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

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ABSTRACT

Introduction: Patients diagnosed with ovarian cancer from more deprived areas may face barriers to accessing timely, quality healthcare. We evaluated the literature for any association between socioeconomic group, treatments received and hospital delay among patients diagnosed with ovarian cancer in the United Kingdom, a country with universal healthcare.

Methods: We searched MEDLINE, EMBASE, CINAHL, CENTRAL, SCIE, AMED, PsycINFO and HMIC from inception to January 2023. Forward and backward citation searches were conducted. Two reviewers independently reviewed titles, abstracts, and full-text articles. UK-based studies were included if they reported socioeconomic measures and an association with either treatments received or hospital delay. The inclusion of studies from one country ensured greater comparability. Risk of bias was assessed using the QUIPS tool, and a narrative synthesis was conducted. The review is reported to PRISMA 2020 and registered with PROSPERO [CRD42022332071].

Results: Out of 2876 references screened, ten were included. Eight studies evaluated treatments received, and two evaluated hospital delays. We consistently observed socioeconomic inequalities in the likelihood of surgery (range of odds ratios 0.24–0.99) and chemotherapy (range of odds ratios 0.70–0.99) among patients from the most, compared with the least, deprived areas. There were no associations between socioeconomic groups and hospital delay.

Policy summary: Ovarian cancer treatments differed between socioeconomic groups despite the availability of universal healthcare. Further research is needed to understand why, though suggested reasons include patient choice, health literacy, and financial and employment factors. Qualitative research would provide a rich understanding of the complex factors that drive these inequalities.

1. Introduction

There were 310,000 ovarian cancer diagnoses and over 205,000 ovarian cancer deaths worldwide in 2020 [1]. It is the 6th most common cause of cancer-related death among women in the United Kingdom (UK) [2]. However, cancer survival varies significantly between comparable countries. An estimated 33.4% of women with advanced-stage disease survive for three years in the UK, a figure significantly worse than Australia, with a three-year net survival rate of 46.9% [3].

Cancer survival also varies within countries, with patients living in more deprived areas at risk of significantly worse survival outcomes [4–7]. The reasons for this are complex and multifaceted, with evidence that patients from more deprived backgrounds experience inequalities along the continuum of care. Patients from more deprived areas are more likely to be diagnosed at a more advanced stage, are at greater risk of emergency diagnosis and report worse cancer care and end-of-life care experiences [8–13]. It has been suggested that access to optimal treatment and delays to diagnosis and treatment also contribute to the survival gradients within and between countries [14–18].

Systematic review evidence has shown that socioeconomic status is strongly linked to the receipt of treatment of ovarian cancer in the United States, a country without a universal healthcare system [19]. However, there has been no systematic review of socioeconomic inequalities in ovarian cancer care outside the United States.

Timely diagnosis and treatment are critical markers of quality cancer care, with delays associated with worse outcomes [20]. The Aarhus

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statement categorised the patient journey into patient, doctor and system intervals, thus providing a framework to evaluate delays [21,22]. Whilst pre-hospital delays are associated with socioeconomic factors, the system interval, the period from primary care-initiated investigations or referral to commencement of treatment, is relatively under-researched [21,23]. Although one Danish study that included all newly diagnosed cancers found that women from less affluent households experienced longer system intervals, there has not been a systematic review of how socioeconomic factors affect this interval among patients with ovarian cancer [22].

Worryingly, existing inequalities have been exacerbated by the COVID-19 pandemic, with vulnerable patient groups disproportionately affected by suboptimal cancer care [24–26]. The evolution of precision medicine and the development of new technologies and treatments will likely worsen these existing inequalities [27,28]. Understanding where these inequalities are in the pathways of care for patients with ovarian cancer is, therefore, essential to inform evidence-based action.

We evaluated the literature for any association between socioeconomic group, treatments received, and the system interval amongst patients with ovarian cancer in the UK. 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. This deliberate approach enhanced the internal validity of our findings, facilitating an examination of the interplay between socioeconomic factors and healthcare delivery within a specific national context, yielding insights for targeted policymaking.

2. Materials and methods

This systematic review was registered, and the protocol was uploaded to PROSPERO (CRD42022332071) [29]. The review is reported according to the PRISMA 2020 statement (Appendix S1) [30]. 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.

2.1. Eligibility criteria

Observational studies were considered for inclusion if relevant outcomes of patients with a primary diagnosis of ovarian, fallopian tube or primary peritoneal cancer (ICD10 C48, C56, C57) were reported. Only studies including patients diagnosed in the UK were eligible. Unpublished manuscripts and conference abstracts were eligible for inclusion. There were no date limits.

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 an individual measure such as occupation]. The relevant outcomes were defined as follows:

- Receipt of cancer-directed treatment. Studies evaluating palliative or supportive care only were excluded. Studies evaluating receipt of radiotherapy were similarly excluded as this treatment modality does not have a role in the primary management of ovarian cancer.
- Or the association between socioeconomic status and the length of the system interval, defined as the period from primary care-initiated investigations or referral to commencement of treatment [21]. Any part of, or the whole system interval, could have been measured.

2.2. Information sources

The following bibliographic databases (platforms) were searched from inception to 25/01/2023: MEDLINE, EMBASE, AMED and PsycINFO (OVID), and; CINAHL (EBSCOhost), CENTRAL (The Cochrane Library) and Science Citation Index Expanded (Web of Science).

The grey literature was searched using HMIC (OVID), BASE, NICE Evidence Search and Google Advanced Search. In addition, twelve websites were systematically hand-searched (Appendix S2).

Backwards and forward citation searches were conducted on 03/02/2023; these details are provided in Appendix S2. The bibliographies of two systematic reviews were also examined for relevant articles [14,15].

2.3. Search strategy

The search strategy was developed in MEDLINE using free-text words and subject indexing terms and subsequently adapted for the other databases. The search strategies are listed in Appendix S3. Briefly, the search strategies combined different concepts:

- Ovarian cancer *and* socioeconomic inequalities *and* treatment *and* the UK/devolved nations/regions
- Or, ovarian cancer *and* socioeconomic inequalities *and* system interval *and* the UK/devolved nations/regions

The development and validation of the search strategy is described in Appendix S4. Search filters were used to focus on UK-based studies [31,32] and exclude non-human studies to improve specificity. The search strategy was reviewed by SG using the Peer Review of Electronic Search Strategies for systematic reviews guideline [33].

2.4. Selection process

Search results were imported into EndNote X9 [34], and duplicates were removed using adapted EndNote de-duplication methods published by Bramer et al., 2016 [35]. The remaining search results were transferred to Covidence systematic review software [36].

BPS and another reviewer (SG or UM) 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. All records were screened in Covidence, ordered by author name.

2.5. Data collection process

A data extraction form was used to extract relevant information from included studies. One researcher (BPS) extracted data and collated it into the form. A second author (UM) then checked the extracted data. Authors from three studies were contacted by email, confirming that their studies did not evaluate any relevant outcomes to the systematic review [37–39].

2.6. Data items and effect measures

The following data were extracted: first author, year of publication, data source, region/country, years of diagnosis, stage, size of the analytical cohort, the measure of socioeconomic status, whether this was an area-based or individual measure, and the number of socioeconomic groups. We have stated where we have made assumptions about missing or unclear information.

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

Cancer-directed therapy received, including the timescale and definitions of treatment. The effect measures extracted were:

- o Adjusted estimates for the likelihood of a particular treatment for the most, compared to the least, deprived socioeconomic groups, with 95% confidence intervals. Details of confounding variables were also extracted.
- o If unavailable, unadjusted rates were extracted. The odds of treatment among patients from the most deprived group compared to the least deprived group were calculated. 95% confidence intervals were

calculated using RevMan 5.4.[40] Statistical tests of association were reported when available.

Measures of the system interval length, including precise definitions of the time intervals.

- o Effects of socioeconomic factors on the system interval were assessed using coefficients from regression analyses. Tests of significance or association were reported when available.
- o Otherwise, rates of patients meeting targets were extracted. The odds of meeting Cancer Waiting Time (CWT) Targets amongst patients from the most, compared to the least, deprived group were calculated. 95% confidence intervals were calculated using RevMan 5.4 [40].

Outcomes were prioritised based on importance, determined by the clinical experience within the study team and the outcomes commonly reported across studies (Further details provided in Appendix S5).

2.7. Study risk of bias assessment

One researcher (BPS) evaluated the risk of bias of included studies against domains adapted from the Quality in Prognosis Studies tool (QUIPS)[41,42]. Each domain was judged as having a high, moderate, or low risk of bias. These evaluations were collated onto a pre-prepared form and checked by a second reviewer (UM).

Risk of bias assessments directly informed the narrative synthesis, as greater weight was given to studies with a lower risk of bias. A study's evidence was considered "strong" if the study did not have a high risk of bias across any category, "moderate" if there was a high risk of bias in one category, and "weak" if there were two or more ratings of a high risk of bias. However, studies were not excluded based on the risk of bias assessment.

3. Synthesis methods

3.1. Synthesis was performed according to different categories

3.1.1. Cancer-directed treatment

- o Receipt of surgery
- o Surgical variation
- o Receipt of chemotherapy
- o Receipt of combination surgery and chemotherapy
- o Receipt of any treatment

3.2. System interval

A narrative synthesis was conducted, according to the synthesis without meta-analysis in systematic reviews reporting guideline [43]. An overall assessment of the association between socioeconomic status and each outcome was made. This considered the consistency of the supporting evidence and the strength of that evidence from each contributing study. Insufficient numbers of studies conducted adjusted analyses to enable a meta-analysis.

4. Results

4.1. Study selection

The database searches yielded 2873 studies following de-duplication, 47 of which were retrieved for full-text screening. An additional three studies were identified from the grey literature. Overall, ten studies were included in the review (Fig. 1) [44].

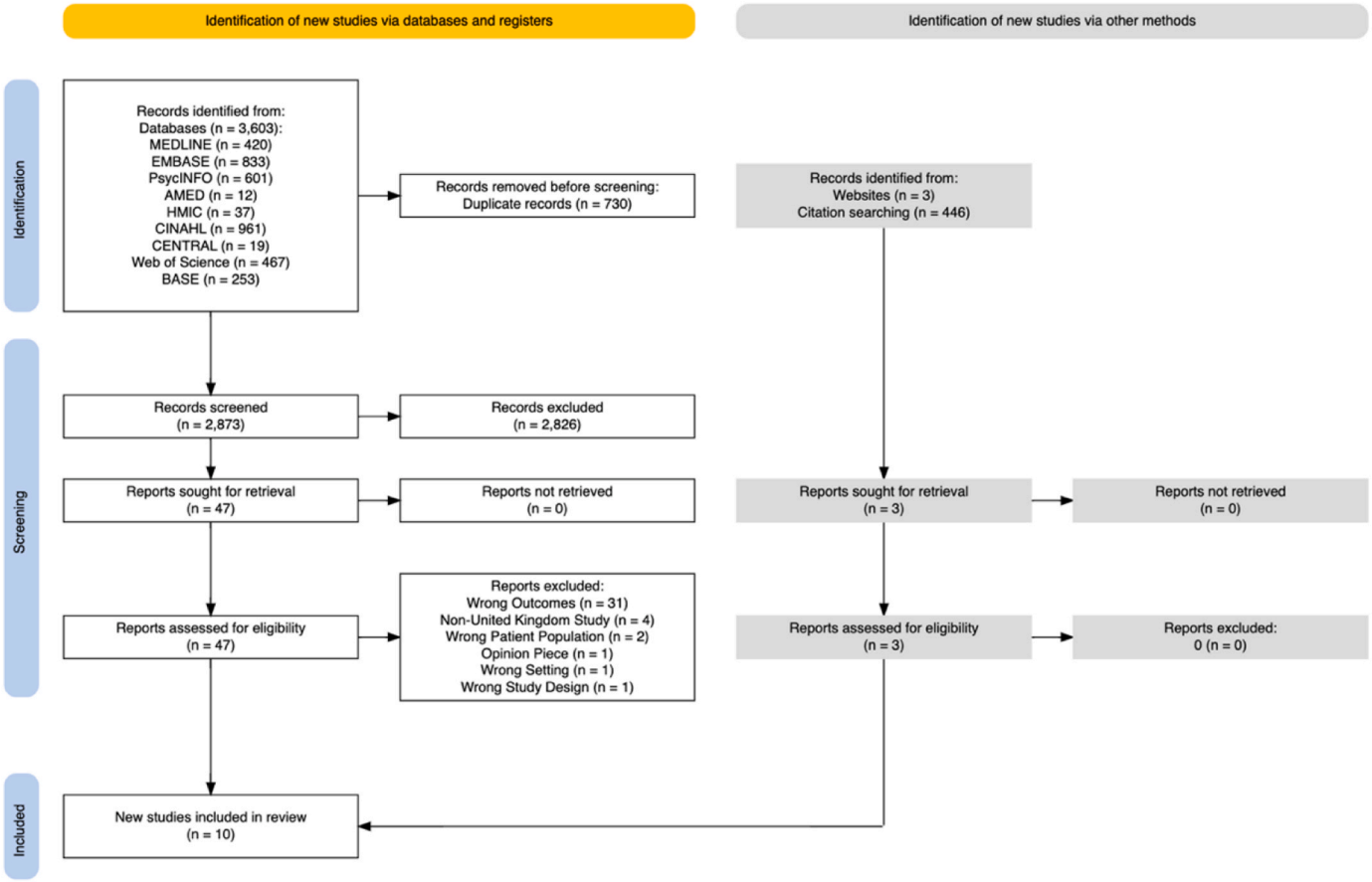

Fig. 1. PRISMA flow diagram of included studies.

4.2. Study characteristics

The characteristics of the included studies are summarised in Table 1. A total of seven studies reported the receipt of surgery [45–51], four studies reported the receipt of chemotherapy [46,47,49,50], and three studies reported the receipt of surgery and chemotherapy in combination [46,47,52]. One study also reported receiving any treatment [49], and three studies reported surgical variation or treatment scheduling [46,49,51].

Time to diagnosis or treatment was examined in two studies, with various time points within the system interval evaluated, summarised in Fig. 2.

Five studies conducted analyses that adjusted for key patient, tumour, or system characteristics [46,49,50,52,53]. The five remaining studies provided unadjusted rates [45,47,48,51,54].

Eight studies were conducted using the Index of Multiple Deprivation (IMD), the official measure of relative deprivation for small, fixed geographic areas in England [46–52, 54]. These areas, on average, have a population of 1500 residents each. Seven studies classified the areas into five quintiles based on their relative disadvantage, with quintile one representing the least deprived and quintile five representing the most deprived [46–49,51,52, 54]. Meanwhile, one study utilised a continuous score ranging from 0 to 80 to rank the areas, with higher scores indicating greater deprivation.[50].

One study employed the Northern Ireland Statistics and Research Agency Deprivation Index, a relative area-based deprivation index similar to IMD [45]. Meanwhile, one study utilised occupation as an individual proxy measure for socioeconomic status.[53] (Table 1).

The blue dotted line indicates the system interval defined by the Aarhus statement [21]. Studies that included any aspect of this system interval were included, even if the interval commenced before the system interval defined here.

Abbreviations: COSD cancer outcomes and services, FIGO international federation of gynaecology and obstetrics, HES hospital episode statistics, IMD index of multiple deprivation, NCIN National Cancer Intelligence Network, NCRAS National Cancer Registration and Analysis Service, NHS national health service, NISRA Northern Ireland statistics and research agency deprivation index, SACT systematic anti-cancer therapy dataset, SES socioeconomic status.

4.3. Risk of bias in studies

Table 2 presents the risk of bias across various domains, including study design and reporting. The study confounding domain was judged to have a high risk of bias for most studies. Only one study was at low risk of bias for study confounding [49]. Four studies adjusted or stratified by stage but did not adjust for comorbidities, therefore considered at moderate risk of bias [46,50,52,54]. Half of the included studies had a high risk of bias, either by not adjusting for stage [53] or providing unadjusted rates [45,47,48,51]. (Table 2).

4.4. Results of studies reporting receipt of surgery

Three of seven studies conducted analyses that accounted for important factors, including adjustment of stage and age,[46,49,50] years of diagnosis,[46] travel time,[50] and comorbidity.[49] One demonstrated reduced odds of surgery for patients from the most deprived compared with the least deprived group [OR 0.48, 95% CI 0.32–0.73].[46] Another demonstrated reduced odds for each incremental increase of one in the continuous deprivation score (indicating greater deprivation) [OR 0.99, 95% CI 0.99–1.0].[50] Meanwhile, the other adjusted study demonstrated that patients from the most deprived quintile were 5.4% less likely to have surgery than the average probability of the whole cohort [$p < 0.001$].[49] (Appendix S6).

The remaining four studies presented unadjusted rates from which odds ratios were calculated.[45,47,48,51] There was no statistically significant association in three [range of ORs 0.58–0.96].[45,47,48] However, one unadjusted study demonstrated reduced odds for patients from the most, compared with the least, deprived quintile [OR 0.24, 95% CI 0.12–0.46].[51] (Appendix S6).

In summary, patients from the most deprived areas were less likely to have surgery. This was supported by two strong and two weak-strength evidence studies (Table 3).

4.5. Results of studies reporting variations in surgery

One study calculated the odds of omentectomy [OR 0.67, 95% CI 0.45–1.01] and exenteration [OR 1.02, 95% CI 0.36–2.91] for patients from the most deprived quintile [46]. The odds of either procedure were not significantly reduced, adjusting for stage, year of diagnosis and age (Appendix S6) [46].

The remaining two studies evaluated the sequencing of surgery and chemotherapy: primary debulking surgery or interval debulking. One study conducted adjusted analyses [49], whilst the other provided unadjusted rates [51]. Neither demonstrated a significant association in treatment sequencing by socioeconomic group (Appendix S6).

Table 1
Characteristics of included studies.

First Author (Year)	Data Source	Region/Country	Stage	Years of Diagnosis	Measure of SES	No. SES Groups
[52]	COSD, HES, SACT	Eleven Centres Across England	FIGO III-IV & Unknown	Assumed 2015–2016	Assumed IMD [Area based]	5
[54]	Cancer Registration Data Linked to Cancer Waiting Times	England	Stage I-IV & Unknown	2009–2013	Income Domain IMD [Area based]	5
[50]	Yorkshire Registry & Northern and Yorkshire Cancer Registry	Northern England	All stages	1994–2002	IMD without access [Area based]	Continuous Score (0–80)
[27]	Eastern Cancer Registration and Information Centre	East Anglia, England	FIGO I-IV	1995–2006	IMD [Area based]	5
[45]	Unknown Source	Northern Ireland	All stages	2014–2017	NISRA [Area based]	5
[48]	National Cancer Data Repository	England	All stages	2004–2006	Assumed IMD [Area based]	5
[47]	Cancer Registration, SACT, HES	England	All stages	2013–2015	Income Domain IMD [Area based]	5
[20]	The National Survey of NHS Patients: Cancer	England	Not Recorded	Not Recorded	Occupation [Individual]	8
[51]	Pan-Birmingham Gynaecological Cancer Centre Database	Birmingham, England	Stage III-IV	2007–2017	IMD [Area based]	10 (but categorised as 5)
[5]	Cancer Registry, SACT, HES	England	Stage II-IV & Unknown	2016–2018	Income Domain IMD [Area based]	5

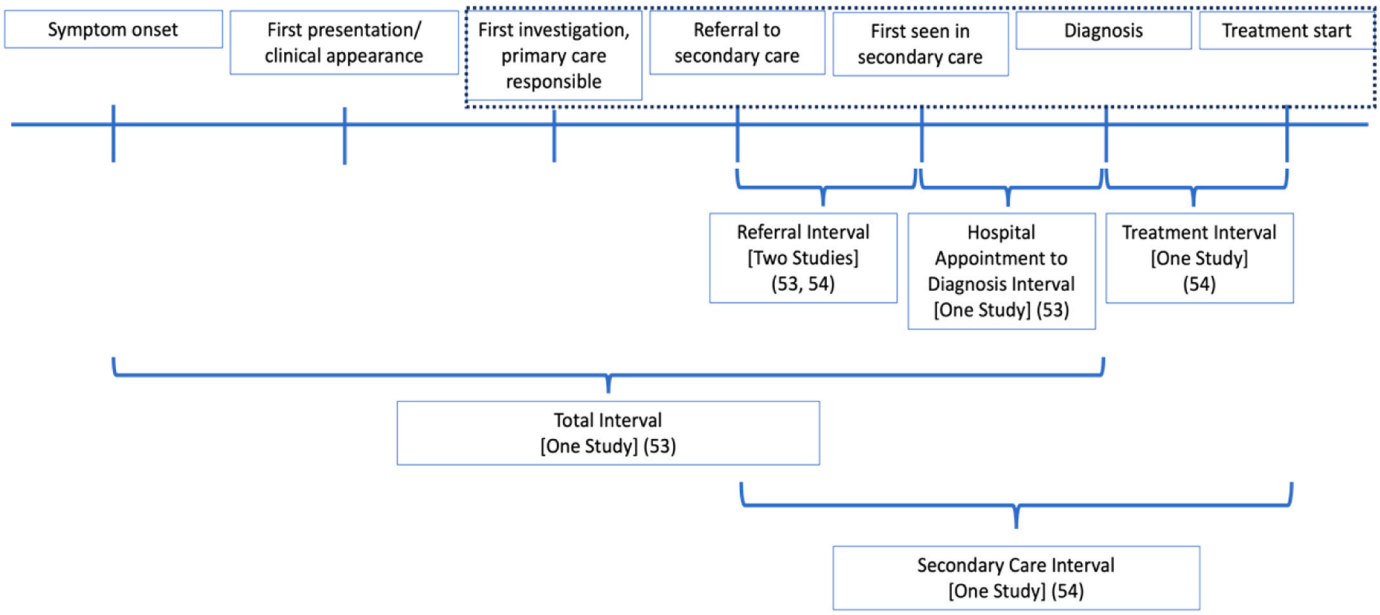

Fig. 2. Time intervals evaluated in the included studies.

Table 2
Study risk of bias assessments.

First author, date	Study Participation				Prognostic factor measurement Definition of socioeconomic status, valid measurement and appropriately categorised	Outcome measurement Definition and methods for the outcome of interest	Study confounding Important potential confounding factors accounted for	Statistical reporting Appropriate analysis and all primary outcomes reported	Strength of Evidence
	Inclusion criteria	Exclusion criteria	Baseline characteristics	Source and time period					
[52]	Low	Low	Low	High	Moderate	Low	Moderate	Low	Moderate
[54]	Low	Low	Low	Low	Low	Low	Moderate	Low	Strong
[50]	Moderate	Moderate	High	Moderate	Moderate	High	Moderate	Moderate	Weak
[27]	Low	Low	Low	Moderate	Low	Low	Moderate	Low	Strong
[45]	Moderate	Moderate	Moderate	High	Moderate	High	High	High	Weak
[48]	Low	Low	High	Low	High	Low	High	High	Weak
[47]	Low	Low	Low	Low	Low	Low	High	Moderate	Moderate
[53]	High	High	High	Moderate	Low	High	High	Moderate	Weak
[51]	Moderate	Moderate	Low	High	High	High	High	High	Weak
[5]	Low	Low	Moderate	Low	Low	Low	Low	Low	Strong

Abbreviations: NCIN National Cancer Intelligence Network, NCRAS National Cancer Registration and Analysis Service.

In summary, there was no evidence of an association between socioeconomic status and treatment sequencing or odds of exenteration or omentectomy (Table 3).

4.6. Results of studies reporting receipt of chemotherapy

Three of four studies conducted analyses adjusted for stage and age [46,49,50], year of diagnosis [46], travel time [50], and comorbidity [49]. One study demonstrated reduced odds with each incremental increase in continuous deprivation score (indicating greater deprivation) [OR 0.99, 95% CI 0.99–1.0] [50]. In another adjusted study, patients from the most deprived quintile were 3.8% less likely to have chemotherapy than the average probability for the cohort [$p < 0.001$] [49]. However, one adjusted study did not demonstrate a significant association between deprivation and receipt of chemotherapy [OR 0.91, 95% CI 0.63–1.31] [46]. The remaining study reported reduced unadjusted odds of chemotherapy for patients from the most deprived quintile [OR 0.70, 95% CI 0.63–0.76] [47]. (Appendix S6).

In summary, chemotherapy usage was less likely for those from the most deprived areas, supported by one strong, one moderate, and one weak strength study (Table 3).

4.7. Results of studies reporting receipt of both surgery and chemotherapy

Two studies conducted multivariable regression, adjusting for age [46,52], surgical complexity,[52] and stage and year of diagnosis [46]. One study demonstrated reduced odds of patients from the most deprived quintile receiving both surgery and chemotherapy [OR 0.71, 95% CI 0.50–1.0], [46] while there was no significant association in the other [OR 0.81, 95% CI 0.56–1.16] [52]. The remaining study demonstrated reduced unadjusted odds of receiving combination surgery and chemotherapy among patients from the most deprived areas [OR 0.71, 95% CI 0.64–0.78] [47]. (Appendix S6).

Overall, patients from the most deprived areas were less likely to receive combined surgery and chemotherapy. This was supported by one strong and one moderate strength study [46,47] (Table 3).

4.8. Results of studies reporting receipt of any treatment

One study evaluated the likelihood of any treatment by deprivation quintile, adjusting for morphology, stage, age, comorbidity, Cancer Alliance and performance status [49]. The study reported that patients from the most deprived quintile were 2.0% less likely to have any

Table 3
Narrative synthesis – assessment of the relationship between deprivation, treatments received and the system interval.

Specific outcome reported	No. of studies (no. subjects)	Studies demonstrating an adverse effect of deprivation	Studies demonstrating no adverse effect of deprivation	Studies demonstrating an unspecified association	Overall assessment/conclusion
Likelihood of receipt of treatment*					
Receipt of surgery	7 (58,398)	2 Strong[46,49] 2 Weak[50,51]	1 Moderate[47] 2 Weak[45,48]	-	Patients from the most deprived group less likely to receive surgery.
Receipt of omentectomy or exenteration	1 (2108)	-	1 Strong[46]	-	No impact of deprivation on likelihood of receiving an omentectomy or exenteration.
Receipt of primary debulking surgery vs. interval debulking surgery	2 (6889)	-	1 Strong[49] 1 Weak[51]	-	No impact of deprivation on likelihood of receiving primary debulking vs. interval debulking surgery.
Receipt of chemotherapy	4 (42,517)	1 Strong[49] 1 Moderate[47] 1 Weak[50]	1 Strong[46]	-	Patients from the most deprived group less likely to receive chemotherapy.
Receipt of combination surgery and chemotherapy	3 (24,871)	1 Strong[46] 1 Moderate[47]	1 Moderate[52]	-	Patients from the most deprived group less likely to receive the combination of surgery and chemotherapy.
Receipt of any treatment vs. no treatment	1 (13,889)	1 Strong[49]	-	-	Patients from the most deprived group less likely to receive any treatment.
Variations in the system interval* *					
Length of the referral interval	2 (11,558)	-	1 Strong[54] 1 Weak[53]	-	No impact of deprivation or occupation on the length of the referral interval.
Length of the hospital appointment to diagnosis interval	1 (3067)	-	-	1 Weak[53]	Unclear impact of occupation on the length of the hospital appointment to diagnosis interval.
Length of the secondary care interval	1 (7772)	-	1 Strong[54]	-	No impact of deprivation on the length of the secondary care interval.
Length of the treatment interval	1 (15,495)	-	1 Strong[54]	-	No impact of deprivation on the length of the treatment interval.
Length of the total interval	1 (3067)	-	1 Weak[53]	-	No impact of occupation on the length of the total interval.

*Further information is provided in Appendix S6. * *Further information is provided in Appendix S7.

treatment than the average probability for the cohort [p = 0.032] [49] (Appendix S6).

4.9. Results of studies reporting variations in time to diagnosis or treatment

One study presented unadjusted rates of patients achieving the CWT targets [54]. There were no significant associations between the deprivation quintile and the odds of being seen by a specialist within two weeks of referral [OR 1.57, 95% CI 0.90–2.75], commencing treatment within 31 days of a decision to treat [OR 1.05, 95% CI 0.85–1.30] or commencing treatment within 62 days of initial referral [OR 1.02, 95% CI 0.70–1.49] [54]. (Appendix S7). This study also provided rates of patients achieving each target stratified by stage [54]. Similarly, there were no significant associations between the odds of meeting each target and deprivation quintile when stratified (data not shown).

The other study presented results across three outcomes: referral delay, hospital appointment to diagnosis, and total delay [53]. Patient occupation was only associated with the hospital appointment to diagnosis interval, adjusting for age, marital status and ethnicity [p = 0.001] [53]. Unfortunately, no magnitude or direction of effect was provided (Appendix S7).

Overall, no evidence suggested an association between deprivation or occupation and the system interval [53,54] (Table 3).

5. Discussion

Socioeconomic disparities in survival amongst patients with ovarian cancer are well documented in developed countries [6,7,19,55,56]. Variations in treatment and delays in diagnosis and treatment likely contribute to these survival disparities [14,15]. Two previous systematic reviews, consisting of studies from the United States, identified an unambiguous relationship between socioeconomic status and receipt of guideline ovarian cancer care or treatment [19,57]. Ours is the first systematic review to evaluate the relationship between deprivation; treatments received and the system interval among patients diagnosed with ovarian cancer in the United Kingdom, a country with universal healthcare.

We screened 2873 abstracts and 47 full texts, identifying ten studies that addressed this important area. Eight studies focused on treatments received, and two focused on the system interval. Studies were evaluated for their strength of evidence; three were strong, two were moderate, and five were weak. We found consistent evidence that patients from the most deprived areas were less likely to have surgery or chemotherapy despite accounting for factors such as stage, comorbidity or patient fitness [46,49,50]. Meanwhile, there was equality in the surgical approach and sequencing of treatments (whether surgery was provided upfront and followed by chemotherapy or neoadjuvant chemotherapy was received before surgery) [49,51]. There was no evidence for disparities in the system intervals examined [53,54].

The underlying reasons for inequalities in receipt of surgery and chemotherapy are largely unexplained. Treatment variations between social groups could be attributed to uncaptured comorbidity or frailty. Frailty can be considered a state of vulnerability to external stressors; as such, it is challenging to define and measure [58]. Clinical assessment often estimates a patient's 'performance status', a score which crudely measures patient fitness. However, performance status is subject to physician bias and has been criticised for not comprehensively reflecting a patient's health status or fitness [59]. Furthermore, it is incompletely captured in routinely collected datasets [60]. One study adjusted for performance status and comorbidity, leading to an attenuated effect of deprivation; however, patients from the most deprived group were still less likely to receive treatment than the average probability for the cohort [49]. It therefore seems improbable that differences in patient fitness between social groups are solely responsible for the observed treatment inequalities.

Treatment inequalities were also observed despite the adjustment of stage. Stage was treated as a variable from I-IV in studies that adjusted

for this. However, in clinical practice, stage is divided into subcategories or substages (e.g. IIIA, IIIB and IIIC) [61]. Diagnosing the substage is essential in determining the most appropriate treatment strategy [62, 63]. Some unexplained variation in treatment could be due to this lack of granular information on stage.

5.1. Strengths and limitations

The extensive searches included eight bibliographic databases, forward and backward citation searching, and hand-searching twelve websites. The non-peer-reviewed literature contributed four of the ten studies [45, 47–49], and the authors of two abstracts [37,38] and one thesis [39] were contacted for further information. The process of identifying additional search terms was thorough, and the search strategy was validated using a test set of potentially eligible studies.

The primary objective of this systematic review was to examine the relationship between socioeconomic group, treatments received, and hospital delay. A limitation of the review was the absence of direct measures for socioeconomic status. Instead, proxy measures such as deprivation or occupation were utilised to infer this information. Although these measures are distinct, it is assumed that it is reasonable to accept that the studies were referring to a socioeconomically disadvantaged population, despite employing different methods.

The review only found a limited number of heterogenous studies addressing this area. Studies varied in methodology, populations, and outcomes, precluding the conduct of a meta-analysis. Furthermore, the studies included in this review were predominately characterised by a high risk of bias. More than half of the studies did not adjust for stage [45,47,48,51–53] and no study adjusted for route to diagnosis.

A significant limitation was that patient choice was unaccounted for. Patients must weigh up responsibilities and competing priorities when evaluating treatment options [64]. Financial, employment, and care responsibilities are a few factors that patients must consider. Patients from more deprived areas may be less likely to accept certain toxic treatments considering these competing priorities, especially in cases of marginal benefit.

Experience of shared-decision making is another influential factor in determining patient choice. Patients need to know the different treatment options, and their potential risks and benefits. Patients, therefore, need this information in a manner and format they can understand. Sadly, evidence from the National Cancer Patient Experience Survey has demonstrated that patients from different socioeconomic backgrounds likely experience different levels of involvement with decision-making [65].

There were also specific limitations across the two studies that evaluated the system interval [53,54]. One study examined data from waiting time targets, but the analysis did not account for age, comorbidity or the type of treatment received [54]. Importantly, the waiting time dataset does not include all patients diagnosed with cancer in England. Only 36.4% of patients registered with ovarian cancer between 2009 and 2013 in England were included in this study's evaluation of the two-week wait or 31-day targets [54]. Meanwhile, the only other study to evaluate the system interval was a relatively small cross-sectional questionnaire that relied on patients' recall of dates [53]. Bias would also have been introduced by some patients choosing not to complete the survey. Therefore, the evidence is inconclusive and further research evaluating the system interval is needed.

5.2. Implications for policy and practice

The UK has universal healthcare provided free at the point of access by the National Health Service (NHS). Despite this, we demonstrated that patients from the most deprived areas are less likely to have surgery or chemotherapy. Given the availability of universal healthcare, these inequalities are unexplained and necessitate further research.

These findings will interest policymakers worldwide as inequalities in cancer care have been recognised across many healthcare jurisdictions [19, 66–68]. Tackling cancer inequalities is important for national and international agendas. The UK's national cancer plan, the NHS Long Term Plan ambitions for cancer, committed to reducing variation and inequalities [69]. Furthermore, The World Health Organisation also specifically commits to tackling inequalities such as these and has published specific research priorities to reduce social inequalities in cancer [70]. Understanding where the inequalities are in the pathways of care will, therefore, influence the action taken at a policy level.

The COVID-19 pandemic simultaneously highlighted and exacerbated underlying inequalities in society. There was a dramatic reduction in urgent cancer referrals, particularly amongst those from the most deprived communities [24]. There are also significant concerns about the growing role of the private healthcare sector in cancer diagnostics and the effect this will have by widening inequalities [71]. New therapies, initiatives, and technology may further widen these inequalities if the most affluent are the first to adopt and benefit from these advances [72]. This is particularly important in the era of precision medicine, with significant advances in genomics and systemic anti-cancer treatment regularly arriving in clinical practice. There is evidence of inequalities in the use of novel precision therapies [73].

Although there was no evidence that patients with ovarian cancer from more deprived backgrounds were more likely to experience a prolonged system interval, only two studies addressed this area, and one had a high risk of bias [53,54]. Notably, the diagnosis dates included in these two studies were before 2015, and waiting times for cancer care have significantly lengthened since then [74]. These findings also contrast the results from other studies that have explored the relationship between socioeconomic status and diagnostic and treatment intervals for patients with cancer in Denmark and patients with lung cancer in England [22,75]. Appropriate systems should be in place to monitor the time to diagnosis and treatment for patients with ovarian cancer from more deprived backgrounds.

In the UK, there is a notable lack of awareness regarding the symptoms of ovarian cancer [76,77]. This lack of awareness likely compounds other barriers that lead to delays in the patient interval. These barriers encompass emotional factors, such as fear, practical considerations like time constraints, and service-related challenges, such as difficulties scheduling appointments with primary care providers [77]. Individuals with higher levels of health literacy may find it easier to navigate the healthcare system, and notably, health literacy has been associated with the length of the primary care interval [78].

Importantly, findings from the International Cancer Benchmarking Partnership reveal that patient and primary care intervals are longer in England than in Denmark among women diagnosed with ovarian cancer [17]. This is an important finding given the relatively high proportion of ovarian cancers diagnosed following an emergency presentation in England (32% compared with 24% of all cancers) [79]. Notably, there are inequalities in the proportion of cancer diagnoses made following an emergency presentation for many cancers [10]. These findings underscore the importance of implementing measures that mitigate any disparities experienced in the patient and primary care intervals.

The reasons for the treatment inequalities are likely to be multifaceted and complex. There may be variations in access to specialist care, financial and employment factors, patient choice, and health literacy, all of which warrant further investigation. However, clinicians can mitigate some of the effects of deprivation. Such strategies may include referring patients for pre-rehabilitation, tailoring communication, and ensuring patients know appropriate financial support and transport schemes [80].

Fundamentally, we need to consider the social determinants of health and address the root causes of inequalities across the cancer care continuum. These conditions determine more than 50% of health outcomes; thus, we must tackle the underlying inequalities in the conditions in which we are "born, grow, live, and age" [81,82].

6. Conclusions

In a country with access to universal healthcare, there was consistent evidence of socioeconomic inequalities in receiving surgery and chemotherapy among women with ovarian cancer. These findings are relevant for policymakers, researchers, and clinicians interested in improving cancer care for all patients across healthcare settings. Eliminating inequalities could narrow the survival gap in ovarian cancer survival within and between countries.

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.

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Declaration of Competing Interest

None.

Data Availability

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

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Consent for publication

Not applicable.

Authors' contributions

BPS – conceptualisation, developed search strategy, screening, data curation and formal analysis, project administration and writing – original draft. SG – developed the search strategy, screening, and review of the manuscript. ML – conceptualisation, supervision, review of the manuscript. UM – conceptualisation, developed search strategy, screening, data curation and formal analysis, supervision, and review of the manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jcpo.2023.100458.

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