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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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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.

Design

MEDLINE, EMBASE, CINAHL, CENTRAL, SCIE, AMED and PsycINFO were searched from inception to January 2023. Grey literature, including HMIC, BASE, and Google Advanced Search, and forward and backward citation searches were conducted. Two reviewers independently reviewed titles, abstracts, and full-text articles. Observational UK-based studies were included if they reported socioeconomic measures and an association with either hospital delay or treatments received. The QUIPS tool assessed bias risk, and a narrative synthesis was conducted. The review is reported to PRISMA 2020 and registered with PROSPERO [CRD42022347652].

Results

Forty-one of the 7,209 identified references were included. Twelve studies evaluated seven different hospital intervals. There was a significant association between area-level deprivation and a longer time from first presentation in primary care to diagnosis. Thirty-two studies evaluated treatments received. There were socioeconomic inequalities in surgery and chemotherapy but not radiotherapy.

Conclusion

Patients with colorectal cancer face inequalities across the cancer care continuum. Further research is needed to understand why and what evidence-based actions can reduce these inequalities in treatment. Qualitative research of patients and clinicians conducted across various settings would provide a rich understanding of the complex factors that drive these inequalities. Further research should also consider using a causal approach to future studies to considerably strengthen the interpretation. Clinicians can try and mitigate some potential causes of colorectal cancer inequalities, including signposting to financial advice and patient transport schemes.

Trial registration

PROSPERO [CRD42022347652].

Strengths and limitations

- The searches were extensive – conducted across eight databases, supplemented with citation searching and hand-searching websites.
- The search strategy was validated.
- The inclusion of non-peer-reviewed literature was a key strength.
- Due to heterogeneous methods, meta-analysis was not possible.

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Competing interests

The authors declare no conflict of interest.

Introduction

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)

Timely diagnosis and treatment are also essential, with delays associated with worse outcomes. The Aarhus statement suggested a framework for measuring these delays, categorising the patient journey into patient, doctor and system intervals.(4) Specifically, the system interval was defined as the period from primary care-initiated investigations or referral to the commencement of treatment.(4) Socioeconomic circumstances can impact this interval and yet is comparatively under-researched.

Existing inequalities have been exacerbated by the COVID-19 pandemic, with vulnerable patient groups disproportionately affected by suboptimal care.(5) The evolution of precision medicine and the development of new technologies and surgical 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 documented.(7) Understanding where inequalities are in the pathways of care for patients with colorectal cancer is essential to inform policy and identify areas of further 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

system, our systematic review homogenised the healthcare infrastructure, policy, and patient population, ensuring a more interpretable analysis of disparities in cancer care with greater scope for policy impact.

Methods

This systematic review was registered with PROSPERO (CRD42022347652). The review is reported according to the PRISMA 2020 statement (Appendix S1).(8)

Eligibility criteria

Published and grey-literature observational studies were considered for inclusion if relevant outcomes of patients with a primary diagnosis of colorectal cancer (ICD10 C18-C20) in the UK were reported.

Outcomes were only included if they had been analysed by a measure of socioeconomic status [e.g., an area-based measure such as the Index of Multiple Deprivation (IMD) or individual measures such as occupation]. The relevant outcomes were defined as follows:

- The association between socioeconomic status and the length of the system interval, as defined by the Aarhus statement.(4) Any part of the system interval could have been measured.
- Or receipt of cancer-directed treatment. Studies evaluating palliative or supportive care only were excluded.

Information sources

The following bibliographic databases were searched from inception to 26/01/2023: MEDLINE, EMBASE, AMED and PsycINFO, CINAHL, CENTRAL and Science Citation Index Expanded.

The grey literature was searched using HMIC, BASE, NICE Evidence Search and Google Advanced Search on 26/01/2023. In addition, twelve websites were systematically hand-searched, and backwards and forward citation searches were conducted on 30/03/2023 (details in Appendix S2).

Search strategy

The search strategies are listed in Appendix S3. The search strategy was developed and validated in conjunction with SG, an information specialist (details in Appendix S4). BPS and another reviewer (MS or KS) independently screened all titles and abstracts against the pre-determined eligibility criteria. The full texts of eligible titles and abstracts were obtained and independently screened for inclusion. Conflicts were resolved by consensus.

Data Collection Process

One researcher (BPS) extracted information from the included studies, collating the relevant data onto a data extraction form. A second author (KS) checked the extracted data, and discrepancies were reconciled by consensus. The data items and effect measures that were sought for extraction are detailed in Appendix S5.

Study risk of bias assessment

Two researchers (BPS and KS) independently evaluated the study risk of bias against domains adapted from the Quality in Prognosis Studies tool (QUIPS).(9) Each domain was judged to have a high, moderate, or low risk of bias, with the evaluations collated onto a pre-prepared form (Appendix S6).

Risk of bias assessments informed the narrative synthesis, with greater weight given to studies with a lower risk of bias. A study's evidence was considered "strong" if there were no high risk of bias categories, "moderate" if there was a high risk of bias in one

category, and "weak" if there were two or more categories at high risk of bias. However, studies were not excluded based on this.

Synthesis methods

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

Results

Study Selection

The database searches yielded 7,201 studies, 214 of which were retrieved for full-text screening. An additional six studies were identified from the grey literature. Overall, forty-one studies were included (Figure 1).(11)

Study Characteristics

The characteristics of the included studies are summarised in Appendix S7. The system 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, 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, 46)

Thirty-two of the forty-one studies adjusted or stratified for at least one other factor.(12-26, 32-41, 44-49, 51) The remaining nine studies provided unadjusted rates.(27-31, 42, 43, 50, 52)

Risk of bias in studies

Assessments of the risk of bias are summarised in Figure 3 and Appendix S6. The domain most at risk of bias was study confounding, with sixteen studies at high risk of bias.(13, 27-31, 39-43, 47-50, 52) Although some of these studies conducted adjusted analyses, important factors such as stage were unaccounted for.

Results of studies reporting variations in the system interval

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),(18) while there was no significant association in the other (OR 0.95) 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.(13) Overall, the evidence was inconclusive for an association between deprivation and the referral to first-seen interval. (Table 1; Appendix S8)

First seen to diagnosis interval

One study estimated the association between occupation and the number of days from the first hospital appointment to communication of diagnosis.(13) A significant

association was demonstrated (p=0.028), but no magnitude or direction of effect was provided. The evidence was, therefore, inconclusive. (Table 1; Appendix S8)

Diagnosis to treatment interval

Five studies evaluated the diagnosis to treatment interval.(14-18) Two estimated the number of days from diagnosis to major surgery, adjusting for; stage, sex, age, grade and morphology.(14, 16) No significant associations were demonstrated. (Appendix S8)

Two studies evaluated the likelihood of commencing treatment within 31 days from the date a treatment plan was agreed upon.(15, 18) One study demonstrated increased unadjusted odds (OR 1.28),(18) while the other presented reduced adjusted odds of patients from the most deprived areas commencing treatment within 31 days (OR 0.91).(15) (Appendix S8)

Another study calculated the likelihood of treatment for the most deprived quintile across several time points. They demonstrated reduced adjusted odds of treatment within one week (OR 0.78), one month (OR 0.84) and two to three months (OR 0.91) but non-reduced odds at four to six months (OR 1.07) after the first contact with the health system.(17) (Appendix S8)

Overall, the evidence for an association between deprivation and length of the diagnosis to treatment interval was inconclusive. (Table 1; Appendix S8)

Test to diagnosis interval / secondary care diagnostic interval

One study evaluated the secondary care diagnostic interval (SCDI), defined as the period between the date of the first interaction with secondary care to the date of diagnosis.(12) This study evaluated the factors associated with an interval greater than the median, adjusting for sex, age, stage, comorbidities, ethnicity, route to diagnosis and

additional diagnostic tests.(12) The odds of a longer interval were not significantly increased for patients from the most deprived quintile (OR 1.07). (Appendix S8)

Another study evaluated the time from the first investigation to cancer diagnosis.(23) The authors conducted quantile regression, adjusting for age, comorbidities, sex, test type and symptom category, focussing on the median and 75th centiles.(23) There was no significant association between deprivation and interval length. (Appendix S8)

Overall, there was no evidence of a prolonged SCDI or test-to-diagnosis interval for patients from the most deprived background. (Table 1; Appendix S8)

First presentation to diagnosis interval

Three studies evaluated the time from the first symptom or feature of colorectal cancer in primary care records to diagnosis.(21-23) One study demonstrated an association between deprivation and a longer interval in two of three econometric analyses.(21) The other two studies conducted quantile regression, focusing on the median and 75th centiles, adjusting for age, comorbidities, sex and type of symptom.(22, 23) Both studies demonstrated an association between the most deprived quintile and a longer first presentation to diagnosis interval for patients with colon cancer (e.g. adjusted median interval of 204 versus 126 days).(22) Meanwhile, there was no such association among patients with rectal cancer,(23) possibly reflecting that patients with rectal cancer are more likely to present with localising symptoms. (Appendix S8)

Overall, three robust studies provided evidence that patients from the most deprived quintile experienced a longer first presentation to diagnosis interval. (Table 1; Appendix S8

Symptom to diagnosis interval

One study estimated the effect of occupation on the time between a patient's first symptom and diagnosis.(13) No significant effect was demonstrated, adjusting for ethnicity, age, marital status and sex.(13) (Table 1; Appendix S8)

Referral to treatment interval

Four studies evaluated the time from referral to treatment.(15, 18-20) Two studies demonstrated no significant association between deprivation and the likelihood of commencing treatment within 62 days of referral (range of ORs 1.02-1.07).(18, 19) Another study demonstrated reduced odds of patients commencing treatment within 62 days of referral, adjusted for age, stage, referral interval and first treatment received (OR 0.82).(15) (Appendix S8)

Meanwhile, one study estimated hazard ratios for the time between referral and first treatment, adjusting for stage, distance and presentation.(20) There was no significant association between deprivation and time to treatment (HR 1.24). (Appendix S8)

Overall, the association between deprivation and this interval was inconclusive. (Table 1; Appendix S8)

Results of studies reporting treatment inequalities

Results of studies reporting likelihood of receipt of primary surgery

The outcome of interest was primary surgery in eleven studies, here defined as resection of the tumour.(19, 20, 24-31, 36) Five studies clearly defined the outcome as a tumour resection,(25, 27-29, 36) while the received surgical procedure was not identified in the other six studies.(19, 20, 24, 26, 30, 31) (Appendix S9)

Across seven studies, adjustment was made for different factors: age,(19, 20, 24-26, 29, 36) stage,(19, 20, 24-26, 36) sex,(19, 24-26, 29, 36) comorbidity,(24, 25, 36) site (colon vs rectum),(19, 25, 36) distance or time to hospital,(20, 26) year of diagnosis,(24, 36)

region,(19) and histology, grade and presentation.(36) Meanwhile, four studies provided only rates of patients receiving surgery.(27, 28, 30, 31) (Appendix S9)

Six studies presented reduced odds of surgery for patients from the most deprived background (range of ORs 0.32-0.99).(24, 26-28, 30, 31) One study presented increased odds of *not* receiving surgery amongst the most deprived patients with rectal cancer (OR 1.35) but no significant association among patients with colon cancer (OR 0.96).(36) Meanwhile, one study presented increased odds of surgery for patients from the most deprived background (OR 1.63),(25) and three studies demonstrated no association (range of ORs 0.52-0.88).(19, 20, 29) Overall, there was moderate evidence of the effect of deprivation due to a lack of consistent effect across the mixed-strength studies. (Table 1; Appendix S9)

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

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 examined the receipt of liver resection, demonstrating significantly reduced odds of resection for patients from the most deprived group (range of ORs 0.70-0.76).(32-34) One study examined the receipt of pulmonary resection, with no significant association demonstrated between deprivation and the likelihood of resection (OR 1.04).(35) (Table 1; Appendix S9)

Results of studies reporting likelihood of surgical variation

Seven studies evaluated variations in surgery.(37-43) Six reported rates or odds of abdominoperineal resection (APER) or anterior resection (AR).(37-42) Five studies adjusted for important variables, including age,(37-40) sex,(37-41) stage,(37, 38) year of diagnosis or resection,(37-41) surgeon workload,(37, 38) and admission type.(37-40) Five of the seven studies demonstrated that APER was significantly more likely than

AR for patients from the most deprived areas (range of ORs 1.37-1.64).(37, 39-42) (Table 1; Appendix S10)

Meanwhile, one study of 120 patients presented unadjusted rates of total pelvic exenteration (TPE) compared with partial pelvic exenteration (PPE).(43) There was a non-significant association between deprivation and the unadjusted odds of TPE (OR 1.75). (Table 1; Appendix S10)

Results of studies reporting likelihood of receipt of chemotherapy

Thirteen studies examined whether patients received any chemotherapy,(19, 20, 24-27, 44-50) eleven of which conducted adjusted analyses.(19, 20, 24-26, 44-49) Six studies evaluated the use of adjuvant chemotherapy.(24, 44, 45, 49-51) Two studies evaluated the use of palliative chemotherapy.(24, 46) Meanwhile, the intent of chemotherapy was unknown in the remaining seven studies.(19, 20, 25-27, 47, 48)

Eight studies demonstrated reduced adjusted odds of chemotherapy for patients from the most deprived group (range of ORs 0.44-0.99).(19, 24-26, 44, 45, 47, 48) One study demonstrated reduced adjusted odds for patients from the most deprived group with colon (OR 0.45) but not rectal cancer (OR 0.73).(46) Two studies did not show a significant association between deprivation and receipt of chemotherapy (range of ORs 0.49-2.13).(20, 49) (Appendix S11)

Meanwhile, two studies presented unadjusted rates.(27, 50) One demonstrated reduced odds of chemotherapy for the most deprived patients with colorectal cancer (OR 0.31).(50) The other demonstrated reduced odds of chemotherapy for the most deprived patients with colon (OR 0.85) but not rectal cancer (OR 1.03).(27) (Appendix S11)

One study examined the receipt of combination versus single-agent chemotherapy, adjusting for age, sex, ethnicity, tumour size, lymph node yield and year of

diagnosis.(51) However, no adjustment was made for co-morbidity. Patients from the most deprived area had significantly reduced odds of receiving combination chemotherapy (OR 0.50).(51) (Appendix S11)

Five of the six studies evaluating the use of adjuvant chemotherapy demonstrated inequalities.(24, 44, 45, 50, 51) Meanwhile, both studies evaluating the use of palliative chemotherapy demonstrated similar inequalities.(24, 46) Overall, the evidence supported the hypothesis that patients from the most deprived group are less likely to receive chemotherapy or combination adjuvant chemotherapy. (Table 1; Appendix S11)

Results of studies reporting likelihood of receipt of radiotherapy

Seven studies reported receipt of radiotherapy by socioeconomic group.(19, 20, 25-27, 43, 52) Two studies evaluated the use of neoadjuvant radiotherapy.(19, 43) One study evaluated patterns of pre and post-operative radiotherapy.(52) The intent of radiotherapy was unknown in four studies.(20, 25-27)

Three studies conducted analyses that adjusted for important factors, including; age,(20, 25, 26) stage,(20, 25, 26) sex,(25, 26) distance or journey time,(20, 26) tumour site (colon vs rectum),(20) and comorbidity.(25) None of these studies demonstrated a significant association between deprivation group and radiotherapy (range of ORs 0.85-0.99). The remaining four studies reported unadjusted rates of radiotherapy.(19, 27, 43, 52) Two of these studies demonstrated increased odds of radiotherapy for patients from the most deprived group (range of ORs 1.33-1.39).(27, 52) The other two studies looked at rates of neoadjuvant radiotherapy specifically and did not show a significant association between deprivation and odds of treatment (range of ORs 1.00-1.15).(19, 43) (Appendix S12)

Overall, there was no evidence to support an association between socioeconomic status 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)

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

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

*Studies represented in more than one column due to different conclusions depending on the underlying cancer type (colon vs. rectal cancer).(23, 27, 36, 46)

Discussion

Main Findings

This is the first systematic review to evaluate what is already known about the relationship between socioeconomic status, the system interval, and the treatment that patients with colorectal cancer receive.

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)

Surgery in the management of colorectal cancer

There was moderate 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.

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 APER than anterior resection. APER is associated with a worse quality of life and is generally considered less preferable if a less deforming surgery is possible.

Despite adjustment, socioeconomic inequalities were frequently observed. This suggests the presence of uncaptured factors such as co-morbidity or frailty. There may also have been variations in access to specialist care, financial and employment factors, patient choice, health-seeking behaviours and health literacy, all of which warrant further investigation.(55-57)

Chemotherapy in the management of colorectal cancer

There was strong evidence that patients from more deprived areas were less likely to receive chemotherapy or combination adjuvant chemotherapy. Trust in clinicians, financial and employment factors, social support, adequate communication and provision of information are critical in influencing the use of chemotherapy.(58-61) These, amongst other uncaptured factors such as comorbidity or frailty, could be responsible for the observed inequalities.

Radiotherapy in the management of rectal cancer

There was no evidence that patients from more deprived areas were less likely to receive radiotherapy. The absence of observed inequalities could reflect the nature of this outpatient treatment and the availability of patient transport. This is compared with, for example, surgery, which necessitates hospital admission and prolonged time away from work and social support. A lung cancer study similarly demonstrated a greater likelihood of radiotherapy but a reduced likelihood of surgery amongst less affluent patients.(62)

Strengths and weaknesses

This systematic review identified many studies and employed a robust methodology. The process of identifying search terms was thorough, and the search was validated. The searches were extensive, conducted across eight databases, supplemented with citation searching and a thorough examination of the grey literature. These additional

search methods identified six studies.(27, 28, 35, 36, 44, 52) Inclusion of non-peer-reviewed literature was also a key strength of this review.(25, 27, 28, 36)

The included studies were, however, heterogeneous in the methodology and populations studied. Out of forty-one studies, only fifteen included patients diagnosed after 2010.(12, 14, 18, 21-23, 27, 32, 33, 35, 36, 43-45, 51) Of the six studies evaluating the system interval in patients diagnosed since 2010, four demonstrated some inequalities.(18, 21-23) Meanwhile, seven out of the nine studies that evaluated inequalities in treatments amongst patients diagnosed after 2010 demonstrated the presence of inequalities.(27, 32, 33, 36, 44, 45, 51) Therefore, although most studies included patients from over a decade ago, inequalities persisted in recent cohorts despite a national focus on reducing inequalities.

Another limitation was that studies frequently analysed colorectal cancer as a single disease despite differences in presentation and management. Significantly, no study utilised causal inference approaches, exemplified by an absence of reported directed acyclic graphs.(63) The methods used could have introduced a bias known as the "table 2 fallacy", whereby estimates from regression models are mistakenly interpreted.(63) Using a causal approach to future studies would considerably strengthen the interpretation and, thus, meaningfully impact policy.(64)

Implications for policy and practice

Due to significant heterogeneity across studies, we could not firmly conclude whether patients from more deprived backgrounds systematically experience longer system intervals. However, COVID-19 detrimentally impacted cancer diagnostic activity for most patients, especially those in deprived areas.(5) It is important to ensure measures are in place to monitor the system interval for patients most at risk of delays.(5)

There was moderate evidence of socioeconomic inequalities in surgery and strong evidence for inequalities in chemotherapy. Some inequalities may partly be due to wording in clinical guidelines. For example, the National Institute for Health and Care Excellence advises that primary surgery for colorectal cancer is "offered" (a strong recommendation); the same guideline advises liver resection be "considered" (less certain benefit).(65) Similarly, adjuvant chemotherapy can be estimated to reduce the risk of death in stage III disease by 10-15%. However, there is a significant risk of long-term toxicity. Patients must carefully weigh the potential harms and benefits of these less strongly recommended treatments. Shared-decision making is vital. Inequalities will result when some patients experience better shared-decision making and can cover the costs of additional treatment, such as time off work.(66)

Clinicians can mitigate some of the effects of deprivation. Such strategies may include referring patients for pre-rehabilitation, tailored communication, and ensuring patients are aware of appropriate financial support and transport schemes.(66)

Further studies are needed to evaluate for inequalities in novel treatments. In the era of precision oncology and an ever-increasing armamentarium of novel treatments, the marginal benefits of new therapies mustn't just be experienced by the most affluent. A prostate cancer study exemplified this, demonstrating that patients from more deprived backgrounds living at greater distances from specialist centres were significantly less likely to receive robotic prostatectomy.(67) If we accept the benefit of newer surgical technology and techniques, such as robotic surgery, these should be available for all patients no matter where they live.

Future research

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

of chemotherapy and surgery. In particular, observational research of recent cohorts should utilise causal inference. Beyond this, qualitative research will be of great value in gaining a richer insight into the causes and drivers of these inequalities.

Conclusions

Despite a healthcare system that provides free healthcare at the point of access, there were unexplained socioeconomic inequalities in surgery, chemotherapy and aspects of the system interval. Further research is needed to understand the variations in treatment between socioeconomic groups.

Differences in patient selection for treatment have been linked with worse colorectal cancer survival within and between countries, with evidence of improved outcomes when care is aligned with optimal pathways.(68) Eliminating inequalities could narrow survival gaps within and between countries. These findings will interest policymakers, clinicians and researchers worldwide, as inequalities in cancer care and outcomes of different socioeconomic groups have been recognised across healthcare jurisdictions.

Additional Information

Acknowledgements

Not applicable.

Authors' Contributions

BPS – conceptualisation, developed search strategy, screening, data curation and formal analysis, project administration and writing – original draft.

KS – conceptualisation, screening, data curation and formal analysis, review of the manuscript

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

This published article and its supplementary information files include all data generated or analysed during this study.

Competing Interests

The authors declare no conflict of interest.

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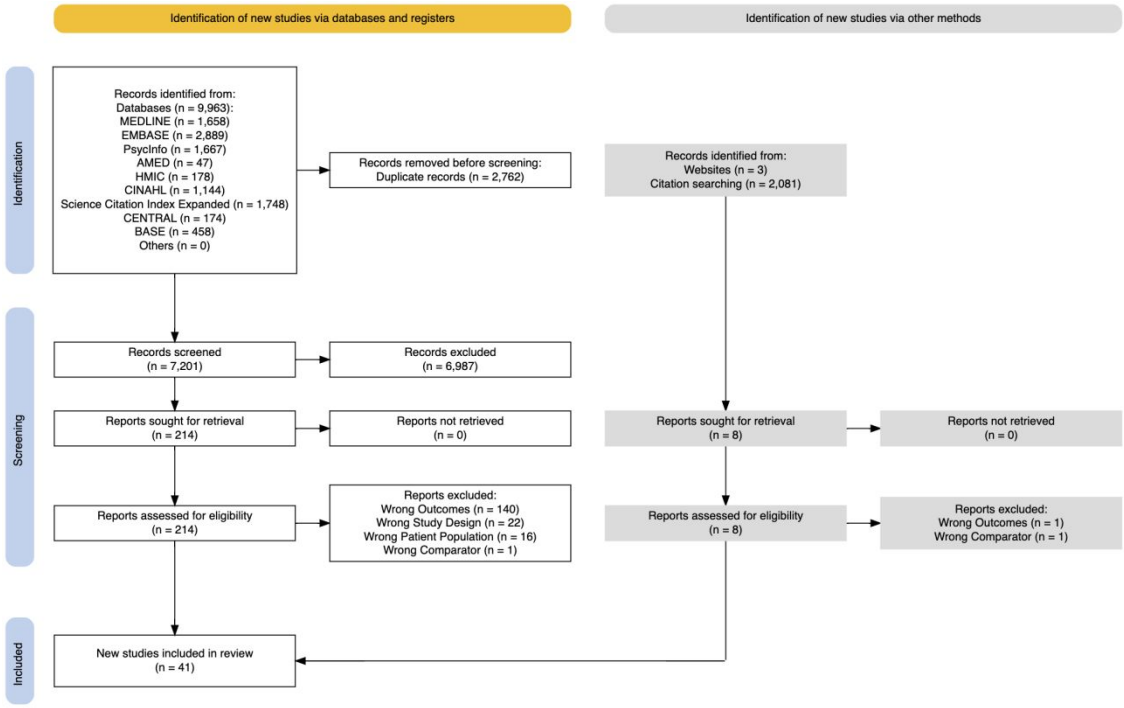

Figure 1: PRISMA flow diagram of included studies.

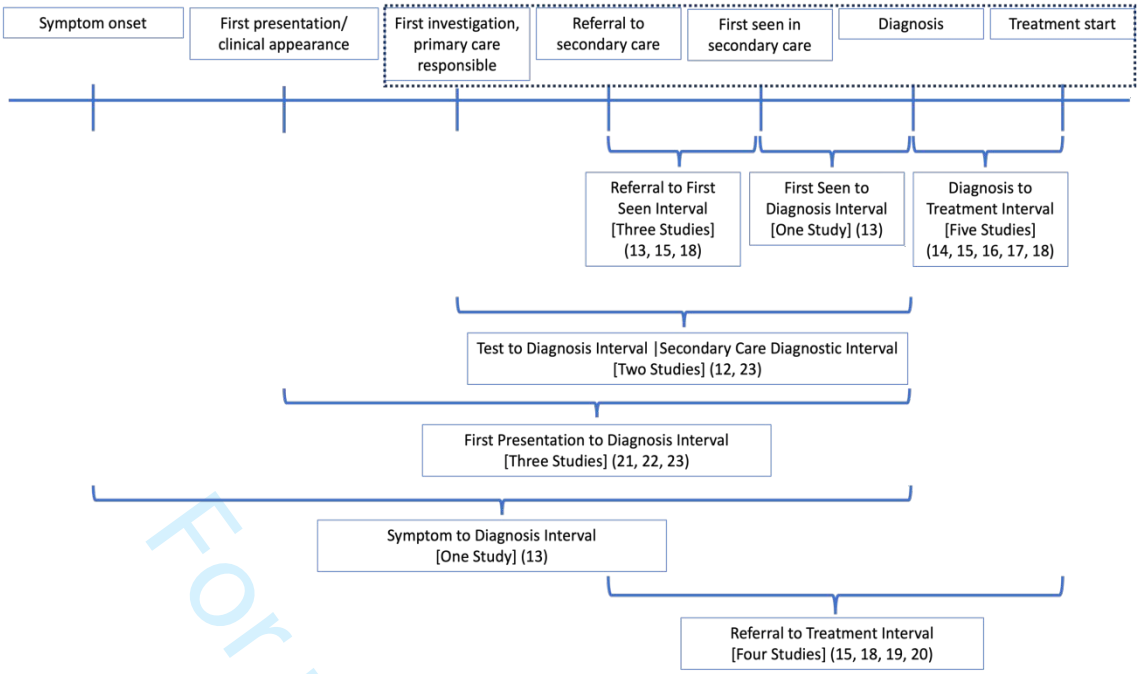

Figure 2: Time intervals evaluated in the included studies.

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

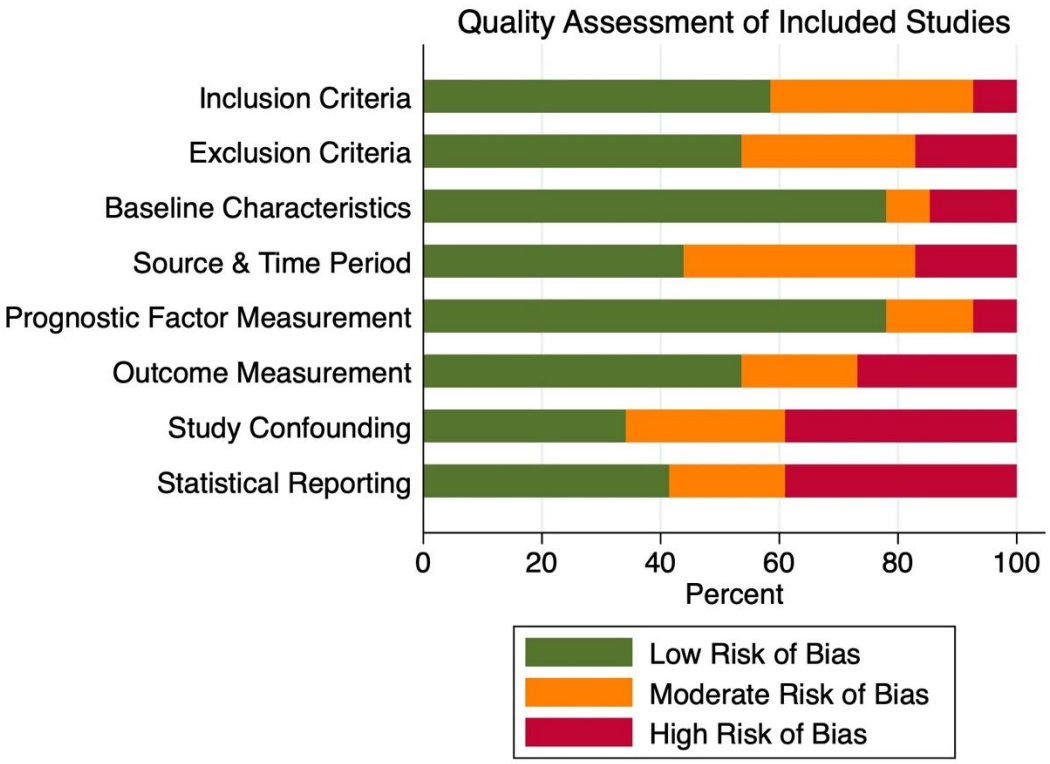

Figure 3: Risk of bias in the included studies. For each element the proportion of studies with high, moderate and low risk of bias is illustrated.

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

Contents

Appendix S1: PRISMA Statement Checklist[1]

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

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			
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 S8-

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

Appendix S2: List of Hand-Searched Online Sources and Details of Citation Searches

The following websites were hand-searched on 30/03/2023:

- The National Cancer Registration and Analysis Service (http://www.ncin.org.uk/home)
- 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-and-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 searches on 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 records using forwards searching.[41] These records were then screened by BPS in EndNote X9.[42]
The bibliographies of two systematic reviews were also examined for relevant articles.[43,44]

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"/
31 exp Primary Health Care/
32 exp Drug Therapy/
33 chemotherapy.mp.
34 Radiotherapy/ or Radiotherapy, Adjuvant/
35 radiotherapy.mp.
36 accessibility.mp.

37 access.mp.
38 pattern$.mp.
39 palliative care/ or Patient care/ or Primary Health care/
40 care.mp.
41 investigation.mp.
42 exp "Quality of Health Care"/
43 exp Patient Selection/ or exp Eligibility Determination/
44 exp "Referral and Consultation"/
45 Receipt.mp. or exp "Patient Acceptance of Health Care"/
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 Detection of Cancer"/
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 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.
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.
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,jw,in.
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.

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]

71 3 and 24 and 48

72 3 and 24 and 53

73 71 or 72

74 64 and 73

75 74 not 70

Appendix S3.2: Search Strategies – EMBASE (OVID)

OVID Embase <1974 to 2021 August 31>

1 exp colorectal tumor/
2 ((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)).mp.
3 1 or 2 [cancer population of interest]
4 exp socioeconomics/
5 (socio-economic or socioeconomic or socio-demographic or sociodemographic).mp.
6 exp education/
7 exp income/
8 exp health status/
9 exp poverty/
10 (socioeconomic position or socio-economic position).mp.
11 inequalities.mp.
12 exp social environment/
13 social factors.mp.
14 income.mp.
15 exp demography/
16 social class.mp.
17 education.mp.
18 exp health disparity/
19 depriv*.mp.
20 (equity or equitable).mp.
21 (inequity or inequitable).mp.
22 inequities.mp.
23 disparit*.mp.
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 20 or 21 or 22 or 23 or 23 [inequality concept]
25 surgery.mp.
26 treatment.mp.
27 exp health care access/
28 exp health care disparity/
29 treatment disparities.mp.
30 exp health care delivery/
31 exp primary health care/
32 exp drug therapy/
33 chemotherapy.mp.
34 adjuvant radiotherapy/ or radiotherapy/
35 radiotherapy.mp.
36 accessibility.mp.
37 access.mp.
38 pattern*.mp.
39 palliative therapy/ or patient care/ or primary health care/
40 care.mp.
41 investigation.mp.

42 exp health care quality/
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 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.
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.

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,ad.
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,ad.
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,ad.
62 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61
63 (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/)
64 62 not 63 [NICE UK Filter]
65 letter.pt.
66 (animal* not human*).sh,hw.
67 65 or 66 [excluding animals and unwanted publication types]
68 3 and 24 and 48
69 3 and 24 and 53
70 68 or 69
71 64 and 70
72 71 not 67
73 limit 72 to conference abstract status
74 limit 73 to dd=20200831-20210831
75 72 not 73
76 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/
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.
31 exp Radiation Therapy/
32 exp Chemotherapy/
33 radiotherapy.af.
34 accessibility.af.
35 access.af.
36 pattern$.af.
37 exp Palliative Care/
38 care.af.
39 investigation.af.
40 exp "Quality of Care"/ or exp "Quality of Services"/

41 exp Patient Selection/
42 exp Decision Making/
43 receipt.af.
44 provision.af.
45 attendance.af.
46 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]
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 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.
48 (stage* adj5 (diagnosis or diagnostic)).ti,ab.
49 47 or 48 [interval concept]
50 (national health service* or NHS*).ti,ab,in.
51 (english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab.
52 (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.
53 (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.
54 (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.

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

Appendix S3.4: Search Strategies – AMED (OVID)

AMED (Allied and Complementary Medicine) <1985 to August 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 1 or 2
4 exp Socioeconomic factors/
5 (socio-economic or socioeconomic or socio-demographic or sociodemographic).mp.
6 exp 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 depriv*.mp.
19 (equity or equitable).mp.
20 (inequity or inequitable).mp.
21 inequities.mp.
22 disparit*.mp.
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 20 or 21 or 22
24 surgery.mp.
25 Treatment.mp.
26 exp Health services accessibility/
27 treatment disparities.mp.
28 exp "Delivery of health care"/
29 exp Primary health care/
30 exp Drug therapy/
31 chemotherapy.mp.
32 exp Radiotherapy/
33 radiotherapy.mp.
34 accessibility.mp.
35 access.mp.
36 pattern$.mp.
37 exp palliative care/
38 exp Patient care/
39 care.mp.
40 investigation.mp.
41 exp "Quality of health care"/

42 exp Patient assessment/
43 exp "Referral and consultation"/
44 exp "Patient acceptance of health care"/
45 receipt.mp.
46 Provision.mp.
47 Attendance.mp.
48 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
49 ((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.
50 (stage* adj5 (diagnosis or diagnostic)).ti,ab.
51 49 or 50
52 3 and 23 and 48
53 3 and 23 and 51
54 52 or 53

Appendix S3.5: Search Strategies – HMIC (OVID)

HMIC Health Management Information Consortium <1979 to August 2021>

1 exp Colorectal cancer/
2 ((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)).af..
3 1 or 2
4 exp Socioeconomic factors/
5 (socio-economic or socioeconomic or socio-demographic or sociodemographic).af.
6 exp education/
7 exp Income/
8 exp health status/
9 exp Poverty/
10 (socio-economic position or socioeconomic position).af.
11 inequalities.af.
12 exp Social conditions/
13 social factors.af.
14 income.af.
15 social class.af.
16 education.af.
17 exp Health inequalities/
18 depriv*.af.
19 (equity or equitable).af.
20 (inequity or inequitable).af.
21 inequities.af.
22 disparit*.af.
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 20 or 21 or 22
24 surgery.af.
25 treatment.af.
26 exp Access to health services/
27 treatment disparities.af.
28 exp Service delivery/
29 exp primary care/
30 exp Drug therapy/
31 chemotherapy.af.
32 exp Radiotherapy/
33 radiotherapy.af.
34 accessibility.af.
35 access.af.
36 pattern*.af.
37 exp Palliative care/
38 exp patient care/
39 care.af.
40 investigation.af.
41 exp "Quality of patient care"/

42 exp Patient selection/
43 exp Patient eligibility/
44 exp Patient referral/
45 receipt.af.
46 provision.af.
47 attendance.af.
48 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
49 exp Early diagnosis/
50 exp Patient waiting time/
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 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.
52 (stage* adj5 (diagnosis or diagnostic)).ti,ab.
53 49 or 50 or 51 or 52
54 3 and 23 and 48
55 3 and 23 and 53
56 54 or 55

Appendix S3.6: Search Strategies – CENTRAL (The Cochrane Library)

Search Name: CENTRAL Search
Last Saved: 01/09/2021 17:45:46

ID	Search
#1	MeSH descriptor: [Colorectal Neoplasms] explode all trees
#2	(((colon* or colorectal or rectal) NEAR/3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*))):ti,ab,kw
#3	#1 or #2
#4	MeSH descriptor: [Socioeconomic Factors] explode all trees
#5	((socio-economic or socioeconomic or socio-demographic or sociodemographic)):ti,ab,kw
#6	MeSH descriptor: [Education] explode all trees
#7	MeSH descriptor: [Income] explode all trees
#8	MeSH descriptor: [Health Status] explode all trees
#9	MeSH descriptor: [Poverty] explode all trees
#10	((socio-economic position or socioeconomic position)):ti,ab,kw
#11	(inequalities):ti,ab,kw
#12	MeSH descriptor: [Social Environment] explode all trees
#13	(social factors):ti,ab,kw
#14	(income):ti,ab,kw
#15	MeSH descriptor: [Residence Characteristics] explode all trees
#16	(Social class):ti,ab,kw
#17	(education):ti,ab,kw
#18	MeSH descriptor: [Health Status Disparities] explode all trees
#19	(Depriv*):ti,ab,kw
#20	((equity or equitable)):ti,ab,kw
#21	((inequity or inequitable)):ti,ab,kw
#22	(inequities):ti,ab,kw
#23	(disparit*):ti,ab,kw
#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 #20 or #21 or #22 or #23
#25	(surgery):ti,ab,kw
#26	(treatment):ti,ab,kw
#27	MeSH descriptor: [Health Services Accessibility] explode all trees
#28	MeSH descriptor: [Healthcare Disparities] explode all trees
#29	(treatment disparities):ti,ab,kw
#30	MeSH descriptor: [Delivery of Health Care] explode all trees
#31	MeSH descriptor: [Primary Health Care] explode all trees
#32	MeSH descriptor: [Drug Therapy] explode all trees
#33	(chemotherapy):ti,ab,kw
#34	MeSH descriptor: [Radiotherapy] explode all trees
#35	(radiotherapy):ti,ab,kw
#36	(accessibility):ti,ab,kw
#37	(access):ti,ab,kw
#38	(pattern*):ti,ab,kw

#49 MeSH descriptor: [Patient Care] explode all trees
#40 MeSH descriptor: [Palliative Care] explode all trees
#41 MeSH descriptor: [Primary Health Care] explode all trees
#42 (care or investigation):ti,ab,kw
#43 MeSH descriptor: [Quality of Health Care] explode all trees
#44 MeSH descriptor: [Patient Selection] explode all trees
#45 MeSH descriptor: [Eligibility Determination] explode all trees
#46 MeSH descriptor: [Referral and Consultation] explode all trees
#47 MeSH descriptor: [Patient Acceptance of Health Care] explode all trees
#48 (receipt or provision or attendance):ti,ab,kw
#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 #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48
#50 MeSH descriptor: [Early Detection of Cancer] explode all trees
#51 MeSH descriptor: [Delayed Diagnosis] explode all trees
#52 (((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary NEAR/1 care) or (secondary NEAR/1 care) or total or (help NEAR/3 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) NEAR/5 (delay* or interval* or time* or pathway* or route*))):ti,ab,kw
#53 ((stage* NEAR/5 (diagnosis or diagnostic))):ti,ab,kw
#54 #50 or #51 or #52 or #53
#55 MeSH descriptor: [United Kingdom] explode all trees
#56 ((national health service* or NHS*)):ti,ab,kw
#57 ((english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) NEAR/5 english))):ti,ab,kw
#58 ((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,kw
#59 ((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,kw

#60 ((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,kw

#61 ((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,kw

#62 ((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,kw

#63 #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62

#64 MeSH descriptor: [Africa] explode all trees

#65 MeSH descriptor: [Americas] explode all trees

#66 MeSH descriptor: [Antarctic Regions] explode all trees

#67 MeSH descriptor: [Arctic Regions] explode all trees

#68 MeSH descriptor: [Asia] explode all trees

#69 MeSH descriptor: [Oceania] explode all trees

#70 MeSH descriptor: [United Kingdom] explode all trees

#71 MeSH descriptor: [Europe] explode all trees

#72 #64 or #65 or #66 or #67 or #68 or #69

#73 #70 or #71

#74 #72 NOT #73

#75 #63 NOT #74

#76 #3 and #24 and #49

#77 #3 and #24 and #54

#78 #76 or #77

#79 #78 and #75

Appendix S3.7: Search Strategies – Science Citation Index Expanded

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

18
#9 AND #17
17
#10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16
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"))
14
(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"))
13
(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 (AD=(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*))))))

12

(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 (AD=(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*))

11

(TI=(english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) near/5 english))) OR (AB=(english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) near/5 english)))

10

((TI=((national health service* or NHS*))) OR AB=((national health service* or NHS*))) OR AD=((national health service* or NHS*))

9

#7 OR #8

8

#1 AND #2 AND #6

7

#1 AND #2 AND #3

6

#4 or #5

5

TS=(stage* near/5 (diagnosis or diagnostic))

4

TS=((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary near/1 care) or (secondary near/1 care) or total or (help near/3 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) near/5 (delay* or interval* or time* or pathway* or route*))

3

TS=(surgery or treatment or "treatment disparities" or chemotherapy or radiotherapy or accessibility or access or pattern* or care or investigation or receipt or provision or attendance)

2

TS=(socio-economic or socioeconomic or socio-demographic or sociodemographic or "socio-economic position" or "socioeconomic position" or inequalities or "social factors"

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

1

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

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+")

S28	(MH "Healthcare Disparities")
S29	TI (treatment disparities) or AB (treatment disparities)
S30	(MH "Health Care Delivery+")
S31	(MH "Primary Health Care")
S32	(MH "Drug Therapy+")
S33	TI (chemotherapy) or AB (chemotherapy)
S34	(MH "Radiotherapy, Adjuvant+") OR (MH "Radiotherapy+")
S35	TI (radiotherapy) or AB (radiotherapy)
S36	TI (accessibility) or AB (accessibility)
S37	TI (access) AB (access)
S38	TI (pattern*) or AB (pattern*)
S39	(MH "Patient Care+") or (MH "Palliative Care")
S40	TI (care) or AB (care)
S41	TI (investigation) or AB (investigation)
S42	(MH "Quality of Health Care+")
S43	(MH "Eligibility Determination") or (MH "Patient Selection")
S44	(MH "Referral and Consultation+")
S45	TI (("receipt") or ("patient acceptance of health care")) or AB (("receipt") or ("patient acceptance of health care"))
S46	TI (provision) or AB (provision)
S47	TI (attendance) or AB (attendance)
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
S49	(MH "Early Detection of Cancer")
S50	(MH "Early Diagnosis+")
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 radiothera* or treatment* or diagnos*) n5 (delay* or interval* or time* or pathway* or route*)))
S52	TI ((stage* n5 (diagnosis or diagnostic))) OR AB ((stage* n5 (diagnosis or diagnostic)))
S53	S49 OR S50 OR S51 OR S52
S54	(MH "Great Britain") OR (MH "United Kingdom+")

S55	TI ((national health service* or NHS*)) OR AB ((national health service* or NHS*)) OR AF ((national health service* or NHS*))
S56	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)))
S57	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 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*))
S58	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"

	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*)))))))
S59	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 AF ((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"))
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 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"))
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"))
S62	S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61
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+"))
S64	S62 NOT S63
S65	PT case report or case study
S66	PT letter
S67	(((MH "Animals+") OR (MH "Animal Studies") OR (TI "animal model*")) NOT (MH "human"))
S68	S65 OR S66 OR S67

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

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 (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 bias				**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

Appendix S6: Study Risk of Bias Assessment - CONTINUED

	Selection bias				**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**
Lejeune (2010)	Low	Low	Low	Low	Low	High	Moderate	Moderate	Moderate
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	Moderate
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	Moderate
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

	Selection bias				**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 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
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

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.

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

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 - 50th centile* Ref adj interval 126.0 (94.5,157.5) † MD adj interval 204.1 days (151.0,257.3) | p=0.04	↑	Strong
Benitez Majano (2022) [2]	C: 3,215	Age | Comorbidities | Sex | Symptoms | Test Type	Test to diagnosis interval	Quantile Regression - 50th centile* LD ref group MD adj coef 0.7 (-2.7,4.1) | p=0.729	=	Strong
		Age | Comorbidities | Sex | Symptoms	First presentation to diagnosis interval	Quantile Regression - 50th centile* LD ref group MD adj coef 91.0 (21.0,161.0) | p=0.028	↑	
	R: 1,621	Age | Comorbidities | Sex | Symptoms | Test Type	Test to diagnosis Interval	Quantile Regression - 50th centile* LD ref group MD adj coef 0.0 (-4,0.4) | p=1.00	=	
		Age | Comorbidities | Sex | Symptoms	First presentation to diagnosis interval	Quantile Regression - 50th centile* LD ref group MD adj coef 78.8 (14.8,142.7) | 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
Di Girolamo (2018)	50,955	No adjustment	Referral to first seen interval [Within 2 weeks Y/N]	(Derived) LD OR 1.0 MD OR 0.80 (0.70-0.91)	↑	Strong
	46,702		Referral to treatment interval [Within 62 days Y/N]	(Derived) LD OR 1.0 MD OR 1.02 (0.95-1.10)	=	
	116,177		Diagnosis to treatment interval [Within 31 days Y/N]	(Derived) LD OR 1.0 MD OR 1.28 (1.14-1.44)	↓	
Hayes (2021)	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)	=	Strong
	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)	↑	
	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)	↑	
Lejeune (2010)	71,917	Age | Stage	Diagnosis to treatment interval [Within 1 week Y/N]	LD OR 1.0 MD adjusted OR 0.78 (0.72,0.84)	↑	Moderate
			Diagnosis to treatment interval [Within 1 month Y/N]	LD OR 1.0 MD adjusted OR 0.84 (0.78,0.90)	↑	
			Diagnosis to treatment interval [Within 2-3 months Y/N]	LD OR 1.0 MD adjusted OR 0.91 (0.85,0.98)	↑	
			Diagnosis to treatment interval [Within 4-6 months Y/N]	LD OR 1.0 MD adjusted OR 1.07 (0.96,1.18)	=	

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
Neal (2005)	15,891	Age | Ethnicity | Marital Status | Sex	Symptom to diagnosis interval	Generalised linear modelling Nonsignificant result	=	Weak
			Referral to first seen interval	Generalised linear modelling Nonsignificant result	=	
			First seen to diagnosis interval	Generalised linear modelling F(7) = 2.247, p=0.028	∘	
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
Price (2020)	Unknown	Age | Sex | Time Period	First presentation to diagnosis interval	Pre-post difference-in-differences MD coef 0.1 (-0.03,0.2, p=0.147)	=	Strong
				Event-study difference-in-differences MD coef 0.069 (0.002,0.136, p=0.043)	↑	
				Semiparametric varying-coefficient analyses Significant association	↑	
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) or other measure	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
Saito (2021) [2]	28,452	Age | Comorbidities | Grade | Morphology | Presentation | Sex | Site | Stage | Year of Diagnosis	Diagnosis to Treatment Interval [Time from diagnosis to major resection amongst patients who had elective surgery]	Linear Regression LD adjusted coefficient 1.00 MD adjusted coefficient 0.99 (0.97,1.02)	=	Strong

Abbreviations: Adj adjusted, C colon, Coef coefficient, GP general practitioner, LD least deprived, MD most deprived, R rectal, Ref reference group.

*Results also presented for the 75th centile
†The reference group was men aged 55 to 64 years old in the least deprived group with no recorded comorbidities or mental health morbidities and who had rectal bleeding or a change in bowel habit.

Legend

↑ Increased likelihood	↓ Decreased likelihood	= No significant difference between groups	° Significant association observed

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	↓	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	↓	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	↓	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	↓	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
Jones (2008)	Received during the study period (assumed)	C: 16,850	Age | Sex | Stage | Time to Hospital	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	↓	Weak
		R: 11,406			R: OR 0.99 (for a 1 unit increase in IMD)	R: 0.98-0.99	↓	
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	↓	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	↓	Weak
NCRAS (2018)	C: 30 days before diagnosis to 6 months after	75,552	Unadjusted	Receipt of major resection	C: (Derived) LD OR 1.0 MD OR 0.76	C: (Derived) 0.72-0.80	↓	Moderate
	R: 30 days before diagnosis to 12 months after	28,136			R: (Derived) LD OR 1.0 MD OR 0.66	R: (Derived) 0.61-0.72	↓	
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

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
Saito (2019) [1]	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 *not* receiving major surgery]	C: LD OR 1.0 MD OR 0.96	C: 0.87-1.07	=	Strong
		R: 22,630			C: LD OR 1.0 MD OR 1.35	R: 1.22-1.49	↓	
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)	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	↓	Strong

Abbreviations: C colon cancer, CI confidence interval, CRC colorectal cancer, LD least deprived, MD most deprived, NS not specified, OR odds ratio, R rectal cancer.

Legend

↑ Increased likelihood	↓ Decreased likelihood	= No significant difference 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	↑	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	↑	Weak

Abbreviations: APER Abdominoperineal Excision, AR Anterior Resection, CI confidence interval, LD least deprived, MD most deprived, OR odds ratio, TPE Total Pelvic Exenteration.

Legend

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

Appendix S11: 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	↓	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
Crawford (2012)	6 months of diagnosis	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	↓	Weak
					R: LD OR 1.0 MD OR 0.73	R: 0.36-1.50	=	
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	↓	Strong
Hayes (2019)	12 months of diagnosis (assumed)	24,263	Age | Comorbidities | Sex | Stage | Year of Diagnosis	Chemotherapy in surgical patients	LD OR 1.0 MD OR 0.72	0.65-0.80	↓	Strong
		7,647		Chemotherapy in non-surgical patients	LD OR 1.0 MD OR 0.44	0.36-0.55	↓	

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	↓	Weak
Jones (2008)	Received during the study period (assumed)	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	↓	Weak
		R: 11,406			R: OR 0.99 (for a 1 unit increase in IMD)	R: 0.99-1.0	↓	
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	↓	Weak
NCRAS (2018)	31 days before diagnosis to 12 months after	C: 75,552	Unadjusted	Receipt of chemotherapy	C: (Derived) LD OR 1.0 MD OR 0.85	0.81-0.89	↓	Moderate
		R: 28,136			R: (Derived) LD OR 1.0 MD OR 1.03	0.95-1.11	=	
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	↓	Weak

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

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	↑	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.

Legend

↑ 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
Crawford (2012)	6 months of diagnosis	C: 11,163	Age | Sex | Stage	Receipt of any treatment (chemotherapy, radiotherapy, surgery NS)	C: LD OR 1.0 MD OR 0.54	C: 0.39-0.76	↓	Weak
		R: 7,058			R: LD OR 1.0 MD OR 0.54	R: 0.34-0.84	↓	
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	↓	Moderate

Abbreviations: C colon, CI confidence interval, LD least deprived, MD most deprived, NHS National Health Service, NS not specified, OR odds ratio, R rectal.

Legend

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

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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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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.

Design

MEDLINE, EMBASE, CINAHL, CENTRAL, SCIE, AMED and PsycINFO were searched from inception to January 2023. Grey literature, including HMIC, BASE, and Google Advanced Search, and forward and backward citation searches were conducted. Two reviewers independently reviewed titles, abstracts, and full-text articles. Observational UK-based studies were included if they reported socioeconomic measures and an association with either hospital delay or treatments received. The QUIPS tool assessed bias risk, and a narrative synthesis was conducted. The review is reported to PRISMA 2020 and registered with PROSPERO [CRD42022347652].

Results

Forty-one of the 7,209 identified references were included. Twelve studies evaluated seven different hospital intervals. There was a significant association between area-level deprivation and a longer time from first presentation in primary care to diagnosis. Thirty-two studies evaluated treatments received. There were socioeconomic inequalities in surgery and chemotherapy but not radiotherapy.

Conclusion

Patients with colorectal cancer face inequalities across the cancer care continuum. Further research is needed to understand why and what evidence-based actions can reduce these inequalities in treatment. Qualitative research of patients and clinicians conducted across various settings would provide a rich understanding of the complex factors that drive these inequalities. Further research should also consider using a causal approach to future studies to considerably strengthen the interpretation. Clinicians can try and mitigate some potential causes of colorectal cancer inequalities, including signposting to financial advice and patient transport schemes.

Trial registration

PROSPERO [CRD42022347652].

Strengths and limitations

- The searches were extensive – conducted across eight databases, supplemented with citation searching and hand-searching websites.
- The search strategy was validated.
- The inclusion of non-peer-reviewed literature was a key strength.
- Due to heterogeneous methods, meta-analysis was not possible.

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Competing interests

The authors declare no conflict of interest.

Introduction

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)

Timely diagnosis and treatment are also essential, with delays associated with worse outcomes. The Aarhus statement suggested a framework for measuring these delays, categorising the patient journey into patient, doctor and system intervals.(4) Specifically, the system interval was defined as the period from primary care-initiated investigations or referral to the commencement of treatment.(4) Socioeconomic circumstances can impact this interval and yet is comparatively under-researched.

Existing inequalities have been exacerbated by the COVID-19 pandemic, with vulnerable patient groups disproportionately affected by suboptimal care.(5) The evolution of precision medicine and the development of new technologies and surgical 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 documented.(7) Understanding where inequalities are in the pathways of care for patients with colorectal cancer is essential to inform policy and identify areas of further 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

system, our systematic review homogenised the healthcare infrastructure, policy, and patient population, ensuring a more interpretable analysis of disparities in cancer care with greater scope for policy impact.

Methods

This systematic review was registered with PROSPERO (CRD42022347652). The review is reported according to the PRISMA 2020 statement (Appendix S1).(8)

Patient and public involvement

This study was discussed with Involve Hull, a patient and public involvement group affiliated with the author's institution. The review was considered necessary by all members of the group.

Eligibility criteria

Published and grey-literature observational studies were considered for inclusion if relevant outcomes of patients with a primary diagnosis of colorectal cancer (ICD10 C18-C20) in the UK were reported.

Outcomes were only included if they had been analysed by a measure of socioeconomic status [e.g., an area-based measure such as the Index of Multiple Deprivation (IMD) or individual measures such as occupation]. The relevant outcomes were defined as follows:

- The association between socioeconomic status and the length of the system interval, as defined by the Aarhus statement.(4) Any part of the system interval could have been measured.
- Or receipt of cancer-directed treatment. Studies evaluating palliative or supportive care only were excluded.

Information sources

The following bibliographic databases were searched from inception to 26/01/2023: MEDLINE, EMBASE, AMED and PsycINFO, CINAHL, CENTRAL and Science Citation Index Expanded.

The grey literature was searched using HMIC, BASE, NICE Evidence Search and Google Advanced Search on 26/01/2023. In addition, twelve websites were systematically hand-searched, and backwards and forward citation searches were conducted on 30/03/2023 (details in Appendix S2).

Search strategy

The search strategies are listed in Appendix S3. The search strategy was developed and validated in conjunction with SG, an information specialist (details in Appendix S4). BPS and another reviewer (MS or KS) independently screened all titles and abstracts against the pre-determined eligibility criteria. The full texts of eligible titles and abstracts were obtained and independently screened for inclusion. Conflicts were resolved by consensus.

Data Collection Process

One researcher (BPS) extracted information from the included studies, collating the relevant data onto a data extraction form. A second author (KS) checked the extracted data, and discrepancies were reconciled by consensus. The data items and effect measures that were sought for extraction are detailed in Appendix S5.

Study risk of bias assessment

Two researchers (BPS and KS) independently evaluated the study risk of bias against domains adapted from the Quality in Prognosis Studies tool (QUIPS).(9) Each domain was judged to have a high, moderate, or low risk of bias, with the evaluations collated onto a pre-prepared form (Appendix S6).

Risk of bias assessments informed the narrative synthesis, with greater weight given to studies with a lower risk of bias. A study's evidence was considered "strong" if there were no high risk of bias categories, "moderate" if there was a high risk of bias in one category, and "weak" if there were two or more categories at high risk of bias. However, studies were not excluded based on this.

Synthesis methods

A narrative synthesis was conducted, according to the synthesis without meta-analysis in systematic reviews reporting guideline.(10) An overall assessment of the association between socioeconomic status and each outcome was made, considering the consistency and strength of supporting evidence from each study. Coefficients were extracted based on multivariable models. Given the inherent methodological heterogeneity, diverse patient populations, varying measures of deprivation, and significant statistical heterogeneity observed across the included studies, a meta-analysis was deemed inappropriate as it could yield misleading or oversimplified results. While a meta-analysis was not conducted, forest plots were generated to visually illustrate the observed outcomes in individual studies.

Results

Study Selection

The database searches yielded 7,201 studies, 214 of which were retrieved for full-text screening. An additional six studies were identified from the grey literature. Overall, forty-one studies were included (Figure 1).(11)

Study Characteristics

The characteristics of the included studies are summarised in Appendix S7. The system 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,

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, 46)

Thirty-two of the forty-one studies adjusted or stratified for at least one other factor.(12-26, 32-41, 44-49, 51) The remaining nine studies provided unadjusted rates.(27-31, 42, 43, 50, 52)

Risk of bias in studies

Assessments of the risk of bias are summarised in Figure 3 and Appendix S6. The domain most at risk of bias was study confounding, with sixteen studies at high risk of bias.(13, 27-31, 39-43, 47-50, 52) Although some of these studies conducted adjusted analyses, important factors such as stage were unaccounted for.

Results of studies reporting variations in the system interval

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 ($p>0.05$).(13) Overall, the evidence was inconclusive for an association between deprivation and the referral to first-seen interval. (Table 1; Appendix S8)

First seen to diagnosis interval

One study estimated the association between occupation and the number of days from the first hospital appointment to communication of diagnosis.(13) A significant association was demonstrated (p=0.028), but no magnitude or direction of effect was provided. The evidence was, therefore, inconclusive. (Table 1; Appendix S8)

Diagnosis to treatment interval

Five studies evaluated the diagnosis to treatment interval.(14-18) Two estimated the number of days from diagnosis to major surgery, adjusting for; stage, sex, age, grade and morphology.(14, 16) No significant associations were demonstrated (coefficient 0.99, 95% CI 0.97-1.02)(14) (coefficient 0.21, 95% CI -0.55-0.98).(16) (Appendix S8)

Two studies evaluated the likelihood of commencing treatment within 31 days from the date a treatment plan was agreed upon.(15, 18) One study demonstrated increased unadjusted odds (OR 1.28, 95% CI 1.14-1.44),(18) while the other presented reduced adjusted odds of patients from the most deprived areas commencing treatment within 31 days (OR 0.91, 95% CI 0.84-0.98).(15) (Appendix S8)

Another study calculated the likelihood of treatment for the most deprived quintile across several time points. They demonstrated reduced adjusted odds of treatment within one week (OR 0.78, 95% CI 0.72-0.84), one month (OR 0.84, 95% CI 0.78-0.90) and two to three months (OR 0.91, 95% CI 0.85-0.98) but non-reduced odds at four to six months (OR 1.07, 95% CI 0.96-1.18) after the first contact with the health system.(17) (Appendix S8)

Overall, the evidence for an association between deprivation and length of the diagnosis to treatment interval was inconclusive. (Table 1; Appendix S8)

Test to diagnosis interval / secondary care diagnostic interval

One study evaluated the secondary care diagnostic interval (SCDI), defined as the period between the date of the first interaction with secondary care to the date of diagnosis.(12) This study evaluated the factors associated with an interval greater than the median, adjusting for sex, age, stage, comorbidities, ethnicity, route to diagnosis and additional diagnostic tests.(12) The odds of a longer interval were not significantly increased for patients from the most deprived quintile (OR 1.07, 95% CI 1.00-1.13). (Appendix S8)

Another study evaluated the time from the first investigation to cancer diagnosis.(23) The authors conducted quantile regression, adjusting for age, comorbidities, sex, test type and symptom category, focussing on the median and 75th centiles.(23) There was no significant association between deprivation and interval length (coefficient 0.7, 95% CI -2.7-4.1). (Appendix S8)

Overall, there was no evidence of a prolonged SCDI or test-to-diagnosis interval for patients from the most deprived background. (Table 1; Appendix S8)

First presentation to diagnosis interval

Three studies evaluated the time from the first symptom or feature of colorectal cancer in primary care records to diagnosis.(21-23) One study demonstrated an association between deprivation and a longer interval in two of three econometric analyses (pre-to-post difference-in-differences 95% CI -0.03-0.2 & p=0.147 | event-study difference-in-differences 95% CI 0.002-0.136 & p=0.043 | semiparametric varying-coefficient analysis significance stated but not reported).(21) The other two studies conducted quantile regression, focusing on the median and 75th centiles, adjusting for age, comorbidities, sex and type of symptom.(22, 23) Both studies demonstrated an association between the most deprived quintile and a longer first presentation to diagnosis interval for patients with colon cancer (e.g. adjusted median interval of 204

versus 126 days, p=0.04).(22) Meanwhile, there was no such association among patients with rectal cancer,(23) possibly reflecting that patients with rectal cancer are more likely to present with localising symptoms. (Appendix S8)

Overall, three robust studies provided evidence that patients from the most deprived quintile experienced a longer first presentation to diagnosis interval. (Table 1; Appendix S8

Symptom to diagnosis interval

One study estimated the effect of occupation on the time between a patient's first symptom and diagnosis.(13) No significant effect was demonstrated, adjusting for ethnicity, age, marital status and sex (p>0.05).(13) (Table 1; Appendix S8)

Referral to treatment interval

Four studies evaluated the time from referral to treatment.(15, 18-20) Two studies demonstrated no significant association between deprivation and the likelihood of commencing treatment within 62 days of referral (range of ORs 1.02-1.07).(18, 19) Another study demonstrated reduced odds of patients commencing treatment within 62 days of referral, adjusted for age, stage, referral interval and first treatment received (OR 0.82, 95% CI 0.74-0.91).(15) (Appendix S8)

Meanwhile, one study estimated hazard ratios for the time between referral and first treatment, adjusting for stage, distance and presentation.(20) There was no significant association between deprivation and time to treatment (HR 1.24, 95% CI 0.93-1.67). (Appendix S8)

Overall, the association between deprivation and this interval was inconclusive. (Table 1; Appendix S8)

Results of studies reporting treatment inequalities

Results of studies reporting likelihood of receipt of primary surgery

The outcome of interest was primary surgery in eleven studies, here defined as resection of the tumour.(19, 20, 24-31, 36) Five studies clearly defined the outcome as a tumour resection,(25, 27-29, 36) while the received surgical procedure was not identified in the other six studies.(19, 20, 24, 26, 30, 31) (Appendix S9)

Across seven studies, adjustment was made for different factors: age,(19, 20, 24-26, 29, 36) stage,(19, 20, 24-26, 36) sex,(19, 24-26, 29, 36) comorbidity,(24, 25, 36) site (colon vs rectum),(19, 25, 36) distance or time to hospital,(20, 26) year of diagnosis,(24, 36) region,(19) and histology, grade and presentation.(36) Meanwhile, four studies provided only rates of patients receiving surgery.(27, 28, 30, 31) (Appendix S9)

Six studies presented reduced odds of surgery for patients from the most deprived background (range of ORs 0.32-0.99).(24, 26-28, 30, 31) One study presented increased odds of *not* receiving surgery amongst the most deprived patients with rectal cancer (OR 1.35, 95% CI 1.22-1.49) but no significant association among patients with colon cancer (OR 0.96, 95% CI 0.87-1.07).(36) Meanwhile, three studies demonstrated no association (range of ORs 0.52-0.88).(19, 20, 29)

One study revealed a higher likelihood of surgery for patients from the most deprived background (OR 1.63, 95% CI 1.17-2.26).(25) Additionally, the study reported increased odds of surgery in older age groups. These findings, which were unexpected, were confirmed by consulting the author. However, it is important to note that this analysis was based on regional data from a historical cohort of colorectal cancers diagnosed between 1997 and 2004. While the reported methodology appears robust, the results of this small study are opposed to other studies (see Figure 4) and cautious interpretation is required.

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)

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

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 examined the receipt of liver resection, demonstrating significantly reduced odds of resection for patients from the most deprived group (range of ORs 0.70-0.76).(32-34) One study examined the receipt of pulmonary resection, with no significant association 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 overview of the findings from these studies, each highlighted with an asterisk.

Results of studies reporting likelihood of surgical variation

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

Meanwhile, one study of 120 patients presented unadjusted rates of total pelvic exenteration (TPE) compared with partial pelvic exenteration (PPE).(43) There was a non-significant association between deprivation and the unadjusted odds of TPE (OR 1.75, 95% CI 0.55-5.68). (Table 1; Appendix S11)

Results of studies reporting likelihood of receipt of chemotherapy

Thirteen studies examined whether patients received any chemotherapy,(19, 20, 24-27, 44-50) eleven of which conducted adjusted analyses.(19, 20, 24-26, 44-49) Six studies evaluated the use of adjuvant chemotherapy.(24, 44, 45, 49-51) Two studies evaluated the use of palliative chemotherapy.(24, 46) Meanwhile, the intent of chemotherapy was unknown in the remaining seven studies.(19, 20, 25-27, 47, 48)

Appendix S12 displays a forest plot, providing an overview of the findings from the studies. Eight studies demonstrated reduced adjusted odds of chemotherapy for patients from the most deprived group (range of ORs 0.44-0.99).(19, 24-26, 44, 45, 47, 48) One study demonstrated reduced adjusted odds for patients from the most deprived group with colon (OR 0.45, 95% CI 0.27-0.77) but not rectal cancer (OR 0.73, 95% CI 0.36-1.50).(46) Two studies did not show a significant association between deprivation and receipt of chemotherapy (range of ORs 0.49-2.13).(20, 49) (Appendix S13)

Meanwhile, two studies presented unadjusted rates.(27, 50) One demonstrated reduced odds of chemotherapy for the most deprived patients with colorectal cancer (OR 0.31, 95% CI 0.09-0.91).(50) The other demonstrated reduced odds of chemotherapy for the most deprived patients with colon (OR 0.85, 95% CI 0.81-0.89) but not rectal cancer (OR 1.03, 95% CI 0.95-1.11).(27) (Appendix S13)

One study examined the receipt of combination versus single-agent chemotherapy, adjusting for age, sex, ethnicity, tumour size, lymph node yield and year of diagnosis.(51) However, no adjustment was made for co-morbidity. Patients from the

most deprived area had significantly reduced odds of receiving combination chemotherapy (OR 0.50, 95% CI 0.42-0.59).(51) (Appendix S13)

Five of the six studies evaluating the use of adjuvant chemotherapy demonstrated inequalities.(24, 44, 45, 50, 51) Meanwhile, both studies evaluating the use of palliative chemotherapy demonstrated similar inequalities.(24, 46) Overall, the evidence strongly supports the hypothesis that patients from the most deprived group are less likely to receive chemotherapy or combination adjuvant chemotherapy. (Table 1; Appendix S13)

Results of studies reporting likelihood of receipt of radiotherapy

Seven studies reported receipt of radiotherapy by socioeconomic group.(19, 20, 25-27, 43, 52) Two studies evaluated the use of neoadjuvant radiotherapy.(19, 43) One study evaluated patterns of pre and post-operative radiotherapy.(52) The intent of radiotherapy was unknown in four studies.(20, 25-27)

Three studies conducted analyses that adjusted for important factors, including; age,(20, 25, 26) stage,(20, 25, 26) sex,(25, 26) distance or journey time,(20, 26) tumour site (colon vs rectum),(20) and comorbidity.(25) None of these studies demonstrated a significant association between deprivation group and radiotherapy (range of ORs 0.85-0.99). Appendix S14 presents a forest plot, providing an overview of the findings from these studies. The remaining four studies reported unadjusted rates of radiotherapy.(19, 27, 43, 52) Two of these studies demonstrated increased odds of radiotherapy for patients from the most deprived group (range of ORs 1.33-1.39).(27, 52) The other two studies looked at rates of neoadjuvant radiotherapy specifically and did not show a significant association between deprivation and odds of treatment (range of ORs 1.00-1.15).(19, 43) (Appendix S15)

Overall, there was no evidence to support an association between socioeconomic status and receipt of radiotherapy. (Table 1; Appendix S15) 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. For the most socioeconomically deprived quintile, 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 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 interval
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)	
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)	-	-	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 – 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 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)	-	-	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)	-	-	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

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

2 *Studies represented in more than one column due to different conclusions depending on the underlying cancer type (colon vs. rectal cancer).(23, 27, 36, 46)

Discussion

Main Findings

This is the first systematic review to evaluate what is already known about the relationship between socioeconomic status, the system interval, and the treatment that patients with colorectal cancer receive.

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)

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.

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 APER than anterior resection. APER is associated with a worse quality of life and is generally considered less preferable if a less deforming surgery is possible.

Despite adjustment, socioeconomic inequalities were frequently observed. This suggests the presence of uncaptured factors such as co-morbidity or frailty. There may also have been variations in access to specialist care, financial and employment factors, patient choice, health-seeking behaviours and health literacy, all of which warrant further investigation.(55-57)

Chemotherapy in the management of colorectal cancer

There was strong evidence that patients from more deprived areas were less likely to receive chemotherapy or combination adjuvant chemotherapy. Trust in clinicians, financial and employment factors, social support, adequate communication and provision of information are critical in influencing the use of chemotherapy.(58-61) These, amongst other uncaptured factors such as comorbidity or frailty, could be responsible for the observed inequalities.

Radiotherapy in the management of rectal cancer

There was no evidence that patients from more deprived areas were less likely to receive radiotherapy. The absence of observed inequalities could reflect the nature of this outpatient treatment and the availability of patient transport. This is compared with, for example, surgery, which necessitates hospital admission and prolonged time away from work and social support. A lung cancer study similarly demonstrated a greater likelihood of radiotherapy but a reduced likelihood of surgery amongst less affluent patients.(62)

Strengths and weaknesses

This systematic review identified many studies and employed a robust methodology. The process of identifying search terms was thorough, and the search was validated. The searches were extensive, conducted across eight databases, supplemented with citation searching and a thorough examination of the grey literature. These additional

search methods identified six studies.(27, 28, 35, 36, 44, 52) Inclusion of non-peer-reviewed literature was also a key strength of this review.(25, 27, 28, 36)

The included studies were, however, heterogeneous in the methodology and populations studied. Out of forty-one studies, only fifteen included patients diagnosed after 2010.(12, 14, 18, 21-23, 27, 32, 33, 35, 36, 43-45, 51) Of the six studies evaluating the system interval in patients diagnosed since 2010, four demonstrated some inequalities.(18, 21-23) Meanwhile, seven out of the nine studies that evaluated inequalities in treatments amongst patients diagnosed after 2010 demonstrated the presence of inequalities.(27, 32, 33, 36, 44, 45, 51) Therefore, although most studies included patients from over a decade ago, inequalities persisted in recent cohorts despite a national focus on reducing inequalities.

Another limitation was that studies frequently analysed colorectal cancer as a single disease despite differences in presentation and management. Significantly, no study utilised causal inference approaches, exemplified by an absence of reported directed acyclic graphs.(63) The methods used could have introduced a bias known as the "table 2 fallacy", whereby estimates from regression models are mistakenly interpreted.(63) Using a causal approach to future studies would considerably strengthen the interpretation and, thus, meaningfully impact policy.(64)

Implications for policy and practice

Due to significant heterogeneity across studies, we could not firmly conclude whether patients from more deprived backgrounds systematically experience longer system intervals. However, COVID-19 detrimentally impacted cancer diagnostic activity for most patients, especially those in deprived areas.(5) It is important to ensure measures are in place to monitor the system interval for patients most at risk of delays.(5)

There was strong evidence of socioeconomic inequalities in surgery and chemotherapy. Some inequalities may partly be due to wording in clinical guidelines. For example, the National Institute for Health and Care Excellence advises that primary surgery for colorectal cancer is "offered" (a strong recommendation); the same guideline advises liver resection be "considered" (less certain benefit).(65) Similarly, adjuvant chemotherapy can be estimated to reduce the risk of death in stage III disease by 10-15%. However, there is a significant risk of long-term toxicity. Patients must carefully weigh the potential harms and benefits of these less strongly recommended treatments. Shared-decision making is vital. Inequalities will result when some patients experience better shared-decision making and can cover the costs of additional treatment, such as time off work.(66)

Clinicians can mitigate some of the effects of deprivation. Such strategies may include referring patients for pre-rehabilitation, tailored communication, and ensuring patients are aware of appropriate financial support and transport schemes.(66)

Further studies are needed to evaluate for inequalities in novel treatments. In the era of precision oncology and an ever-increasing armamentarium of novel treatments, the marginal benefits of new therapies mustn't just be experienced by the most affluent. A prostate cancer study exemplified this, demonstrating that patients from more deprived backgrounds living at greater distances from specialist centres were significantly less likely to receive robotic prostatectomy.(67) If we accept the benefit of newer surgical technology and techniques, such as robotic surgery, these should be available for all patients no matter where they live.

Future research

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

of chemotherapy and surgery. In particular, observational research of recent cohorts should utilise causal inference. Beyond this, qualitative research will be of great value in gaining a richer insight into the causes and drivers of these inequalities.

Conclusions

Despite a healthcare system that provides free healthcare at the point of access, there were unexplained socioeconomic inequalities in surgery, chemotherapy and aspects of the system interval. Further research is needed to understand the variations in treatment between socioeconomic groups.

Differences in patient selection for treatment have been linked with worse colorectal cancer survival within and between countries, with evidence of improved outcomes when care is aligned with optimal pathways.(68) Eliminating inequalities could narrow survival gaps within and between countries. These findings will interest policymakers, clinicians and researchers worldwide, as inequalities in cancer care and outcomes of different socioeconomic groups have been recognised across healthcare jurisdictions.

Figure Captions

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 studies with high, moderate and low risk of bias is illustrated.

Figure 4: Forest plot demonstrating the odds of receipt of surgery in the most deprived versus the least deprived patient group.

Additional Information

Acknowledgements

Not applicable.

Authors' Contributions

BPS – conceptualisation, developed search strategy, screening, data curation and formal analysis, project administration and writing – original draft.

KS – conceptualisation, screening, data curation and formal analysis, review of the manuscript

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

This published article and its supplementary information files include all data generated or analysed during this study.

Competing Interests

The authors declare no conflict of interest.

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Identification of new studies via databases and registers

Identification of new studies via other methods

Identification

Records identified from:
Databases (n = 9,963):
MEDLINE (n = 1,658)
EMBASE (n = 2,889)
PsycInfo (n = 1,667)
AMED (n = 47)
HMIC (n = 178)
CINAHL (n = 1,144)
Science Citation Index Expanded (n = 1,748)
CENTRAL (n = 174)
BASE (n = 458)
Others (n = 0)

Records removed before screening:
Duplicate records (n = 2,762)

Records identified from:
Websites (n = 3)
Citation searching (n = 2,081)

Screening

Records screened
(n = 7,201)

Records excluded
(n = 6,987)

Reports sought for retrieval
(n = 214)

Reports not retrieved
(n = 0)

Reports sought for retrieval
(n = 8)

Reports not retrieved
(n = 0)

Reports assessed for eligibility
(n = 214)

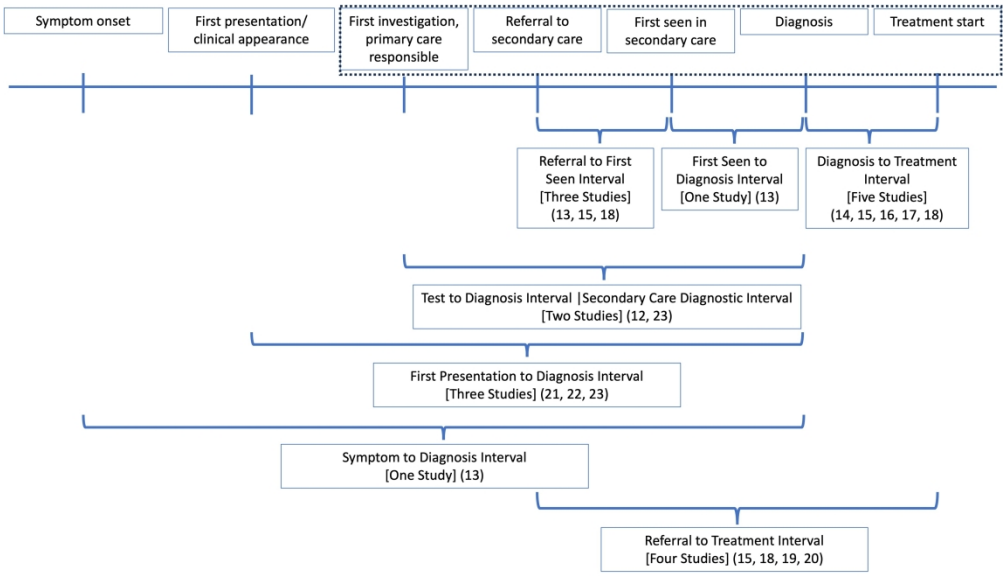
Reports excluded:
Wrong Outcomes (n = 140)
Wrong Study Design (n = 22)
Wrong Patient Population (n = 16)
Wrong Comparator (n = 1)

Reports assessed for eligibility
(n = 8)

Reports excluded:
Wrong Outcomes (n = 1)
Wrong Comparator (n = 1)

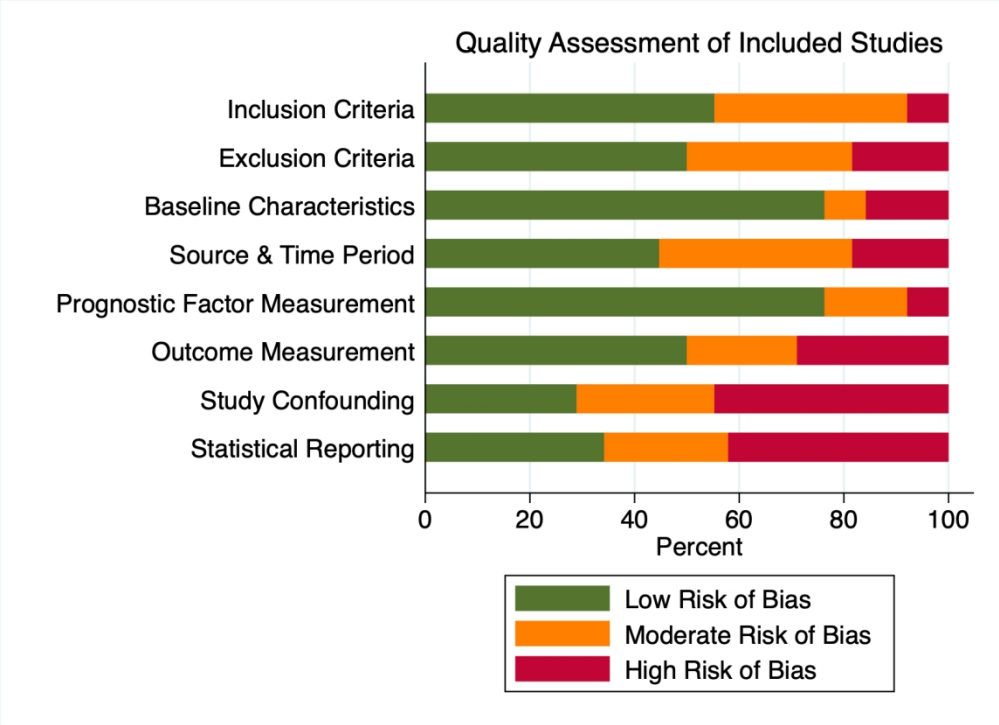
Included

New studies included in review
(n = 41)



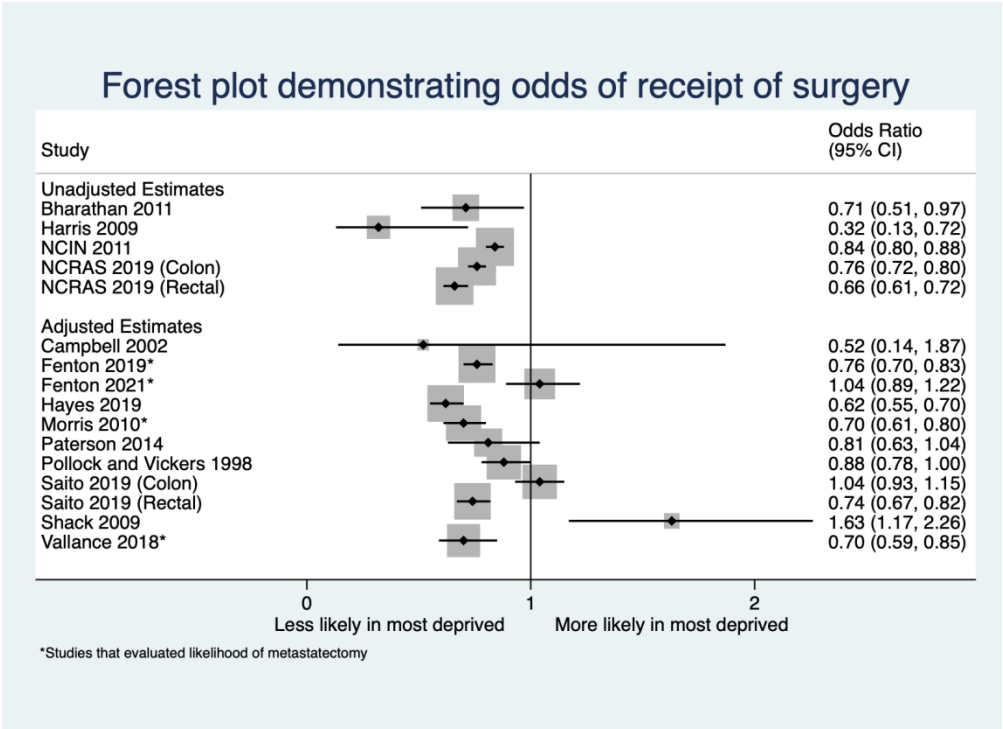
Time intervals evaluated in the included studies. The blue dotted line indicates the system interval defined by the Aarhus statement.(4) Studies that included any aspect of this system interval were included, even if the interval commenced before the system interval defined here.

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)



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

297x215mm (144 x 144 DPI)

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

Contents

Appendix S1: PRISMA Statement Checklist[1]

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

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			
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 S8-

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

Appendix S2: List of Hand-Searched Online Sources and Details of Citation Searches

The following websites were hand-searched on 30/03/2023:

- The National Cancer Registration and Analysis Service (http://www.ncin.org.uk/home)
- 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-and-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 searches on 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 records using forwards searching.[41] These records were then screened by BPS in EndNote X9.[42]
The bibliographies of two systematic reviews were also examined for relevant articles.[43,44]

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"/
31 exp Primary Health Care/
32 exp Drug Therapy/
33 chemotherapy.mp.
34 Radiotherapy/ or Radiotherapy, Adjuvant/
35 radiotherapy.mp.
36 accessibility.mp.

37 access.mp.
38 pattern$.mp.
39 palliative care/ or Patient care/ or Primary Health care/
40 care.mp.
41 investigation.mp.
42 exp "Quality of Health Care"/
43 exp Patient Selection/ or exp Eligibility Determination/
44 exp "Referral and Consultation"/
45 Receipt.mp. or exp "Patient Acceptance of Health Care"/
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 Detection of Cancer"/
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 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.
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.
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,jw,in.
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.

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]

71 3 and 24 and 48

72 3 and 24 and 53

73 71 or 72

74 64 and 73

75 74 not 70

Appendix S3.2: Search Strategies – EMBASE (OVID)

OVID Embase <1974 to 2021 August 31>

1 exp colorectal tumor/
2 ((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)).mp.
3 1 or 2 [cancer population of interest]
4 exp socioeconomics/
5 (socio-economic or socioeconomic or socio-demographic or sociodemographic).mp.
6 exp education/
7 exp income/
8 exp health status/
9 exp poverty/
10 (socioeconomic position or socio-economic position).mp.
11 inequalities.mp.
12 exp social environment/
13 social factors.mp.
14 income.mp.
15 exp demography/
16 social class.mp.
17 education.mp.
18 exp health disparity/
19 depriv*.mp.
20 (equity or equitable).mp.
21 (inequity or inequitable).mp.
22 inequities.mp.
23 disparit*.mp.
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 20 or 21 or 22 or 23 or 23 [inequality concept]
25 surgery.mp.
26 treatment.mp.
27 exp health care access/
28 exp health care disparity/
29 treatment disparities.mp.
30 exp health care delivery/
31 exp primary health care/
32 exp drug therapy/
33 chemotherapy.mp.
34 adjuvant radiotherapy/ or radiotherapy/
35 radiotherapy.mp.
36 accessibility.mp.
37 access.mp.
38 pattern*.mp.
39 palliative therapy/ or patient care/ or primary health care/
40 care.mp.
41 investigation.mp.

42 exp health care quality/
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 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.
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.

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,ad.
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,ad.
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,ad.
62 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61
63 (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/)
64 62 not 63 [NICE UK Filter]
65 letter.pt.
66 (animal* not human*).sh,hw.
67 65 or 66 [excluding animals and unwanted publication types]
68 3 and 24 and 48
69 3 and 24 and 53
70 68 or 69
71 64 and 70
72 71 not 67
73 limit 72 to conference abstract status
74 limit 73 to dd=20200831-20210831
75 72 not 73
76 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/
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.
31 exp Radiation Therapy/
32 exp Chemotherapy/
33 radiotherapy.af.
34 accessibility.af.
35 access.af.
36 pattern$.af.
37 exp Palliative Care/
38 care.af.
39 investigation.af.
40 exp "Quality of Care"/ or exp "Quality of Services"/

41 exp Patient Selection/
42 exp Decision Making/
43 receipt.af.
44 provision.af.
45 attendance.af.
46 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]
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 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.
48 (stage* adj5 (diagnosis or diagnostic)).ti,ab.
49 47 or 48 [interval concept]
50 (national health service* or NHS*).ti,ab,in.
51 (english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab.
52 (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.
53 (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.
54 (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.

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

Appendix S3.4: Search Strategies – AMED (OVID)

AMED (Allied and Complementary Medicine) <1985 to August 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 1 or 2
4 exp Socioeconomic factors/
5 (socio-economic or socioeconomic or socio-demographic or sociodemographic).mp.
6 exp 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 depriv*.mp.
19 (equity or equitable).mp.
20 (inequity or inequitable).mp.
21 inequities.mp.
22 disparit*.mp.
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 20 or 21 or 22
24 surgery.mp.
25 Treatment.mp.
26 exp Health services accessibility/
27 treatment disparities.mp.
28 exp "Delivery of health care"/
29 exp Primary health care/
30 exp Drug therapy/
31 chemotherapy.mp.
32 exp Radiotherapy/
33 radiotherapy.mp.
34 accessibility.mp.
35 access.mp.
36 pattern$.mp.
37 exp palliative care/
38 exp Patient care/
39 care.mp.
40 investigation.mp.
41 exp "Quality of health care"/

42 exp Patient assessment/
43 exp "Referral and consultation"/
44 exp "Patient acceptance of health care"/
45 receipt.mp.
46 Provision.mp.
47 Attendance.mp.
48 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
49 ((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.
50 (stage* adj5 (diagnosis or diagnostic)).ti,ab.
51 49 or 50
52 3 and 23 and 48
53 3 and 23 and 51
54 52 or 53

Appendix S3.5: Search Strategies – HMIC (OVID)

HMIC Health Management Information Consortium <1979 to August 2021>

1 exp Colorectal cancer/
2 ((colon* or colorectal or rectal) adj3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*)).af..
3 1 or 2
4 exp Socioeconomic factors/
5 (socio-economic or socioeconomic or socio-demographic or sociodemographic).af.
6 exp education/
7 exp Income/
8 exp health status/
9 exp Poverty/
10 (socio-economic position or socioeconomic position).af.
11 inequalities.af.
12 exp Social conditions/
13 social factors.af.
14 income.af.
15 social class.af.
16 education.af.
17 exp Health inequalities/
18 depriv*.af.
19 (equity or equitable).af.
20 (inequity or inequitable).af.
21 inequities.af.
22 disparit*.af.
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 20 or 21 or 22
24 surgery.af.
25 treatment.af.
26 exp Access to health services/
27 treatment disparities.af.
28 exp Service delivery/
29 exp primary care/
30 exp Drug therapy/
31 chemotherapy.af.
32 exp Radiotherapy/
33 radiotherapy.af.
34 accessibility.af.
35 access.af.
36 pattern*.af.
37 exp Palliative care/
38 exp patient care/
39 care.af.
40 investigation.af.
41 exp "Quality of patient care"/

42 exp Patient selection/
43 exp Patient eligibility/
44 exp Patient referral/
45 receipt.af.
46 provision.af.
47 attendance.af.
48 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
49 exp Early diagnosis/
50 exp Patient waiting time/
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 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.
52 (stage* adj5 (diagnosis or diagnostic)).ti,ab.
53 49 or 50 or 51 or 52
54 3 and 23 and 48
55 3 and 23 and 53
56 54 or 55

Appendix S3.6: Search Strategies – CENTRAL (The Cochrane Library)

Search Name: CENTRAL Search
Last Saved: 01/09/2021 17:45:46

ID	Search
#1	MeSH descriptor: [Colorectal Neoplasms] explode all trees
#2	(((colon* or colorectal or rectal) NEAR/3 (cancer* or neoplas* or tumor* or tumour* or malignan* or carcinoma* or metasta* or oncolog*))):ti,ab,kw
#3	#1 or #2
#4	MeSH descriptor: [Socioeconomic Factors] explode all trees
#5	((socio-economic or socioeconomic or socio-demographic or sociodemographic)):ti,ab,kw
#6	MeSH descriptor: [Education] explode all trees
#7	MeSH descriptor: [Income] explode all trees
#8	MeSH descriptor: [Health Status] explode all trees
#9	MeSH descriptor: [Poverty] explode all trees
#10	((socio-economic position or socioeconomic position)):ti,ab,kw
#11	(inequalities):ti,ab,kw
#12	MeSH descriptor: [Social Environment] explode all trees
#13	(social factors):ti,ab,kw
#14	(income):ti,ab,kw
#15	MeSH descriptor: [Residence Characteristics] explode all trees
#16	(Social class):ti,ab,kw
#17	(education):ti,ab,kw
#18	MeSH descriptor: [Health Status Disparities] explode all trees
#19	(Depriv*):ti,ab,kw
#20	((equity or equitable)):ti,ab,kw
#21	((inequity or inequitable)):ti,ab,kw
#22	(inequities):ti,ab,kw
#23	(disparit*):ti,ab,kw
#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 #20 or #21 or #22 or #23
#25	(surgery):ti,ab,kw
#26	(treatment):ti,ab,kw
#27	MeSH descriptor: [Health Services Accessibility] explode all trees
#28	MeSH descriptor: [Healthcare Disparities] explode all trees
#29	(treatment disparities):ti,ab,kw
#30	MeSH descriptor: [Delivery of Health Care] explode all trees
#31	MeSH descriptor: [Primary Health Care] explode all trees
#32	MeSH descriptor: [Drug Therapy] explode all trees
#33	(chemotherapy):ti,ab,kw
#34	MeSH descriptor: [Radiotherapy] explode all trees
#35	(radiotherapy):ti,ab,kw
#36	(accessibility):ti,ab,kw
#37	(access):ti,ab,kw
#38	(pattern*):ti,ab,kw

#49 MeSH descriptor: [Patient Care] explode all trees
#40 MeSH descriptor: [Palliative Care] explode all trees
#41 MeSH descriptor: [Primary Health Care] explode all trees
#42 (care or investigation):ti,ab,kw
#43 MeSH descriptor: [Quality of Health Care] explode all trees
#44 MeSH descriptor: [Patient Selection] explode all trees
#45 MeSH descriptor: [Eligibility Determination] explode all trees
#46 MeSH descriptor: [Referral and Consultation] explode all trees
#47 MeSH descriptor: [Patient Acceptance of Health Care] explode all trees
#48 (receipt or provision or attendance):ti,ab,kw
#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 #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48
#50 MeSH descriptor: [Early Detection of Cancer] explode all trees
#51 MeSH descriptor: [Delayed Diagnosis] explode all trees
#52 (((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary NEAR/1 care) or (secondary NEAR/1 care) or total or (help NEAR/3 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) NEAR/5 (delay* or interval* or time* or pathway* or route*))):ti,ab,kw
#53 ((stage* NEAR/5 (diagnosis or diagnostic))):ti,ab,kw
#54 #50 or #51 or #52 or #53
#55 MeSH descriptor: [United Kingdom] explode all trees
#56 ((national health service* or NHS*)):ti,ab,kw
#57 ((english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) NEAR/5 english))):ti,ab,kw
#58 ((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,kw
#59 ((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,kw

#60 ((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,kw

#61 ((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,kw

#62 ((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,kw

#63 #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62

#64 MeSH descriptor: [Africa] explode all trees

#65 MeSH descriptor: [Americas] explode all trees

#66 MeSH descriptor: [Antarctic Regions] explode all trees

#67 MeSH descriptor: [Arctic Regions] explode all trees

#68 MeSH descriptor: [Asia] explode all trees

#69 MeSH descriptor: [Oceania] explode all trees

#70 MeSH descriptor: [United Kingdom] explode all trees

#71 MeSH descriptor: [Europe] explode all trees

#72 #64 or #65 or #66 or #67 or #68 or #69

#73 #70 or #71

#74 #72 NOT #73

#75 #63 NOT #74

#76 #3 and #24 and #49

#77 #3 and #24 and #54

#78 #76 or #77

#79 #78 and #75

Appendix S3.7: Search Strategies – Science Citation Index Expanded

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

18
#9 AND #17
17
#10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16
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"))
14
(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"))
13
(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 (AD=(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*))))))

12

(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 (AD=(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*))

11

(TI=(english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) near/5 english))) OR (AB=(english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) near/5 english)))

10

((TI=((national health service* or NHS*))) OR AB=((national health service* or NHS*))) OR AD=((national health service* or NHS*))

9

#7 OR #8

8

#1 AND #2 AND #6

7

#1 AND #2 AND #3

6

#4 or #5

5

TS=(stage* near/5 (diagnosis or diagnostic))

4

TS=((patient* or present* or doctor* or physician* or practitioner* or hospital* or system* or (primary near/1 care) or (secondary near/1 care) or total or (help near/3 seek) or pre-treatment* or referr* or specialist* or consultant* or surg* or chemothera* or radiothera* or treatment* or diagnos*) near/5 (delay* or interval* or time* or pathway* or route*))

3

TS=(surgery or treatment or "treatment disparities" or chemotherapy or radiotherapy or accessibility or access or pattern* or care or investigation or receipt or provision or attendance)

2

TS=(socio-economic or socioeconomic or socio-demographic or sociodemographic or "socio-economic position" or "socioeconomic position" or inequalities or "social factors"

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

1

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

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+")
S28	(MH "Healthcare Disparities")
S29	TI (treatment disparities) or AB (treatment disparities)
S30	(MH "Health Care Delivery+")
S31	(MH "Primary Health Care")
S32	(MH "Drug Therapy+")
S33	TI (chemotherapy) or AB (chemotherapy)
S34	(MH "Radiotherapy, Adjuvant+") OR (MH "Radiotherapy+")
S35	TI (radiotherapy) or AB (radiotherapy)
S36	TI (accessibility) or AB (accessibility)
S37	TI (access) AB (access)
S38	TI (pattern*) or AB (pattern*)
S39	(MH "Patient Care+") or (MH "Palliative Care")
S40	TI (care) or AB (care)
S41	TI (investigation) or AB (investigation)
S42	(MH "Quality of Health Care+")
S43	(MH "Eligibility Determination") or (MH "Patient Selection")
S44	(MH "Referral and Consultation+")
S45	TI (("receipt") or ("patient acceptance of health care")) or AB (("receipt") or ("patient acceptance of health care"))
S46	TI (provision) or AB (provision)
S47	TI (attendance) or AB (attendance)
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
S49	(MH "Early Detection of Cancer")
S50	(MH "Early Diagnosis+")
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 radiothera* or treatment* or diagnos*) n5 (delay* or interval* or time* or pathway* or route*)))
S52	TI ((stage* n5 (diagnosis or diagnostic))) OR AB ((stage* n5 (diagnosis or diagnostic)))
S53	S49 OR S50 OR S51 OR S52

S54	(MH "Great Britain") OR (MH "United Kingdom+")
S55	TI ((national health service* or NHS*)) OR AB ((national health service* or NHS*)) OR AF ((national health service* or NHS*))
S56	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)))
S57	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 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*))
S58	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 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" 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*))))))
S59	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 AF ((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"))
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 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"))
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"))
S62	S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61
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+"))

S64	S62 NOT S63
S65	PT case report or case study
S66	PT letter
S67	(((MH "Animals+") OR (MH "Animal Studies") OR (TI "animal model*")) NOT (MH "human"))
S68	S65 OR S66 OR S67
S69	S3 AND S24 AND S48
S70	S3 AND S24 AND S53
S71	S69 OR S70
S72	S64 AND S71
S73	S72 NOT S68

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 (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 bias				**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

Appendix S6: Study Risk of Bias Assessment - CONTINUED

	Selection bias				**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**
Lejeune (2010)	Low	Low	Low	Low	Low	High	Moderate	Moderate	Moderate
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	Moderate
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	Moderate
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

	Selection bias				**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 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
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

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.

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

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 - 50th centile* Ref adj interval 126.0 (94.5,157.5) † MD adj interval 204.1 days (151.0,257.3) | p=0.04	↑	Strong
Benitez Majano (2022) [2]	C: 3,215	Age | Comorbidities | Sex | Symptoms | Test Type	Test to diagnosis interval	Quantile Regression - 50th centile* LD ref group MD adj coef 0.7 (-2.7,4.1) | p=0.729	=	Strong
		Age | Comorbidities | Sex | Symptoms	First presentation to diagnosis interval	Quantile Regression - 50th centile* LD ref group MD adj coef 91.0 (21.0,161.0) | p=0.028	↑	
	R: 1,621	Age | Comorbidities | Sex | Symptoms | Test Type	Test to diagnosis Interval	Quantile Regression - 50th centile* LD ref group MD adj coef 0.0 (-4,0.4) | p=1.00	=	
		Age | Comorbidities | Sex | Symptoms	First presentation to diagnosis interval	Quantile Regression - 50th centile* LD ref group MD adj coef 78.8 (14.8,142.7) | 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
Di Girolamo (2018)	50,955	No adjustment	Referral to first seen interval [Within 2 weeks Y/N]	(Derived) LD OR 1.0 MD OR 0.80 (0.70-0.91)	↑	Strong
	46,702		Referral to treatment interval [Within 62 days Y/N]	(Derived) LD OR 1.0 MD OR 1.02 (0.95-1.10)	=	
	116,177		Diagnosis to treatment interval [Within 31 days Y/N]	(Derived) LD OR 1.0 MD OR 1.28 (1.14-1.44)	↓	
Hayes (2021)	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)	=	Strong
	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)	↑	
	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)	↑	
Lejeune (2010)	71,917	Age | Stage	Diagnosis to treatment interval [Within 1 week Y/N]	LD OR 1.0 MD adjusted OR 0.78 (0.72,0.84)	↑	Moderate
			Diagnosis to treatment interval [Within 1 month Y/N]	LD OR 1.0 MD adjusted OR 0.84 (0.78,0.90)	↑	
			Diagnosis to treatment interval [Within 2-3 months Y/N]	LD OR 1.0 MD adjusted OR 0.91 (0.85,0.98)	↑	
			Diagnosis to treatment interval [Within 4-6 months Y/N]	LD OR 1.0 MD adjusted OR 1.07 (0.96,1.18)	=	

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
Neal (2005)	15,891	Age | Ethnicity | Marital Status | Sex	Symptom to diagnosis interval	Generalised linear modelling Nonsignificant result	=	Weak
			Referral to first seen interval	Generalised linear modelling Nonsignificant result	=	
			First seen to diagnosis interval	Generalised linear modelling F(7) = 2.247, p=0.028	∘	
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
Price (2020)	Unknown	Age | Sex | Time Period	First presentation to diagnosis interval	Pre-post difference-in-differences MD coef 0.1 (-0.03,0.2, p=0.147)	=	Strong
				Event-study difference-in-differences MD coef 0.069 (0.002,0.136, p=0.043)	↑	
				Semiparametric varying-coefficient analyses Significant association	↑	
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) or other measure	Effect of deprivation on interval length [Longer↑ Shorter↓]	Strength of Evidence
Saito (2021) [2]	28,452	Age | Comorbidities | Grade | Morphology | Presentation | Sex | Site | Stage | Year of Diagnosis	Diagnosis to Treatment Interval [Time from diagnosis to major resection amongst patients who had elective surgery]	Linear Regression LD adjusted coefficient 1.00 MD adjusted coefficient 0.99 (0.97,1.02)	=	Strong

Abbreviations: Adj adjusted, C colon, Coef coefficient, GP general practitioner, LD least deprived, MD most deprived, R rectal, Ref reference group.

*Results also presented for the 75th centile
†The reference group was men aged 55 to 64 years old in the least deprived group with no recorded comorbidities or mental health morbidities and who had rectal bleeding or a change in bowel habit.

Legend

↑ Increased likelihood	↓ Decreased likelihood	= No significant difference between groups	° Significant association observed

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	↓	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	↓	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	↓	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	↓	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
Jones (2008)	Received during the study period (assumed)	C: 16,850	Age | Sex | Stage | Time to Hospital	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	↓	Weak
		R: 11,406			R: OR 0.99 (for a 1 unit increase in IMD)	R: 0.98-0.99	↓	
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	↓	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	↓	Weak
NCRAS (2018)	C: 30 days before diagnosis to 6 months after	75,552	Unadjusted	Receipt of major resection	C: (Derived) LD OR 1.0 MD OR 0.76	C: (Derived) 0.72-0.80	↓	Moderate
	R: 30 days before diagnosis to 12 months after	28,136			R: (Derived) LD OR 1.0 MD OR 0.66	R: (Derived) 0.61-0.72	↓	
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

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

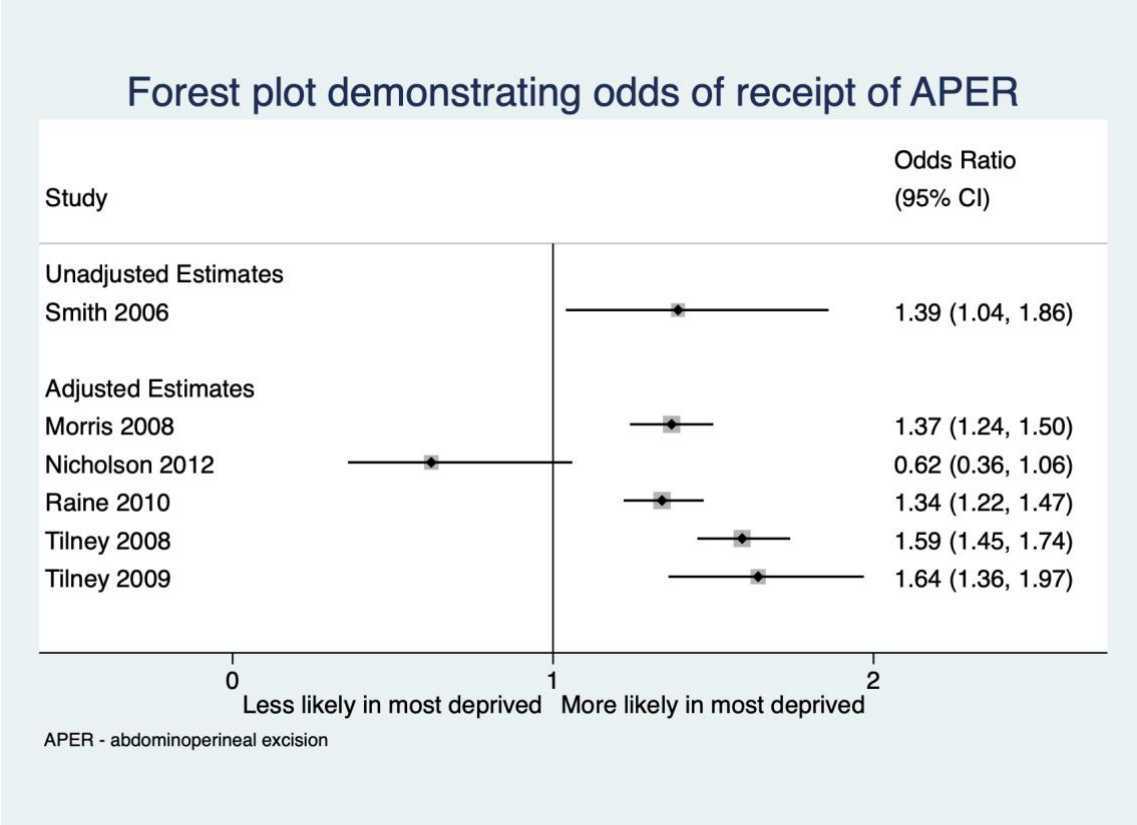
First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Surgery	Strength of Evidence
Pollock and Vickers (1998)	Received during the study period	25,304 (assumed)	Age | Sex	Finished consultant episode that included therapeutic or palliative surgery (assumed part of primary treatment)	LD OR 1.0 MD OR 0.88	0.78-1.00	=	Weak
Saito (2019) [1]	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 *not* receiving major surgery]	C: LD OR 1.0 MD OR 0.96	C: 0.87-1.07	=	Strong
		R: 22,630			R: LD OR 1.0 MD OR 1.35	R: 1.22-1.49	↓	
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)	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	↓	Strong

Abbreviations: C colon cancer, CI confidence interval, CRC colorectal cancer, LD least deprived, MD most deprived, NS not specified, OR odds ratio, R rectal cancer.

Legend

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

Appendix S10: Likelihood of surgical variation - forest plot



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

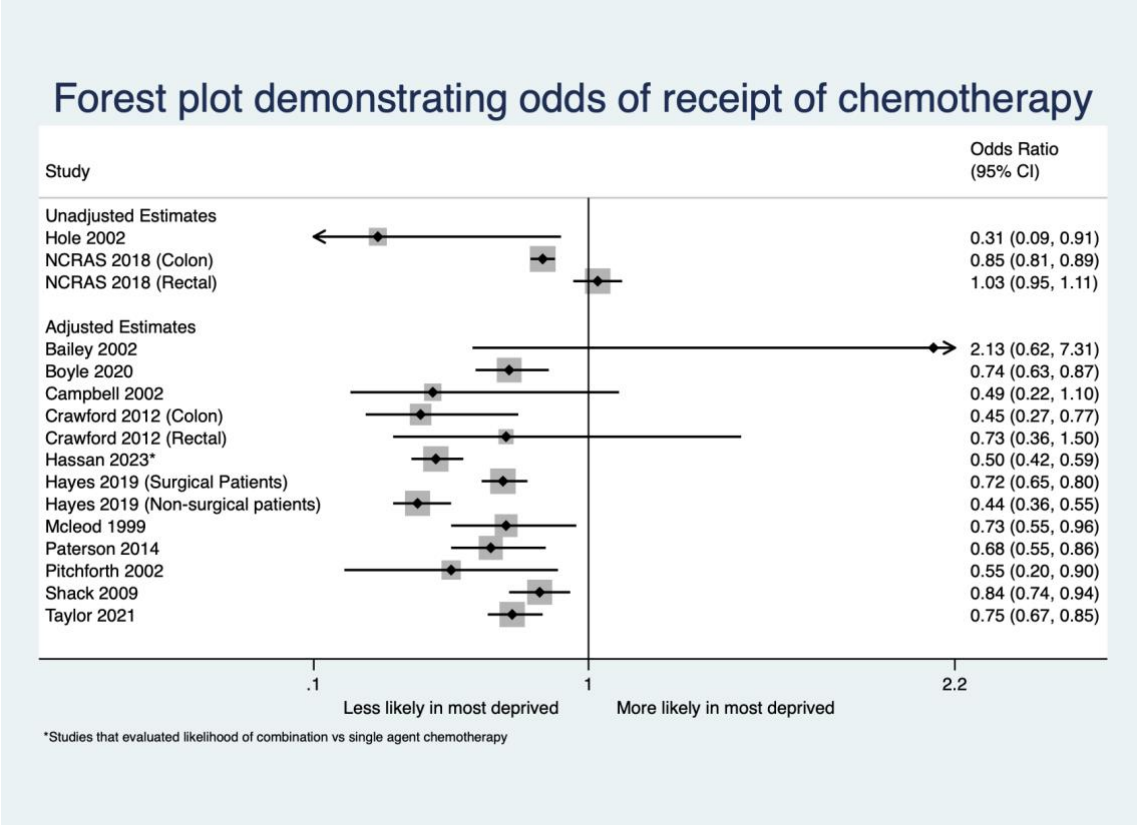
First Author (Year)	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of APER vs AR unless otherwise stated	Strength of Evidence
Morris (2008)	26,097	Age | Sex | Year of Diagnosis | Stage | Surgeon Workload | Presentation	Abdominoperineal Excision 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	↑	Weak

Abbreviations: APER Abdominoperineal Excision, AR Anterior Resection, CI confidence interval, LD least deprived, MD most deprived, OR odds ratio, TPE Total Pelvic Exenteration.

Legend

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

Appendix S12: Likelihood of receipt of chemotherapy – forest plot



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

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	↓	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
Crawford (2012)	6 months of diagnosis	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	↓	Weak
					R: LD OR 1.0 MD OR 0.73	R: 0.36-1.50	=	
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	↓	Strong
Hayes (2019)	12 months of diagnosis (assumed)	24,263	Age | Comorbidities | Sex | Stage | Year of Diagnosis	Chemotherapy in surgical patients	LD OR 1.0 MD OR 0.72	0.65-0.80	↓	Strong
		7,647		Chemotherapy in non-surgical patients	LD OR 1.0 MD OR 0.44	0.36-0.55	↓	

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	↓	Weak
Jones (2008)	Received during the study period (assumed)	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	↓	Weak
		R: 11,406			R: OR 0.99 (for a 1 unit increase in IMD)	R: 0.99-1.0	↓	
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	↓	Weak
NCRAS (2018)	31 days before diagnosis to 12 months after	C: 75,552	Unadjusted	Receipt of chemotherapy	C: (Derived) LD OR 1.0 MD OR 0.85	0.81-0.89	↓	Moderate
		R: 28,136			R: (Derived) LD OR 1.0 MD OR 1.03	0.95-1.11	=	
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	↓	Weak

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

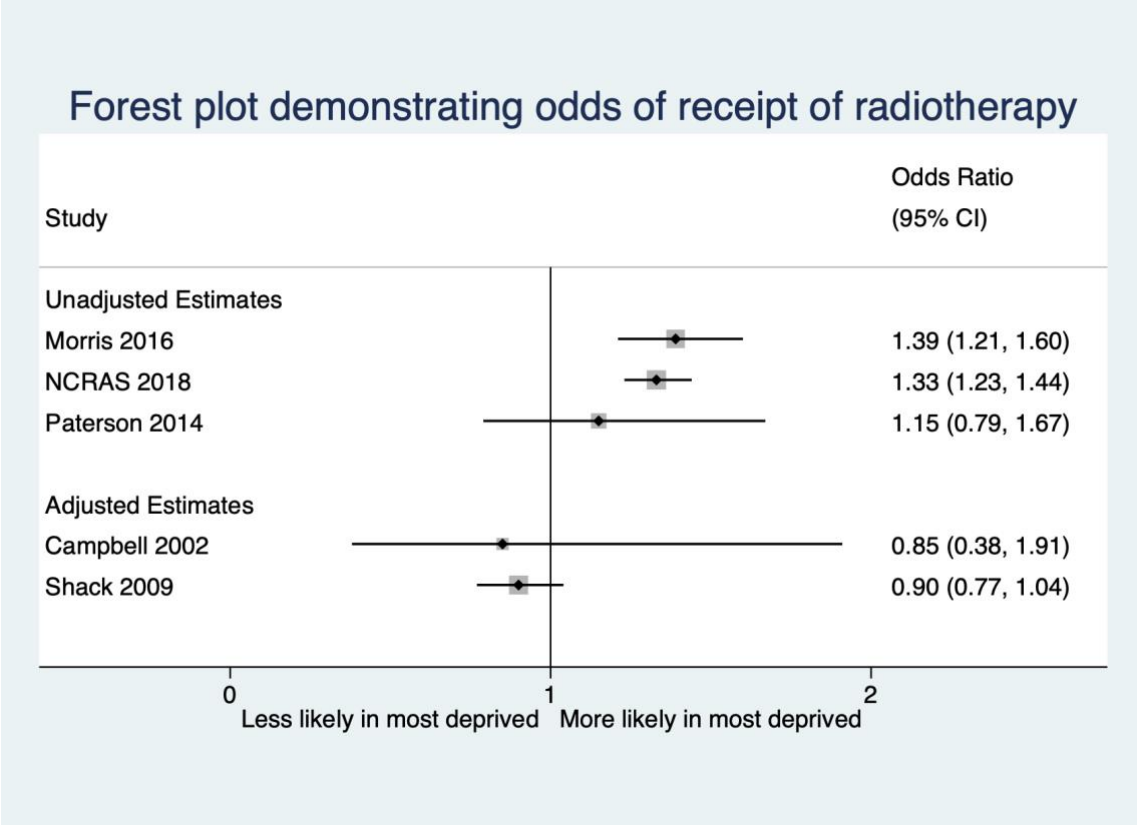
First Author (Year)	Treatment Given Within	Number	Adjusted for	Outcome of Interest	Odds Ratio /Likelihood	95% CI (p-value)	Effect of Deprivation on Odds of Chemotherapy	Strength of Evidence
Pitchforth (2002)	6 months from the first admission	7,303	Age | Comorbidities | Death | Presentation | Rural | Sex | Cancer Centre	Receipt of chemotherapy	LD OR 1.0 MD OR 0.55	0.20-0.90	↓	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	↓	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	↓	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	↓ 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.

Appendix S15: 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	↑	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.

Legend

↑ 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 diagnosis	C: 11,163	Age | Sex | Stage	Receipt of any treatment (chemotherapy, radiotherapy, surgery NS)	C: LD OR 1.0 MD OR 0.54	C: 0.39-0.76	↓	Weak
		R: 7,058			R: LD OR 1.0 MD OR 0.54	R: 0.34-0.84	↓	
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	↓	Moderate

Abbreviations: C colon, CI confidence interval, LD least deprived, MD most deprived, NHS National Health Service, NS not specified, OR odds ratio, R rectal.

Legend

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

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