* LD ref group MD adj coef 91.01R: 1,621Age Comorbidities Sex Symptoms Test TypeTest to diagnosis IntervalVertex of the centile* LD ref group MD adj coef 0.01R: 1,621Age Comorbidities Sex Symptoms Test TypeTest to diagnosis IntervalQuantile Regression - 50th centile* LD ref group MD adj coef 0.01R: 1,621Age Comorbidities Sex Symptoms Test TypeFirst presentation to diagnosis intervalQuantile Regression - 50th centile* 	0	2,115		-	Ref adj interval 126.0 (94.5,157.5) † MD adj interval 204.1 days	1	Strong
Benitez Majano (2022) [2] Age Comorbidities Sex Symptoms First presentation to diagnosis interval Quantile Regression - 50 th centile* LD ref group (21.0,161.0) p=0.028 ↑ Benitez Majano (2022) [2] Age Comorbidities Sex Symptoms Test Type Test to diagnosis Interval Quantile Regression - 50 th centile* LD ref group ↑ R: 1,621 Age Comorbidities Sex Symptoms Test Type Test to diagnosis Interval Quantile Regression - 50 th centile* LD ref group = R: 1,621 Age Comorbidities Sex Symptoms Test Type First presentation to diagnosis interval Quantile Regression - 50 th centile* LD ref group =	Renitez Majano	C: 3,215		e	Quantile Regression - 50 th centile* LD ref group MD adj coef 0.7	=	
(2022) [2] Age Comorbidities Sex Symptoms Test Type Test to diagnosis Interval Quantile Regression - 50 th centile* LD ref group = Structure R: 1,621 Age Comorbidities Sex Age Comorbidities Sex Test to diagnosis Interval Quantile Regression - 50 th centile* LD ref group = Structure R: 1,621 Age Comorbidities Sex First presentation to diagnosis interval Quantile Regression - 50 th centile* LD ref group =					Quantile Regression - 50 th centile* LD ref group MD adj coef 91.0	Ŷ	- Strong
K: 1,621 Age Comorbidities Sex First presentation to diagnosis interval Quantile Regression - 50 th centile*	•	R: 1,621			Quantile Regression - 50 th centile* LD ref group MD adj coef 0.0	=	
(14.8,142.7) p=0.258			Age Comorbidities Sex Symptoms	1	Quantile Regression - 50 th centile* LD ref group MD adj coef 78.8	=	

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Appendix S8: Results of studies reporting variations in the system interval – CONTINUED

First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds ratio (95% CI) or other measure	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
Campbell (2002)	653	Distance Presentation Stage	Referral to treatment interval	Cox Regression LD HR 1.0 MD adjusted HR 1.24 (0.93,1.67)	=	Weak
	i Girolamo (2018) 50,955 46,702 No adjustment 116,177 116,177		Referral to first seen interval [Within 2 weeks Y/N]	(Derived) LD OR 1.0 MD OR 0.80 (0.70-0.91)	1	
Di Girolamo (2018)			Referral to treatment interval [Within 62 days Y/N]	(Derived) LD OR 1.0 MD OR 1.02 (0.95-1.10)	=	Strong
-			Diagnosis to treatment interval [Within 31 days Y/N]	(Derived) LD OR 1.0 MD OR 1.28 (1.14-1.44)	Ļ	
	19,798	Age Site Stage	Referral to first seen interval [Within 2 weeks Y/N]	LD OR 1.0 MD adjusted OR 0.95 (0.87,1.03)	=	
Hayes (2021)	29,445	Age First Treatment Sex Stage	Diagnosis to treatment interval [Within 31 days Y/N]	LD OR 1.0 MD adjusted OR 0.91 (0.84,0.98)	1	Strong
	17,622	Age First Treatment Stage Others	Referral to treatment interval [Within 62 days Y/N]	LD OR 1.0 MD adjusted OR 0.82 (0.74,0.91)	↑	
	71,917		Diagnosis to treatment interval [Within 1 week Y/N]		↑	
Lejeune			Diagnosis to treatment interval [Within 1 month Y/N]	LD OR 1.0 MD adjusted OR 0.84 (0.78,0.90)	↑	
(2010)		Age Stage	Diagnosis to treatment interval [Within 2-3 months Y/N]	LD OR 1.0 MD adjusted OR 0.91 (0.85,0.98)	↑	Moderate
			Diagnosis to treatment interval [Within 4-6 months Y/N]	LD OR 1.0 MD adjusted OR 1.07 (0.96,1.18)	=	

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Appendix S8: Results of studies reporting variations in the system interval - CONTINUED

First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds ratio (95% CI) or other measure	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
			Symptom to diagnosis interval	Generalised linear modelling Nonsignificant result	=	
Neal (2005)	Age Ethnicity Marital Status Sex		Referral to first seen interval	Generalised linear modelling Nonsignificant result	=	Weak
			First seen to diagnosis interval	Generalised linear modelling $F(7) = 2.247$, p=0.028	0	
Paterson (2014)	4,915	Unadjusted	Referral to treatment interval [Within 62 days Y/N]	(Derived) LD OR 1.0 MD OR 1.14 (0.93-1.39)	=	Weak
Pearson (2019)	63,958	Age Comorbidities Ethnicity Investigations Presentation Sex Stage	Secondary care diagnostic interval [Interval longer than the median Y/N]	LD OR 1.0 MD adjusted OR 1.07 (1.00,1.13)	=	Strong
			First presentation to diagnosis	Pre-post difference-in-differences MD coef 0.1 (-0.03,0.2, p=0.147)	=	Strong
Price (2020) Unknown Age		Age Sex Time Period		Event-study difference-in- differences MD coef 0.069 (0.002,0.136, p=0.043)	1	
				Semiparametric varying-coefficient analyses Significant association	1	
Redanial (2014)	46,511	Age Ethnicity Grade Morphology Region Sex Site Stage Time Period	Diagnosis to Treatment Interval [Amongst patients who had a resection within 62 days of diagnosis]	Linear Regression LD coef 0.00 MD adj coef 0.21 (-0.55,0.98)	=	Strong

Appendix S8: Results of studies reporting variations in the system interval - CONTINUED

First Author (Year)	Number	Adju	isted for	C	Outcome of Interest	Odds ratio (95% CI measure) or other	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
Saito (2021) [2]	28,452	Morpholog Sex Site	rbidities Grade y Presentation Stage Year of agnosis	[Time	osis to Treatment Interval from diagnosis to major a amongst patients who had elective surgery]	Linear Regress LD adjusted coeffic MD adjusted coeffic (0.97,1.02)	ient 1.00 vient 0.99	=	Strong
*Results also	o presented for the ce group was m	he 75 th centile		UN	titioner, LD least deprived, M	-			eeding or
	Increased likelih	hood	↓ Decreased lil	kelihood	= No significant differen	nce between groups		nt association observed]
			For peer rev	iew only - h	nttp://bmjopen.bmj.com/site	/about/guidelines.xhtml	I		46

Appendix S9: Results – Likelihood of receipt of surgery

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Surgery	Strength of Evidence
Bharathan (2011)	Not recorded	8,159	Unadjusted	Receipt of surgery [NS] (assumed part of primary treatment)	(Derived) LD OR 1.0 MD OR 0.71	(Derived) 0.51-0.97	Ļ	Weak
Campbell (2002)	1 year of diagnosis	653	Age Distance Stage	Receipt of surgery [NS] (assumed part of primary treatment)	LD OR 1.0 MD OR 0.52	0.14-1.87	=	Weak
Fenton (2019)	3 years of primary colorectal resection	157,383	Age Comorbidities Sex Site Liver Centre Stage Year of Resection	Receipt of Liver Resection	LD OR 1.0 MD OR 0.76	0.70-0.83	Ļ	Strong
Fenton (2021)	3 years of primary colorectal resection	80,869	Age Comorbidities Sex Site Thoracic Centre Stage Year of Resection	Receipt of Pulmonary Resection	LD OR 1.0 MD OR 1.04	0.89-1.22	=	Strong
Harris (2009)	Received during the study period (assumed)	477	Unadjusted	Receipt of surgery [NS] (assumed part of primary treatment)	(Derived) LD OR 1.0 MD OR 0.32	(Derived) 0.13-0.72	Ļ	Weak
Hayes (2019)	12 months of diagnosis (assumed)	31,910	Age Comorbidities Sex Stage Year of Diagnosis	Receipt of surgery [NS] (assumed part of primary treatment)	LD OR 1.0 MD OR 0.62	0.55-0.70	Ļ	Strong

Appendix S9: Results – Likelihood of receipt of surgery - CONTINUED

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Surgery	Strength of Evidence
I (2000)	Received during	C: 16,850	Age Sex Stage	Receipt of surgery [NS] (assumed part of primary treatment)	C: OR 0.99 (for a 1 unit increase in IMD)	C: 0.99-1.0	\downarrow	XX7 1
Jones (2008)	the study period (assumed)	R: 11,406	Time to Hospital		R: OR 0.99 (for a 1 unit increase in IMD)	R: 0.98-0.99	Ļ	Weak
Morris (2010)	3 years of primary colorectal resection	114,155	Age Comorbidities Sex Site Stage Year of Resection	Receipt of Liver Resection	LD OR 1.0 MD OR 0.70	0.61-0.80	Ļ	Strong
NCIN (2011)	30 days before diagnosis to 6 months after	80,690	Unadjusted	Receipt of major resection	(Derived) LD OR 1.0 MD OR 0.84	(Derived) 0.80-0.88	Ļ	Weak
NCD AS (2018)	C: 30 days before diagnosis to 6 months after	75,552	Unadjusted	Receipt of major	C: (Derived) LD OR 1.0 MD OR 0.76	C: (Derived) 0.72-0.80	Ļ	Moderate
NCRAS (2018)	R: 30 days before diagnosis to 12 months after	28,136	Unaujustea	resection	R: (Derived) LD OR 1.0 MD OR 0.66	R: (Derived) 0.61-0.72	Ļ	woderate
Paterson (2014)	Not recorded	4,915	Age Region Sex Site Stage	Receipt of surgery [NS] (assumed part of primary treatment)	LD OR 1.23 MD OR 1.0	0.96-1.58	=	Weak

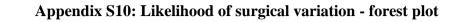
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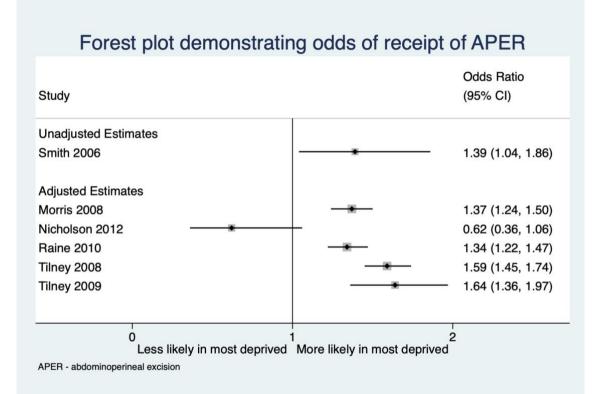
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Appendix S9: Results – Likelihood of receipt of surgery - CONTINUED

					/Likelihood	(p-value)	Deprivation on Odds of Surgery	Evidence
	eceived during e study period	25,304 (assumed)	Age Sex	Finished consultant episode that included therapeutic or palliative surgery (assumed part of primary treatment)	LD OR 1.0 MD OR 0.88	0.78-1.00	=	Weak
	30 days before diagnosis to 180 days after	C: 38,624	Age Comorbidities Grade Histology Presentation Sex Site Stage Year of Diagnosis	Receipt of major resection [Odds of <i>not</i> receiving major surgery]	C: LD OR 1.0 MD OR 0.96	C: 0.87-1.07	=	
Saito (2019) [1] dia		R: 22,630			R: LD OR 1.0 MD OR 1.35	R: 1.22-1.49	Ļ	Strong
Shack (2009)	6 months of diagnosis	29,563	Age Comorbidities Sex Site Stage	Receipt of major resection	LD OR 1.0 MD OR 1.63	1.17-2.26	↑	Strong
Vallance (2018)	year of CRC diagnosis	13,656	Age Comorbidities Presentation Sex Site Liver Centre Stage	Receipt of Liver Resection	LD OR 1.42 MD OR 1.0	1.18-1.70	Ļ	Strong

 $\uparrow Increased likelihood \qquad \downarrow Decreased likelihood \qquad = No significant difference between groups$





Forest plot demonstrating the odds of receipt of abdominoperineal excision of the rectum versus anterior resection in the most deprived versus the least deprived patient group.

Appendix S11: Results – Likelihood of surgical variation

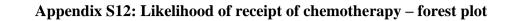
First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of APER vs AR unless otherwise stated	Strength of Evidence
Morris (2008)	26,097	Age Sex Year of Diagnosis Stage Surgeon Workload Presentation	Abdominoperineal Excision vs Anterior Resection	LD OR 1.0 MD OR 1.37	1.24-1.50	↑	Strong
Nicholson (2012)	1,574	Age Stage Sex Surgeon Workload Presentation Year of Diagnosis Others	Abdominoperineal Excision vs Anterior Resection	LD OR 1.0 MD OR 0.62	0.36-1.06	=	Weak
Radwan (2016)	120	Unadjusted	Total Pelvic Exenteration vs Partial Pelvic Exenteration	(Derived) LD OR 1.0 MD OR 1.75	(Derived) 0.55-5.68	= [odds of TPE]	Weak
Raine (2010)	29,214	Age Presentation Sex Year of Resection	Anterior Resection vs Abdominoperineal Excision	LD OR 1.34 MD OR 1.0	1.22-1.47	↑	Weak
Smith (2006)	2,389	Unadjusted	Abdominoperineal Excision vs Anterior Resection	(Derived) LD OR 1.0 MD OR 1.39	(Derived) 1.04-1.86	↑	Weak
Tilney (2008)	52,643	Age Presentation Sex Year of Resection	Abdominoperineal Excision vs Anterior Resection	LD OR 1.0 MD OR 1.59	1.45-1.74	↑	Weak
Tilney (2009)	12,128	Neoadjuvant Therapy Sex Year	Abdominoperineal Excision vs Anterior Resection	LD OR 1.0 MD OR 1.64	1.36-1.97	ſ	Weak

Legend

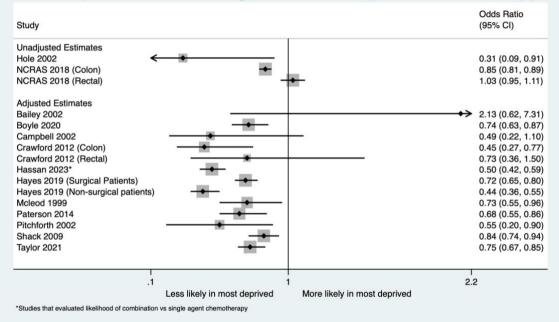
 ↑ Increased likelihood

= No significant difference between groups

Decreased likelihood



Forest plot demonstrating odds of receipt of chemotherapy



Forest plot demonstrating the odds of receipt of chemotherapy in the most deprived versus the least deprived patient group.

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Appendix S13: Results – Likelihood of receipt of chemotherapy

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Chemotherapy	Strength of Evidence
Bailey (2002)	Not recorded	119	Age Social Resources Rating	Receipt of adjuvant chemotherapy	Excellent/good economic resources OR 1.0 Mild/total impairment OR 2.13	0.62-7.31	=	Weak
Boyle (2020)	4 months of surgery	11,932	Access Age ASA Comorbidities Fitness Readmission Sex Stage Others	Receipt of adjuvant chemotherapy	LD OR 1.36 MD OR 1.0	1.15-1.60	Ļ	Strong
Campbell (2002)	1 year of diagnosis	653	Age Distance Presentation Region Stage	Receipt of chemotherapy	LD OR 1.0 MD OR 0.49	0.22-1.10	=	Weak
	6 months of	onths of		Receipt of	C: LD OR 1.0 MD OR 0.45	C: 0.27-0.77	Ļ	
Crawford (2012)	diagnosis	Unknown	Age Sex Stage	chemotherapy in stage IV disease	R: LD OR 1.0 MD OR 0.73	R: 0.36-1.50	=	Weak
Hassan (2023)	4 months of surgery	8,750	Age Ethnicity No. nodes Sex Size Year of Diagnosis	Receipt of combination vs single agent chemotherapy	LD OR 1.0 MD OR 0.50	0.42-0.59	Ļ	Strong
Howas (2010)	12 months of	24,263	Age Comorbidities	Chemotherapy in surgical patients	LD OR 1.0 MD OR 0.72	0.65-0.80	\downarrow	Strong
Hayes (2019)	diagnosis (assumed)	7,647	Sex Stage Year of Diagnosis	Chemotherapy in non-surgical patients	LD OR 1.0 MD OR 0.44	0.36-0.55	\downarrow	Strong

Appendix S13: Results – Likelihood of receipt of chemotherapy - CONTINUED

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Chemotherapy	Strength of Evidence
Hole (2002)	Received during the study period (assumed)	2,269	Unadjusted	Receipt of adjuvant therapy (presumed chemotherapy)	(Derived) LD OR 1.0 MD OR 0.31	(Derived) 0.09-0.91	Ļ	Weak
Lever (2008)	Received during	C: 16,850	Age Sex Stage Time to Hospital	Receipt of chemotherapy	C: OR 0.99 (for a 1 unit increase in IMD)	C: 0.98-0.99	Ļ	Weak
	the study period (assumed)	• •			R: OR 0.99 (for a 1 unit increase in IMD)	R: 0.99-1.0	Ļ	
McLeod (1999)	6 months from the first admission	7,852	Age Comorbidities Death Marital Status Presentation Rural Sex Others	Receipt of chemotherapy	LD OR 1.0 MD OR 0.73	0.55-0.96	Ļ	Weak
N(CD 4 C (2018)	31 days before			Receipt of	C: (Derived) LD OR 1.0 MD OR 0.85	0.81-0.89	Ļ	Madamta
NCRAS (2018)	diagnosis to 12 months after	R: 28,136	Unadjusted	chemotherapy	R: (Derived) LD OR 1.0 MD OR 1.03	0.95-1.11	N	Moderate
Paterson (2014)	Not recorded	4,915	Age Metastatic Disease Region Sex Site	Receipt of chemotherapy	LD OR 1.46 MD OR 1.0	1.16-1.83	Ļ	Weak

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Appendix S13: Results – Likelihood of receipt of chemotherapy - CONTINUED

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Chemotherapy	Strength of Evidence
Pitchforth (2002)	6 months from the first admission	7,303	Age Comorbidities Death Presentation Rural Sex Cancer Centre	Receipt of chemotherapy	LD OR 1.0 MD OR 0.55	0.20-0.90	Ļ	Weak
Shack (2009)	6 months of diagnosis	29,563	Age Comorbidities Sex Site Stage	Receipt of chemotherapy	LD OR 1.0 MD OR 0.84	0.74-0.94	\downarrow	Strong
Taylor (2021)	6 months of surgery	23,402	Age Comorbidities Sex Stage	Receipt of adjuvant chemotherapy	LD OR 1.0 MD OR 0.75	0.67-0.85	\downarrow	Strong
Abbreviations: ASA American Society of Anaesthesiologists grade, CI confidence interval, C colon, LD least deprived, MD most deprived, OR odds ratio, R rectum.								

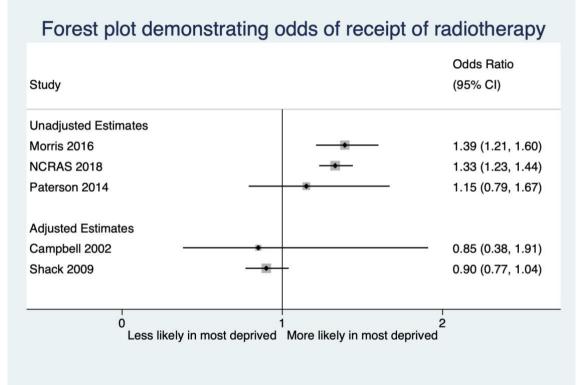
Legend

↑ Increased likelihood

ood ↓ Decreased likelihood

= No significant difference between groups

Appendix S14: Likelihood of receipt of radiotherapy – forest plot



Forest plot demonstrating the odds of receipt of radiotherapy in the most deprived versus the least deprived patient group.

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Radiotherapy	Strength of Evidence
Campbell (2002)	1 year of diagnosis	653	Age Distance Site Stage	Receipt of radiotherapy	LD OR 1.0 MD OR 0.85	0.38-1.91	=	Weak
Jones (2008)	Received during the study period (assumed)	11,406	Age Sex Stage Time to Hospital	Receipt of radiotherapy (rectal cancer cohort)	OR 0.99 (for a 1 unit increase in IMD)	0.99-1.0	=	Weak
Morris (2016)	1 year of surgery	9,201	Unadjusted	Receipt of radiotherapy	(Derived) LD OR 1.0 MD OR 1.39	(Derived) 1.21-1.60	1	Weak
NCRAS (2018)	31 days before diagnosis to 12 months after	28,136	Unadjusted	Receipt of radiotherapy	(Derived) LD OR 1.0 MD OR 1.33	(Derived) 1.23-1.44	↑ (Moderate
Paterson (2014)	Not recorded	1,345	Unadjusted	Receipt of neoadjuvant radiotherapy	(Derived) LD OR 1.0 MD OR 1.15	(Derived) 0.79-1.67	=	Weak
Radwan (2016)	Received during the study period (assumed)	120	Unadjusted	Receipt of neoadjuvant chemoradiotherapy	(Derived) LD OR 1.0 MD OR 1.0	N/A	=	Weak
Shack (2009)	6 months of diagnosis	29,563	Age Comorbidities Sex Stage	Receipt of radiotherapy	LD OR 1.0 MD OR 0.90	0.77-1.04	=	Strong

Abbreviations: CI confidence interval, LD least deprived, MD most deprived, OR odds ratio.

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↑ Increased likelihood	↓ Decreased likelihood	= No significant difference between groups

Appendix S16: Results – Likelihood of receipt of any treatment

First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Any Treatment	Strength of Evidence
Crawford (2012)	6 months of	C: 11,163	A col Sou Stoco	Receipt of any treatment (chemotherapy,	C: LD OR 1.0 MD OR 0.54	C: 0.39-0.76	\downarrow	Weak
Crawlord (2012)	diagnosis	R: 7,058	Age Sex Stage	radiotherapy, surgery NS)	R: LD OR 1.0 MD OR 0.54	R: 0.34-0.84	\downarrow	weak
Lejeune (2010)	6 months of first contact with NHS	71,917	Age Stage	Receipt of any treatment (presumed surgery, chemotherapy, radiotherapy NS)	LD OR 1.0 MD OR 0.87	0.82-0.92	Ļ	Moderate
Abbreviations: C	C colon, CI confidend	ce interval, L	D least deprived, MD mo.	ost deprived, NHS National He	alth Service, NS not spe	cified, OR odds	ratio, R rectal.	
↑ Inci	eased likelihood	↓D	ecreased likelihood	= No significant difference	between groups			

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