Supplementary materials

Literature review

Search strategy

A review of literature examining the association between socioeconomic status and colorectal cancer (CRC) mortality rates in England was conducted on the 17th of July 2022 using the electronic database PubMed and used a combination and variation of the terms "socioeconomic", "colorectal" and "cancer". Search terms and inclusion/exclusion criteria of the articles for literature review are shown in supplementary fig.1. Results were restricted to those published between January 2010 and July 2022 and were restricted to article types: meta-analysis, randomised control trial, review, or systematic review. Articles were included if they were original research, related to socioeconomic inequalities, geographical location, race and ethnicity or health behaviours, as well as CRC screening, treatment, or outcomes. Articles were excluded if they were not in English, if they were protocol, strategy or mathematical modelling papers, and articles discussing research relating only to minority populations in countries outside of Europe. The systematic style search retrieved 141 results, which were then screened first by title and abstract, then using the full text, on an inclusion and exclusion basis to leave 21 results. A further 12 articles were identified by manually searching through reference lists.

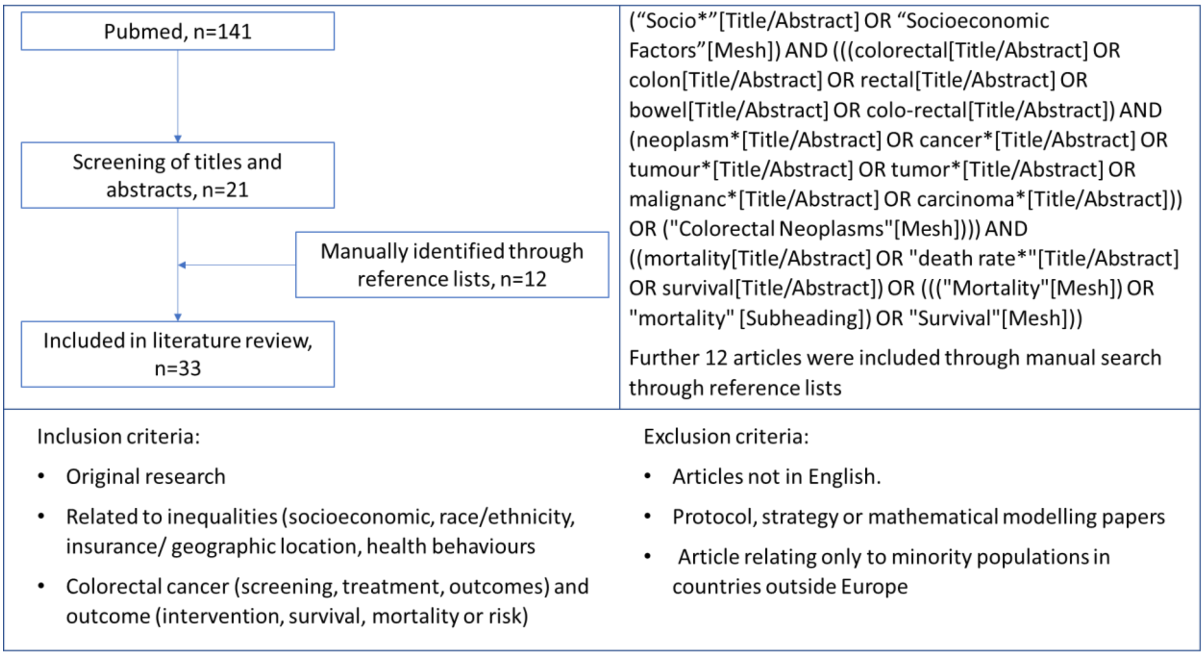

Figure 1 – flow diagram and search strategy to demonstrate the inclusion and exclusion of articles for literature review

Results

Our literature search identified a total of 32 papers. Of these, 10 were retrospective cohort studies[1–10], four were systematic reviews and meta-analyses[11–14], three were prospective cohort studies[15–17] and 15 were systematic style reviews[18–32]. 14 of these papers provided a global perspective on socioeconomic differences in CRC[27-30, 34–37,39,40, 42–44,48] , nine were based in the UK[1,3,6–10,15,33], six were from the Americas[2,22,25,29–31] and three from Germany and Spain[4,16,17].

Screening

13 studies discussed differences in CRC screening by socioeconomic status, income, education, race and ethnicity[12,19, 20,34–36,38,41,42,44,45,47,48]. All studies reported differences in CRC screening uptake by socioeconomic status. A study conducted in England showed overall uptake of screening was 54%, but there was a gradient of uptake across deprivation quintiles from 35% in the most deprived to 61% in the least deprived areas[7]. Furthermore, participation in screening was seen to vary by age, sex and ethnicity, with the most ethnically diverse areas having a

screening uptake of 38% compared with 52-58% screening uptake in less ethnically diverse areas.

Another pilot study for CRC screening in the UK showed that screening uptake was 60% lower in the most deprived groups compared to the least deprived group, and that use of other healthcare services was strongly associated with screening participation[18].

Some studies investigated the effects of income and level of education seperately to socioeconomic status. Three studies found that lower educational attainment was associated with poorer uptake of CRC screening [18,19,26]. Similarly, one study found that lower income was associated with poorer uptake of CRC screening[19].

A systematic-style review of global literature found that of the 24 screening programmes included in the review, 13/24 (54%) did not collect data on screening participation by socioeconomic status and ethnicity[20]. Of the 11 studies that did report data on socioeconomic status, 90% of them reported lower participation in more deprived groups. The most severe difference in participation by deprivation was of 35% screening uptake in the most deprived group compared to 71% in the least deprived. Six programmes collected data on ethnicity, and they reported moderate differences in participation by ethnicity. One study conducted in the USA reported that those with an insurance policy were more likely to engage in screening compared to those on Medicare or Medicaid[29].

Incidence

10 studies discussed differences in CRC incidence by socioeconomic factors or ethnicity[3,6,10,21,22,24,29–32]. Most studies reported an association between low socioeconomic status and increased incidence of CRC; as social deprivation increased CRC incidence rate also increased[3,6,10,21,22,24,30–32].

In a study conducted in England, the age-standardised rate per 100,000 (ASR) of CRC incidence in males for 2006-2010 was 53.4 for those living in the least deprived areas compared to 60.5 for those living in the most deprived areas.

The same study found that for women, the difference in ASR of CRC incidence was narrower, with an incidence rate of 35.6 for those living in the least deprived areas compared to 36.3 for those living in the most deprived areas[3].

A study conducted in Scotland in 2012 found an increased incidence rate ratio of CRC in the most deprived compared to the least deprived of 1.24 (95% CI 1.11-1.39)[10]. Furthermore, being black or of an ethnic minority was also associated with a higher CRC incidence rate compared to being white[22,25,29,31].

Survival

12 studies discussed differences in CRC survival by socioeconomic factors, stage at presentation or ethnicity[21,22, 24,25,29,30,32,38–40,46,48]. Most studies reported a decrease in CRC survival as gradient of deprivation increased[4,5,8,9,14,16,22–24,34]. One study investigating rectal cancer showed that lower socioeconomic status, lower educational achievement and black ethnicity were all associated with poorer overall survival[13].

A study conducted in the UK showed that deprived patients had poorer survival with an Excess Hazard Ratio (EHR) of 1.20 (95% CI 1.16-1.25) and were less likely to receive treatment within 6 months for their cancer compared to less deprived areas Odds Ratio (OR) of 0.87 (95% CI 0.82-0.92). The disparity in survival by deprivation was attenuated but persisted after adjusting for age and stage at diagnosis with an EHR of 1.15 (95% CI 1.08-1.24)[8]. This was attributed to poorer access to treatment by the authors.

Mortality

10 studies discussed differences in CRC mortality by socioeconomic status, education, income or ethnicity[3,6,9,15,17,24,25,27,29,31]. Overall, increasing deprivation was associated with increasing CRC mortality rates in all 10 studies except in a review of studies in Italy, where there was no association between socioeconomic status and mortality rate[27] however the authors noted that this difference may be due to the fact the Italian studies were relatively small. Furthermore, an analysis of the English CRC mortality data in 2007-2011 showed that males in the least deprived quintile had an ASMR of 18.5 compared to 24.0 for males in the most deprived quintile. For females in 2007-2011, the ASMR was 12.1 in the least deprived and increased to 14.0 in the most deprived. Increasing age at diagnosis was associated increasing CRC mortality rate[17,25] and being black or of an ethnic minority was also associated with an increased mortality rate[22,25,29].

Access to treatment

Four papers discussed socioeconomic factors in relation to delays in accessing treatment and the type of treatment received[11,12,15,32]. In a systematic review and meta-analysis of the literature, lower socioeconomic status was associated with an increased OR of 1.67 compared to those of higher socioeconomic status of having delayed initiation of adjuvant chemotherapy for CRC[11]. A further systematic review and meta-analysis found that being of lower socioeconomic status was associated with lower odds of receiving adjuvant chemotherapy, and also increased odds of delayed treatment initiation[12]. Furthermore, one study found that people lower socioeconomic status, lower educational attainment and black ethnicity were more likely to receive less aggressive treatment for their CRC diagnosis[32]. One study found that emergency presentation at diagnosis of CRC was associated with higher 90-day mortality rate when compared to non-emergency presentations, although in this study social deprivation was not associated with stage at presentation[15].

Race and ethnicity

13 papers discussed the role of race and ethnicity in relation to CRC outcomes[12,20,29,36–38,41–43,45–48]. Being black or of an ethnic minority was associated with decreased participation in CRC screening compared to being white[20,26,29]. A review of screening programmes worldwide found that only 6 of the 24 screening programmes studied collected data on screening uptake by race or ethnicity. Reported results on ethnic groups and screening uptake in this study were not always statistically significantly, however the author noted that confounding factors were not reported in adequate detail to provide reliable results[20].

Being black or of another ethnic minority was associated with an increased CRC incidence rate compared to whites[21,22,30–32], as well as increased mortality rate[22,25,27,29,31,32]. Being black or of another ethnic minority was associated with poorer survival from CRC[22,30] and rectal cancer[13].

Methodology supplementary material

The Office for National Statistics (ONS) is the UK's largest independent producer of official statistics and is the recognised national statistical institute for the UK[35]. They are responsible for collecting and publishing statistics including mortality statistics at national, regional, and local levels. The ONS mortality data provides almost complete population coverage for deaths that occur in England, where registration of death is a legal requirement. Deaths are certified by a medical practitioner or coroner using a standardised Medical Certificate of Cause of Death and are then filed by a registrar[36,37]. Data were provided by ONS from population-based death registries, covering the population of England.

CRC mortality was defined with the International Classification of Diseases version 10 (ICD-10) codes as a death caused by C18 (malignant neoplasm of colon), C19 (malignant neoplasm of rectosigmoid junction) or C20 (malignant neoplasm of rectum)[38]. All death certificates with CRC (ICD-10 C18-20)[38] as an underlying or contributing cause of death between 2011-2020 in England were eligible for the analysis. A new composite outcome variable was created that combined CRC as the underlying cause of death and as a contributing cause of death, and this was used at the primary outcome. There was no analysis on trends by underlying and contributing cause of death as there can be inconsistencies in the completeness of ascertainment of death in cancer patients[39], and particularly in those aged 90+ where there may be competing causes of death, differentiation of CRC as an underlying or contributing cause of death can be poorly recorded.

ONS data for CRC deaths also provided data on the year the death was recorded, date of death, age, sex and LSOA, which is equivalent to IMD rank. Age was provided as a continuous variable. It was categorised into 0-49, 50-59, 60-69, 70-79, 80-89 and 90+.

These age categories were chosen because CRC incidence and mortality rates are strongly associated with age; incidence rates of CRC in under 50s are low, and in those 90+ there are many competing causes of mortality. As such, 10-year age categories were considered appropriate to examine differences in CRC mortality by age. Sex was coded for male and female, and a third variable was created for all-persons. Individual records were collapsed and stratified by file year the death was recorded, age category, sex and IMD quintile into an aggregate analytic dataset. English population denominator data was provided by ONS from census estimates. Standardisation was done using the European Standardised Population 2013 edition.

Using the high-quality CRC mortality data for England and the European Standard. Crude, age-specific and age-standardised mortality rates (ASMR) were calculated to examine CRC mortality trends in relation to IMD.

Given the purpose of this study was to quantify the differences in CRC mortality by socioeconomic status, population mortality was chosen as a more appropriate measure than cancer survival to investigate differences in CRC death burden between socioeconomic groups as it is a more ultimate measure of progress against cancer on a population level. Mortality should be interpreted with caution as it cannot estimate prognosis for cancer patients or distinguish between whether changes in mortality rate are due to primary prevention, early diagnosis or better treatment[40]. Mortality is a function of incidence and survival whereby it depends on the number of case diagnoses as well as the prognosis of the disease[41]. Other studies have presented mortality rates alongside incidence and survival data for context to aid in interpretation of mortality rates. These population-based indicators are important to interpret overall progress in cancer control[42].

Socioeconomic status and deprivation

IMD is the official measure of relative deprivation for small areas in England, based on the 2011 census[43]. The IMD ranks every small area of around 1,500 people, known as a Lower Layer Super Output Area (LSOA), from 1 (most deprived) to 32,844 (least deprived) using seven domains of deprivation. The seven domains are:

- Income (22.5%)
- Employment (22.5%)
- Education, skills and training (13.5%)
- Health deprivation and disability (13.5%)
- Crime rank (9.3%)
- Barriers to housing and services (9.3%)
- Living environment (9.3%)

IMD 2015 15 was chosen as the most appropriate index definition as it was the temporally closest score to the 2011 census, although differences in IMD definition are minor. LSOA rank was collapsed into quintiles where IMD 1 was the most deprived and IMD 5 was the least deprived. In analyses for Poisson regression model, those in the least deprived areas (IMD 5) were chosen as the baseline, given the aim of this study was to investigate the effect of increasing socioeconomic deprivation on CRC mortality.

Studies have concluded that interpreting area-based analyses derived from a single measure of deprivation, such as income, occupation or education, may overlook other important factors that influence cancer-related outcomes[44]. Therefore, all seven domains of IMD 2015 were used for analysis. A review of studies investigating socioeconomic differences in cancer survival found that most studies used an ecological or area-based measure of social deprivation to categorise patients[45], and this is thought to be because there are difficulties accessing data on individual-level measures of socioeconomic status.

Calculation of rates

We examined the annual mortality rate (per 100,000 population) in each of the aggregate age groups, seperately in men and women. To examine differences in mortality rates by level of deprivation, we calculated crude, age-specific and age-standardised mortality rates (ASMR). ASMR were calculated by the direct method of age-standardisation with the 2013 European Standard Population[46]. The command disrate was used in STATA[47], which uses the Tiwari et al (2006)[48] formula to calculate confidence intervals that are equal to or wider than those derived by the conventional dstdize command. This command was chosen as the output was easier to process and the desired multiplier for calculation of rates per 100,000 could be specified. When standardisation was run using the dstdize and disrate commands, the ASMR were the same and differences in confidence intervals were negligible.

Age-specific rates were calculated to inspect the CRC mortality of individual age strata before age-standardisation, as we did not want to assume that the patterns of deaths were the same across age categories and were interested to see whether there were any changes in trends in those aged 60+ in the context of the introduction of the English Bowel Cancer Screening Programme in 2006.

Poisson analysis

The simplest distribution to analyse count data is the Poisson distribution, and the Poisson regression model is a statistical tool that can examine the relationship between a count variable and covariates. The key assumption of a Poisson model is that the mean and the variance of the distribution are equal, whereas it is understood that in reality the data may be over or under-dispersed[49].

All statistical models were carried out separately for males, females, and persons and for each year. There was evidence of over-dispersion which violates the assumptions of the Poisson model. Therefore, we used a robust variance estimator to calculate heteroscedasticity-robust standard errors, accounting for Poisson model misspecification due to over-dispersion. However, we also checked the robustness of the results from the Poisson model with robust variance in the sensitivity analysis using a negative binomial model. The difference between the Poisson model and the negative binomial model fitted in our sensitivity analyses showed minimal difference in output. Since level of deprivation by IMD quintile is the exposure of interest, we conducted a linear test for trend on the association between CRC mortality and decreasing deprivation by sex and for each year.

Supplementary tables

	Males					Females					Persons				
	0-49	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**	**0-49**
	IMD 1	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**
2011	1.55	1.27	1.40	1.50	1.36	1.04	0.87	1.42	1.37	1.12	1.30	1.07	1.41	1.43	1.24
2012	1.64	1.39	1.31	1.53	1.08	1.08	1.21	1.63	1.40	1.28	1.36	1.30	1.47	1.47	1.18
2013	1.15	1.52	1.80	1.72	1.22	1.31	1.13	1.45	1.34	1.16	1.23	1.32	1.63	1.53	1.19
2014	1.50	1.12	1.50	1.38	1.42	1.28	1.17	1.30	1.28	1.43	1.39	1.14	1.40	1.33	1.42
2015	1.73	1.44	1.18	1.72	1.62	1.36	1.46	1.24	1.50	1.50	1.55	1.45	1.21	1.61	1.56
2016	1.66	1.43	1.72	1.32	1.36	1.40	1.06	1.48	1.47	1.77	1.53	1.24	1.60	1.40	1.56
2017	1.84	1.55	1.52	2.03	1.24	1.00	1.47	1.72	1.57	1.55	1.42	1.51	1.62	1.80	1.39
2018	1.56	1.97	2.01	1.57	1.83	1.29	1.44	1.60	1.95	2.01	1.43	1.71	1.81	1.76	1.92
2019	1.85	1.62	1.61	2.01	1.94	1.27	1.31	1.66	1.89	1.72	1.56	1.47	1.63	1.95	1.83
2020	1.80	1.38	2.04	1.51	2.13	1.62	1.13	1.45	1.73	1.98	1.71	1.26	1.75	1.62	2.06
	50-59	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**	**50-59**
	IMD 1	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**
2011	20.94	19.31	17.78	16.89	15.83	14.63	10.45	12.11	11.74	11.00	17.78	14.85	14.91	14.28	13.39
2012	24.40	22.39	19.03	19.57	17.22	15.06	15.32	12.72	12.50	13.39	19.73	18.83	15.83	15.99	15.28
2013	21.21	19.91	18.00	13.54	15.53	13.61	13.33	12.15	12.65	9.10	17.40	16.60	15.04	13.09	12.28
2014	20.29	20.87	15.69	14.90	16.72	15.19	11.44	10.32	10.34	9.16	17.73	16.12	12.97	12.59	12.88
2015	22.25	18.76	18.48	17.38	16.91	15.48	14.35	12.90	11.65	11.39	18.85	16.54	15.66	14.47	14.11
2016	22.94	16.39	19.03	15.18	15.88	16.14	15.71	12.34	10.89	12.69	19.52	16.04	15.64	13.00	14.26
2017	20.90	17.75	18.80	15.31	16.98	14.55	13.83	10.54	11.32	11.15	17.70	15.78	14.62	13.29	14.01
2018	20.35	23.23	18.47	15.52	17.36	14.27	12.90	11.02	11.06	12.76	17.29	18.03	14.69	13.26	15.01
2019	21.07	17.51	18.14	15.00	17.60	12.12	13.11	13.68	12.30	13.02	16.56	15.29	15.88	13.63	15.26
2020	27.00	17.87	18.66	16.18	16.15	14.72	14.19	12.71	10.87	10.64	20.81	16.01	15.64	13.48	13.34
	60-69	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**	**60-69**
	IMD 1	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**
2011	69.88	52.83	57.08	49.89	43.79	40.05	29.83	31.20	31.53	28.52	54.80	41.08	43.84	40.47	35.94
2012	78.31	58.73	58.14	48.61	47.18	38.62	34.35	30.54	32.68	28.37	58.27	46.28	44.00	40.43	37.50
2013	73.16	58.58	53.03	47.50	47.42	36.61	36.75	28.98	34.78	28.74	54.73	47.44	40.70	40.97	37.79
2014	65.27	54.45	53.70	43.92	45.40	30.97	32.97	29.42	30.03	27.30	47.97	43.48	41.24	36.78	36.06
2015	64.36	55.19	52.27	50.55	46.31	36.16	31.48	32.18	27.20	27.50	50.15	43.08	41.96	38.53	36.60
2016	67.23	58.47	50.65	49.42	46.96	36.72	34.18	33.67	29.88	28.24	51.85	46.06	41.93	39.36	37.29
2017	73.22	63.45	50.31	46.62	42.45	34.49	29.57	29.37	24.44	28.88	53.69	46.12	39.56	35.19	35.45
2018	64.85	49.99	53.87	46.13	46.67	43.06	29.10	29.61	28.47	27.67	53.85	39.31	41.42	37.03	36.86
2019	62.56	53.32	47.65	47.30	42.04	32.74	32.21	27.83	29.00	26.81	47.51	42.54	37.46	37.87	34.18
2020	64.42	51.75	51.95	44.22	45.63	39.05	33.24	30.73	29.67	27.44	51.59	42.29	41.05	36.72	36.27
	70-79	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**	**70-79**
	IMD 1	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**
2011	189.80	151.21	140.19	131.12	127.83	93.26	96.57	77.75	70.62	70.16	137.08	121.63	106.88	99.02	97.25
2012	172.53	152.10	145.63	135.72	127.36	99.50	83.11	79.24	74.68	72.66	132.81	114.87	110.30	103.37	98.38
2013	168.78	145.47	148.40	128.61	110.02	99.41	71.37	78.28	78.35	68.36	131.14	105.62	111.22	102.02	87.97
2014	179.80	140.25	126.61	121.81	117.26	84.60	80.07	79.62	73.74	70.77	128.39	107.99	101.77	96.41	92.69
2015	158.53	134.13	122.65	104.90	105.55	93.69	82.99	73.69	64.67	57.98	123.61	106.80	96.82	83.68	80.42
2016	171.08	141.78	118.53	114.44	103.75	87.80	81.32	79.10	68.76	63.95	126.38	109.55	97.76	90.38	82.74
2017	151.19	132.66	115.72	116.91	95.95	88.11	76.31	71.72	65.05	67.55	117.49	102.75	92.57	89.64	80.98
2018	149.83	111.61	119.51	108.80	87.61	81.18	76.33	66.49	57.21	58.12	113.32	92.92	91.63	81.66	72.06
2019	153.83	121.54	109.76	102.24	104.79	80.44	84.76	64.27	65.03	64.59	114.91	102.07	85.88	82.66	83.58
2020	145.28	134.21	119.37	113.12	97.69	91.90	71.12	72.88	66.42	65.64	117.01	100.82	94.92	88.52	80.75
	80-89	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**	**80-89**
	IMD 1	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**
2011	350.52	300.02	305.68	314.45	303.79	201.53	196.37	190.56	190.94	187.77	256.68	235.66	235.61	240.42	235.55
2012	343.59	333.15	309.64	305.01	288.31	207.21	199.05	193.01	203.91	189.92	258.36	250.54	239.32	244.98	231.01
2013	369.98	313.09	322.99	284.73	291.90	190.42	184.83	178.09	195.41	195.90	258.73	234.61	236.34	232.12	236.42
2014	336.27	310.41	284.99	285.20	261.71	208.48	195.28	190.43	194.37	190.83	257.61	240.58	228.88	232.09	221.04
2015	354.71	335.32	283.92	288.87	261.87	202.16	205.47	196.38	188.71	181.46	261.55	257.19	232.37	230.74	215.96
2016	338.84	314.04	284.06	284.70	267.95	203.70	191.77	176.20	172.66	188.01	256.89	241.00	220.96	220.12	222.50
2017	350.72	321.58	310.84	282.32	259.96	191.89	202.94	179.07	191.52	181.74	255.16	251.10	234.25	230.21	215.72
2018	318.12	322.35	282.00	297.42	249.93	211.15	197.71	193.84	176.45	171.50	254.14	248.73	231.05	228.38	205.77
2019	318.50	312.66	293.85	267.63	268.38	220.16	175.01	194.92	180.49	177.75	260.13	231.93	236.95	218.15	217.44
2020	345.26	322.86	294.94	286.98	268.08	195.34	196.57	193.29	183.58	174.12	256.57	248.97	236.66	228.43	215.33
	90+	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**	**90+**
	IMD 1	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**	**IMD 1**	**IMD 2**	**IMD 3**	**IMD 4**	**IMD 5**
2011	522.67	511.57	533.30	412.07	435.05	319.76	329.75	303.81	319.04	328.78	370.57	376.83	365.73	344.48	359.51
2012	523.62	621.83	488.27	486.33	504.06	327.42	332.02	313.30	289.72	319.13	378.23	408.80	361.61	344.93	373.84
2013	550.76	412.37	508.92	549.43	431.44	348.42	336.79	369.85	298.02	323.68	402.08	357.39	408.84	370.16	356.09
2014	597.40	473.99	541.50	507.19	545.72	297.09	288.41	283.35	332.34	320.53	378.80	339.83	357.10	383.25	389.73
2015	464.05	568.69	575.72	551.89	425.57	278.42	296.13	348.99	294.70	340.10	330.21	373.17	415.33	371.32	367.17
2016	523.24	453.62	491.78	491.62	480.27	300.78	292.61	335.15	337.76	312.66	363.74	338.98	382.23	384.74	366.87
2017	510.50	510.94	515.59	511.11	416.19	274.08	234.64	287.90	299.42	329.08	343.36	316.60	357.86	365.62	357.73
2018	478.06	546.47	518.26	504.10	475.69	294.43	357.01	306.57	309.93	343.63	349.71	414.22	372.93	372.01	387.78
2019	487.89	536.66	538.11	490.50	495.58	300.45	266.07	325.30	336.10	309.64	357.82	349.14	393.20	386.33	372.71
2020	426.10	549.28	474.40	506.33	470.23	314.18	308.83	291.18	302.19	339.97	349.14	383.76	350.05	369.06	384.80

Supplementary table 1 - Age-specific colorectal cancer mortality rates per 100,000 people by sex and IMD in England, 2011-2020

		IMD 1		IMD 2		IMD 3		IMD 4		IMD 5	
		Crude	**ASR (95% CI)**	**Crude**	**ASR (95% CI)**	**Crude**	**ASR (95% CI)**	**Crude**	**ASR (95% CI)**	**Crude**	**ASR (95% CI)**
Males	**2011**	28.1	48.1 (45.6-50.7)	26.6	40.2 (38.1-42.4)	31.8	40.0 (38.1-42.0)	32.1	37.4 (35.6-39.3)	31.8	36.0 (34.2-37.8)
	2012	28.3	47.8 (45.3-50.4)	29.2	43.9 (41.7-46.1)	32.8	40.4 (38.5-42.4)	33.4	38.4 (36.6-40.3)	32.9	36.4 (34.7-38.3)
	2013	27.7	47.5 (45.0-50.0)	27.4	40.1 (38.0-42.2)	33.7	41.0 (39.1-43.0)	32.3	36.8 (35.0-38.6)	31.9	34.2 (32.5-35.9)
	2014	27.4	46.8 (44.3-49.3)	27.0	39.5 (37.5-41.6)	31.2	37.4 (35.6-39.3)	31.8	35.3 (33.7-37.1)	32.9	34.8 (33.2-36.5)
	2015	26.5	44.6 (42.2-47.0)	28.0	40.9 (38.9-43.1)	31.4	37.4 (35.6-39.2)	32.8	35.7 (34.0-37.5)	32.1	32.8 (31.3-34.5)
	2016	27.3	46.0 (43.7-48.5)	27.6	39.7 (37.7-41.7)	31.4	36.4 (34.7-38.2)	33.0	35.1 (33.5-36.8)	33.1	33.2 (31.7-34.9)
	2017	27.3	45.1 (42.8-47.5)	28.7	40.6 (38.6-42.6)	32.8	37.3 (35.5-39.0)	34.2	35.6 (34.0-37.3)	32.0	31.1 (29.6-32.7)
	2018	25.6	42.1 (40.0-44.4)	27.6	38.5 (36.6-40.5)	33.3	37.1 (35.4-38.9)	34.5	35.1 (33.5-36.7)	32.8	31.5 (30.0-33.0)
	2019	26.4	42.6 (40.5-44.9)	27.8	38.3 (36.4-40.2)	32.7	35.9 (34.3-37.6)	33.6	33.5 (32.0-35.1)	35.8	33.5 (32.0-35.1)
	2020	27.2	43.3 (41.1-45.6)	28.9	39.7 (37.8-41.7)	34.2	37.0 (35.4-38.7)	35.5	34.9 (33.4-36.5)	35.6	32.9 (31.5-34.5)
Females	**2011**	21.3	26.9 (25.3-28.5)	22.9	25.2 (23.8-26.7)	25.1	23.7 (22.5-25.1)	25.7	23.2 (22.0-24.5)	25.1	22.6 (21.4-23.8)
	2012	21.8	27.7 (26.1-29.3)	23.3	25.5 (24.1-27.0)	25.7	24.2 (22.9-25.5)	26.9	24.1 (22.8-25.4)	26.2	23.2 (22.0-24.4)
	2013	21.0	26.9 (25.3-28.5)	21.9	23.9 (22.6-25.3)	25.5	23.7 (22.5-25.0)	27.4	24.4 (23.1-25.7)	26.0	22.5 (21.3-23.7)
	2014	19.9	25.3 (23.8-26.9)	21.9	24.0 (22.6-25.3)	25.0	23.2 (22.0-24.5)	26.9	23.4 (22.2-24.6)	26.4	22.5 (21.3-23.7)
	2015	20.4	26.4 (24.9-28.0)	22.9	25.1 (23.7-26.5)	26.4	24.2 (22.9-25.5)	25.5	21.9 (20.8-23.1)	25.7	21.5 (20.4-22.7)
	2016	20.3	26.3 (24.8-27.9)	22.4	24.6 (23.3-26.0)	26.1	24.0 (22.7-25.2)	26.1	22.3 (21.1-23.5)	27.2	22.4 (21.3-23.6)
	2017	19.1	24.9 (23.4-26.4)	21.6	23.5 (22.2-24.9)	24.7	22.3 (21.2-23.6)	26.1	21.8 (20.7-23.0)	27.7	22.4 (21.3-23.6)
	2018	20.4	26.4 (24.9-27.9)	22.6	24.3 (23.0-25.7)	25.5	22.7 (21.5-23.9)	25.6	21.3 (20.2-22.4)	27.1	21.7 (20.6-22.8)
	2019	19.7	25.2 (23.8-26.7)	21.8	23.6 (22.3-24.9)	26.1	22.9 (21.7-24.1)	27.7	22.6 (21.5-23.7)	27.9	21.9 (20.8-23.0)
	2020	20.7	26.7 (25.2-28.3)	22.3	23.8 (22.5-25.1)	26.6	23.3 (22.2-24.5)	27.5	22.3 (21.2-23.4)	28.4	22.1 (21.0-23.2)
Persons	**2011**	24.7	35.8 (34.4-37.2)	24.7	31.5 (30.3-32.8)	28.4	30.6 (29.5-31.7)	28.9	29.4 (28.4-30.5)	28.4	28.5 (27.4-29.5)
	2012	25.0	36.3 (34.9-37.7)	26.2	33.1 (31.9-34.4)	29.2	31.2 (30.1-32.3)	30.1	30.3 (29.2-31.3)	29.5	28.9 (27.9-30.0)
	2013	24.3	35.6 (34.2-37.0)	24.6	31.0 (29.8-32.2)	29.5	31.3 (30.2-32.4)	29.8	29.6 (28.6-30.6)	28.9	27.7 (26.7-28.7)
	2014	23.6	34.4 (33.1-35.8)	24.4	30.6 (29.5-31.8)	28.1	29.2 (28.2-30.3)	29.3	28.5 (27.5-29.6)	29.6	27.8 (26.9-28.8)
	2015	23.4	34.1 (32.8-35.5)	25.4	31.7 (30.5-32.9)	28.9	29.8 (28.8-30.9)	29.1	27.8 (26.9-28.8)	28.8	26.6 (25.7-27.6)
	2016	23.8	34.8 (33.5-36.2)	25.0	31.1 (30.0-32.3)	28.7	29.4 (28.4-30.4)	29.5	27.9 (27.0-28.9)	30.1	27.2 (26.2-28.1)
	2017	23.1	33.6 (32.4-35.0)	25.1	30.8 (29.7-32.0)	28.7	28.8 (27.8-29.8)	30.1	27.9 (26.9-28.8)	29.8	26.3 (25.4-27.2)
	2018	23.0	33.3 (32.0-34.6)	25.1	30.5 (29.4-31.6)	29.3	29.1 (28.1-30.1)	30.0	27.3 (26.4-28.3)	29.9	26.0 (25.1-27.0)
	2019	23.0	33.0 (31.7-34.3)	24.8	29.8 (28.7-30.9)	29.4	28.6 (27.6-29.6)	30.6	27.4 (26.5-28.4)	31.8	27.1 (26.2-28.0)
	2020	23.9	34.1 (32.8-35.4)	25.6	30.7 (29.6-31.8)	30.4	29.4 (28.4-30.4)	31.4	27.8 (26.9-28.8)	32.0	27.0 (26.1-27.9)

Supplementary table 2 - Crude and age-standardised colorectal cancer mortality rates (per 100,000) with 95% confidence interval by sex and IMD in England, 2011-2020

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