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Research Paper

Modifiable pre-treatment factors are associated with quality of life in women with gynaecological cancers at diagnosis and one year later: Results from the HORIZONS UK national cohort study

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HIGHLIGHTS

- Quality of life (QOL) declined between diagnosis and 3 months but improved by 12 months.
- Depression, anxiety, living in a more deprived area and comorbidities which limit daily life were associated with worse QOL at baseline and 12 months.
- Higher self-efficacy and being older (50+ years) was associated with better QOL at baseline and 12 months.

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ABSTRACT

Objective. Personalised care requires the identification of modifiable risk factors so that interventions can be implemented rapidly following a gynaecological cancer diagnosis. Our objective was to determine what pre-treatment factors are associated with quality of life (QOL) at baseline (pre-treatment) and 12 months.

Methods. 1222 women with a confirmed diagnosis of endometrial, ovarian, cervical or vulvar cancer from 82 UK NHS hospitals agreed to complete questionnaires at baseline, three and 12 months. Questionnaires included measures of QOL, health, lifestyle, support and self-management. The primary outcome measure was QOL as measured by Quality of Life in Adult Cancer Survivors (QLACS). Sites provided clinical data at baseline, six and 12 months. Linear regression models were constructed to examine the association between baseline characteristics and QOL outcomes.

Results. QOL declined between baseline and 3 months, followed by an improvement at 12 months. Baseline (pre-treatment) factors associated with worse QOL at both baseline and 12 months were depression, anxiety, living in a more deprived area and comorbidities which limit daily activities, whereas higher self-efficacy and age of 50+ years were associated with better QOL.

Conclusions. Depression, anxiety and self-efficacy are modifiable risk factors that can impact on QOL. Screening for these, and assessment of whether comorbidities limit daily activities, should be incorporated in a holistic needs assessment and interventions to improve self-efficacy should be made available. Care can then be personalised from the outset to enable all women with a gynaecological cancer the opportunity to have the best QOL.

1. Introduction

An estimated 1.4 million women were diagnosed with cervical, endometrial, ovarian or vulvar cancer world-wide in 2018, representing 15% of all new cancer diagnoses in women [1]. Improvements in detection and treatment have resulted in greater numbers of women living with and beyond gynaecological cancers: for example, in England and Wales, the 10-year age-standardised net survival increased from 55% to 72% for endometrial cancer and from 18% to 35% for ovarian cancer between 1972 and 2017 [2]. As gynaecological cancer survival rates increase, more women are experiencing this as a complex and ongoing

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disease, with multiple lines of treatment and cycles of recurrence and remission. There is also an increasing number who, although potentially cured, may live with the fear of recurrence and the long-term consequences of treatment [3]. In both scenarios, quality of life (QOL) is likely to be affected in the months and years following a diagnosis.

Globally there is a growing recognition of the need to support people living with and beyond cancer so that the quality of survival can be improved [4]. In the UK, this is operationalised through the NHS Long Term Plan for Cancer which states that "where appropriate every person diagnosed with cancer will have access to personalised care, including needs assessment, a care plan and health and wellbeing information and support." [5]. For women living with a gynaecological cancer, there is a range of significant and long-term physical and psychosocial problems that can impact QOL, both as a result of the cancer itself and its treatment [6–10]. Physical symptoms and issues include those commonly experienced by people living with any cancer, such as pain and fatigue [11], but there are also issues particularly pertinent to this group including the loss of fertility, treatment-induced menopause, sexual dysfunction, bowel and urinary incontinence, and lower limb lymphoedema [6,8–10,12,13]. Commonly reported psychosocial issues include depression and anxiety, fear of cancer recurrence, as well as issues with body image, relationships and sexuality [7,12,14,15].

Longitudinal assessment of QOL following the diagnosis and treatment of a gynaecological cancer enables us to understand long-term outcomes [6]. Previous studies which have examined QOL prior to treatment and over time, report improvements at follow-up when compared to pre-treatment evaluations, including at three [16] and 12 months [12,17,18]. Poor pre-treatment QOL has been associated with post-operative morbidity and hospital re-admission [19]. However, despite several studies describing QOL in women with a gynaecological cancer, few have examined factors associated with it. Understanding determinants of QOL can identify at risk groups, support personalised care during treatment and inform intervention design [14]. Furthermore, recognising who may be at greater risk of poorer outcomes allows follow-up care to be planned appropriately (e.g. the NHS long term plan advocating for risk stratification in the pathway [20]).

The Macmillan HORIZONS Programme [21] was established to assess the impact of cancer and its treatment on people's everyday lives over time, to identify factors associated with recovery and ability to self-manage, and to predict those most likely to need support. This research focus was driven by people affected by cancer [22]. HORIZONS is a national UK prospective longitudinal cohort study comprising three cohorts: breast cancer (women aged under 50 years), non-Hodgkin lymphoma and gynaecological cancers. The gynaecological cohort included 1222 women diagnosed with cervical, endometrial, ovarian or vulvar cancer. All participants were treated with curative intent, recognising that, for some, the chance of cure was low but they may live with disease for several years. HORIZONS involves collection of a range of clinical, socio-demographic and patient-reported psychosocial data, with outcomes reported from before the start of treatment and at set intervals over a number of years. HORIZONS is informed by a conceptual framework of recovery of health and wellbeing following a diagnosis of cancer and its treatment. [21]. The conceptual framework assumes that personal, environmental, clinical and lifestyle factors will influence how disruptive cancer and its treatment are to an individual's health and well-being. The unique contribution of the HORIZONS conceptual framework is that it combines the perspective of the individual (including factors present prior to cancer treatment), a social network approach and consideration of how people self-manage the demands placed on them by cancer, and their capacity and confidence to do this [21]. The framework is built on empirical evidence and its component parts are well established in the literature and reflect the priorities of people living with and beyond cancer. While other published studies look at quality of life over time, they do not include the range of measures included in HORIZONS, chosen to reflect the dynamic, multifaceted recovery process from before the start of treatment. These features of the HORIZONS Programme make it unique and permit a thorough investigation of the determinants of key outcomes for people living with and beyond cancer, including QOL.

The primary outcome measure was the Quality of Life in Adult Cancer Survivors (QLACS) scale [23]. We also measure QOL using the European Organisation for Research and Treatment of Cancer (EORTC) QLQ-C30 [24]. Whilst there is some overlap in the issues covered by these instruments, the QLQ-C30 was originally developed for use in clinical trials and focuses on QOL during treatment, whereas QLACS was developed to assess QOL among cancer survivors so includes issues relevant to QOL beyond treatment. This paper reports on QOL assessed before starting treatment (baseline), and at three and 12 months post-study entry. We aim to answer the following:

1. What pre-treatment factors are associated with QOL at baseline?
2. What pre-treatment factors are associated with QOL at 12 months?

Based on the conceptual framework [19] and our previous research with colorectal cancer patients [25,26], we hypothesised that adequate self-efficacy (a person's confidence to achieve particular goals in living with or managing problems associated with illness [27]) would be a key protective factor whilst depression would be a key risk factor for poor QOL.

2. Method

2.1. Participants and procedure

Women with a confirmed diagnosis of endometrial, ovarian, cervical or vulvar cancer who were due to receive primary treatment with curative intent were recruited from 57 NHS sites (82 hospitals) across the UK, between September 2016 and March 2019 [21]. Detailed eligibility criteria are provided in the supplementary material (S1). The stages of included cancer types were limited to those where treatment was given with curative intent, even if the chances of cure were low, in order to assess the longer-term impact of a cancer diagnosis and treatment. FIGO stages IA to IIIA1 for ovarian cancer; IA to IIIC2 for endometrial cancer; IA2 to IIIB for cervical cancer and IA to IIIC for vulvar cancer were included. Women with pre-malignant conditions were excluded. Rare gynaecological tumours were excluded as it was anticipated that insufficient numbers would be recruited to make any meaningful conclusions and a separate focused study may be more appropriate.

Women were consented prior to receiving any treatment, except in cases where a confirmed diagnosis could only be made at the time of surgery. These participants entered the study following a confirmed surgical diagnosis.

Baseline questionnaires were completed by participants at study entry, with follow-up questionnaires sent to participants three and 12 months later, following status checks to ensure this was appropriate. Case Report Forms (CRFs) were completed by NHS site staff at baseline, then six and 12 months later.

Ethical, legal and governance approvals were obtained from the UK Health Research Authority, Health Care Research Wales, Health and Social Care Trusts in Northern Ireland and NHS Research Scotland (REC Ref: 16/NW/0425; IRAS: 202342) and all participants provided written informed consent.

2.2. Measures

A range of validated and study-specific outcome measures were selected informed by the study's conceptual framework and following discussions with patient representatives and clinical experts [21] (supplementary material S2). At baseline, participants provided socio-demographic data (including gender, ethnicity, domestic status, household make-up, level of education reached and caring responsibilities), socioeconomic data (including employment, income, state benefits, pension, and accommodation) and lifestyle data (including height,

weight, smoking, vaping, alcohol consumption, diet and exercise). Measures of participants' general health status, social support, social integration, health literacy, self-efficacy, resilience and ability to navigate health services were also included. Physiological, clinical and treatment data were collected from medical records (including age, cancer type, tumour grade, cancer stage and ECOG performance status), and participants' postcodes were used to obtain Indices of Multiple Deprivation.

The primary outcome is QLACS [23], which comprises 47 items grouped into 12 domains, seven of which are generic and five cancer-specific. Each item is rated on a seven-point scale. The Generic Summary Score (QLACS-GSS), based on scores from items in the seven generic domains (cognitive problems, energy/fatigue, negative feelings, pain, positive feelings, sexual function, sexual avoidance), was used in analyses. A lower QLACS-GSS score corresponds to better QOL. We also used the EORTC QLQ-C30 [24] to assess QOL. The EORTC QLQ-C30 comprises 30 items, with most items rated using a four-point scale. A summary score, based on 27 of the 30 items drawn from the five functioning scales (physical, role, cognitive, emotional and social) and eight symptom scales (dyspnoea, pain, fatigue, insomnia, appetite loss, nausea and vomiting, constipation and diarrhoea) [28], was used in the analyses. A higher summary score corresponds to better QOL.

2.3. Analysis

t-tests were used to compare QOL scores at each time point. The baseline characteristics of participants who participated at baseline and at 12 months were compared using either Pearson's chi-square tests for categorical measures or *t*-tests for approximately-normally distributed continuous measures.

Linear regression models were constructed to examine the association between baseline characteristics and QLACS-GSS at baseline (model one), QLQ-C30 summary score at baseline (model two), QLACS-GSS at 12 months (model three), and QLQ-C30 summary score at 12 months (model four). Complete case analysis was applied in each model, i.e. only participants for whom there were no missing data for the baseline characteristics and outcome were included. Residual tests for normality and standard error robustness checks were conducted on each model. We did not adjust for ethnicity owing to the small proportion of participants who were not White British.

A p-value <0.05 was considered statistically significant. All statistical analyses were performed using STATA version 15.1.

3. Results

Fig. 1 shows the flow of participants through the study. All patients presenting with a gynaecological cancer in the timeframe of the study were screened. Reasons for declining to take part included being too busy, not wanting to take part in research, not wanting to complete questionnaires, feeling too anxious or distressed or ill, privacy concerns, and not wanting to be reminded of diagnosis. The demographic profile of people who declined to participate was similar to those who consented. The mean age of those who declined was 63, and of those who consented was 61 and there was no difference in ECOG status. Decliners were slightly more likely to have Stage 3 cancers (15%, as opposed to 10% of consenters) and less likely to have Stage 1 cancers (69%, as opposed to 76% of consenters). We cannot exclude the fact that there could have been differences in baseline and 12 month QOL measures between those that did and did not respond.

The response rate for questionnaires was 80% at baseline and 59% at 12 months. Medical details, collected by CRFs, were received for 100% of those eligible at baseline and 99% at 12 months. Most participants were from England (82%), with 13% from Wales, 3% from Scotland and 2% from Northern Ireland. In most cases, participants completed the baseline questionnaire before any treatment, but this was not possible for 28% of participants, as a confirmed diagnosis could only be made at the time of surgery.

The baseline characteristics of the sample are shown in Table 1. The proportion of participants with each cancer type was consistent with what would be expected in a mixed gynaecological sample, with the majority having endometrial cancer and fewest diagnosed with vulvar cancer. The majority of participants had an ECOG performance status of either 0 or 1, indicating good functioning. About half had at least one comorbidity which they reported limited the activities they did on a typical day. Participants lived in areas from all five quintiles of deprivation. Participants were scored as having lower socio-economic status (SES) if they were unemployed or on benefits (excluding child benefit), were renters, or lacked access to a car or to the internet. Just under half of participants reported one or more of these indicators. The majority had a BMI of ≥25 indicating they were overweight or obese. About half reported being physically active and most had never smoked. Most participants lived with others, although less than 20% felt they were fully supported socially. About a third had caring responsibilities. The majority of participants were treated with surgery (90%), 27% received chemotherapy and 21% radiotherapy. While these treatment figures were not baseline characteristics, they were included in the regression models for completeness. A higher proportion of women aged 50+ years at baseline went on to complete the 12-month questionnaire compared to those who did not (supplementary material, S3). There were no other significant differences in the baseline characteristics of those who responded at 12 months and those that did not (supplementary material, S3 and S4).

3.1. Quality of life

Summary statistics for the QLACS-GSS and the QLQ-C30 summary score in the first 12 months from diagnosis are shown in Fig. 2. On both measures, QOL was significantly worse 3 months post diagnosis compared with baseline. By 12 months, the QLQ-C30 summary score was significantly better than it was at baseline. Although the QLACS-GSS was lower (indicating better QOL) at 12 months compared with 3 months, this difference was not quite significant ($p = 0.057$), and it had not returned to baseline levels.

The results from the four regression models are summarised in Fig. 3: only significant variables are shown and, for ease of interpretation, QLACS-GSS axes have been reversed so that bars to the right of zero indicate better QOL for both measures. Final models are presented in the supplementary material (S5- S7).

3.2. Model one: association between baseline characteristics and QLACS-GSS at baseline

For the QLACS-GSS, where a higher score corresponds to worse QOL, having either one (4.57 95% CI 1.60, 7.54) or two or more (5.54 95% CI 2.21, 8.87) *limiting comorbidities* and were associated with an increase in QLACS-GSS (worse QOL) at baseline. A one unit increase in *HADS anxiety score* and *HADS depression score* was associated with an increase in QLACS-GSS of 1.05 (95% CI 0.71, 1.39) and 2.79 (95% CI 2.25, 3.32), respectively i.e. worse QOL.

A lower QLACS-GSS (better QOL) at baseline was associated with being *obese* (-4.54 95% CI -7.64, -1.44), being *over the age of 50* (-8.21 95% CI -11.74, -4.69) and being *physically active* (-4.29 95% CI -6.87, -1.72). Better *health status* and greater *self-efficacy* were also associated with better QOL: a one unit increase on the EQ-5D was associated with a decrease in QLACS-GSS score of 0.29 (95% CI -0.36, -0.22) and a one unit increase in self-efficacy was associated with a decrease in QLACS-GSS score of 1.39 (95% CI -2.27, -0.52).

3.3. Model two: association between baseline characteristics and QLQ-C30 summary score at baseline

For the QLQ-C30 summary score, where a lower score corresponds to worse QOL, having either one (-2.86 95% CI -4.77, -8.94) or two or

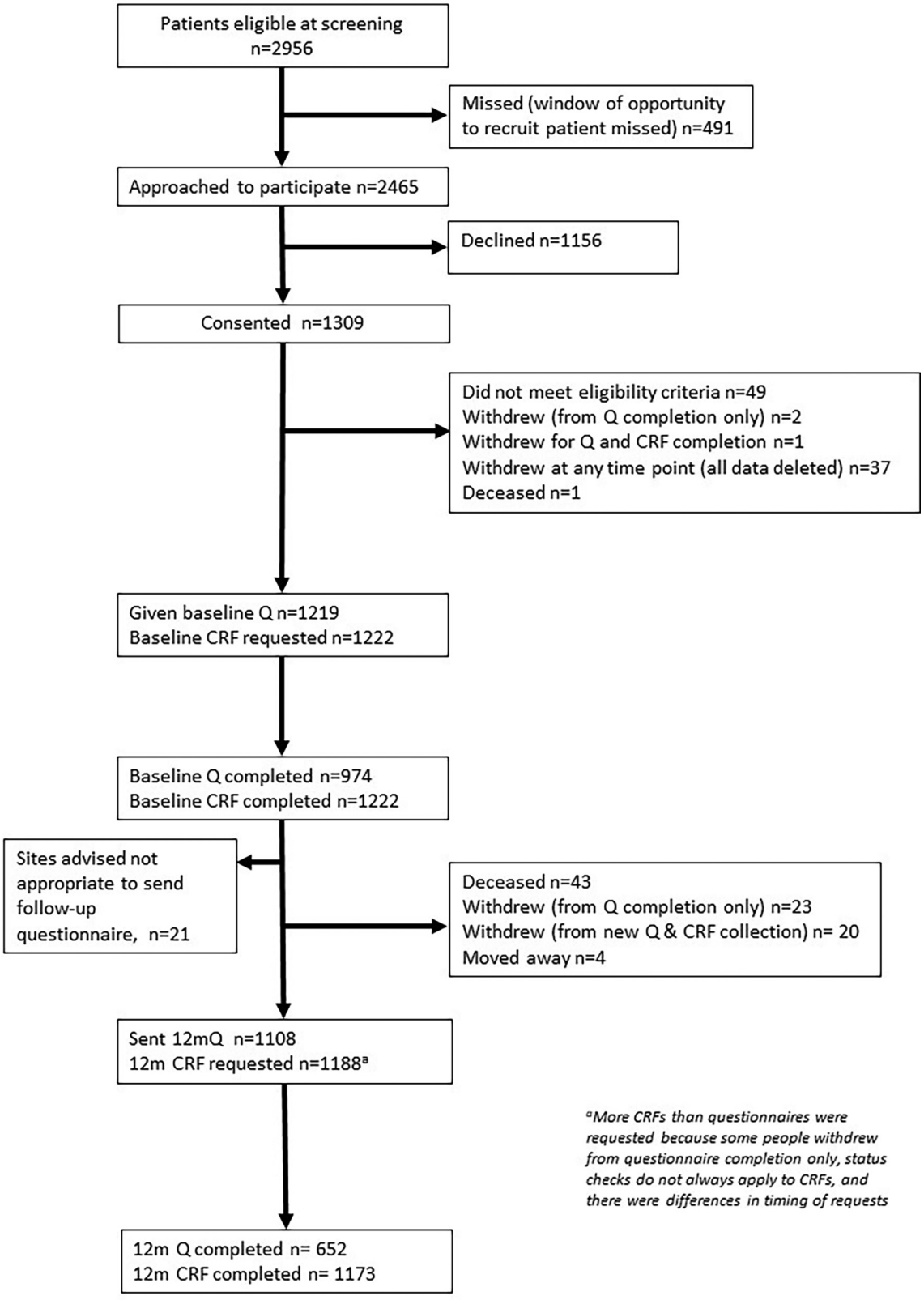

Fig. 1. Participant flowchart.

more *limiting comorbidities* (-4.49 95% CI -6.64, -2.35), and *cancer stage* two or above (-1.93 95% CI -3.94, 0.08) was associated with lower scores at baseline. A one unit increase in the *HADS anxiety score* and *HADS depression score* was associated with a decrease in QLQ-C30 summary score of 0.36 (95% CI -0.58, -0.13) and 1.92 (95% CI -2.28, -1.57), respectively. Finally, being in the most *deprived* quintile was associated with a decrease in QLQ-C30 summary score of 4.19 (95% CI -6.68, -1.70).

Table 1
Baseline characteristics of recruited participants.

	Number	Percent
Age (years) n = 1222		
49 and below	209	17.10
50 +	1013	82.90
Mean age = 61, SD = 13.26		
Cancer type n = 1222		
Ovarian	158	12.93
Endometrial	811	66.37
Cervical	214	17.51
Vulvar	39	3.19
Tumour grade n = 1222		
1	509	41.65
2	301	24.63
3	359	29.38
Unknown	53	3.19
Cancer stage n = 1222		
1	903	73.90
2 or 3	291	23.81
Unknown	28	2.29
ECOG status n = 1222		
0	664	54.34
1	467	38.22
2 +	30	2.45
Unknown	61	4.99
Limiting comorbidities n = 974		
0	477	48.92
1	246	25.33
2 +	251	25.74
Ethnicity n = 974		
White British	900	92.40
Other White Background	38	3.90
Asian/Asian British	12	1.23
Other Ethnic Background	15	1.54
Unknown	9	0.92
Domestic status n = 974		
Married/civil partnership	561	57.60
Single/separated/divorced	400	41.07
Unknown	13	1.33
Deprivation index n = 1222		
1st quintile (most deprived)	174	14.24
2nd quintile	271	22.18
3rd quintile	258	21.11
4th quintile	250	20.46
5th quintile (least deprived)	262	21.44
Unknown	7	0.57
Socioeconomic status n = 974		
0 (Higher SES)	544	55.85
1	244	25.05
2 + (Lower SES)	181	18.58
Unknown	5	0.51
Education n = 974		
Higher than compulsory	658	67.56
Compulsory or lower	270	27.72
Unknown	46	4.72
Body Mass Index (kg/m^2) n = 1222		
Underweight (<18.5)	14	1.15
Healthy weight (18.5–24.9)	234	19.15
Overweight (25–29.9)	254	20.79
Obese (30–39.9)	367	30.03
Severely obese (40 +)	156	12.77
Unknown	197	16.12
Exercise n = 974		
Active	470	48.25
Inactive	459	47.13
Unknown	45	4.62
Smoking status n = 974		
Never	587	60.27
Current smoker	76	7.80
Ex-smoker	297	30.49
Unknown	14	1.44
Social support n = 974		
Not full support (MOS-SSS ;less than100)	794	81.53
Full support (MOS-SSS = 100)	174	17.86
Unknown	6	0.61
Live alone n = 974		
No	775	79.57
Yes	198	20.33
Unknown	1	0.10
Caring for anyone n = 974		
No	649	66.63
Yes	320	32.85
Unknown	5	0.51

Like the QLACS-GSS, higher QLQ-C30 summary scores (better QOL) at baseline were associated with better *health status* (measured by EQ-5D) and *self-efficacy*. A one unit increase in EQ-5D was associated with an increase in QLQ-C30 summary score of 0.16 (95% CI 0.12, 0.21) and a one unit increase in self-efficacy was associated with an increase in QLQ-C30 summary score of 0.81 (95% CI 0.24, 1.38). Being *single, separated or divorced* (2.08 95% CI 0.09, -4.08) or being *obese* (2.10 95% CI 0.02, 4.18) were also associated with higher QLQ-C30 summary scores (better QOL).

3.4. Model three: association between baseline characteristics and QLACS-GSS at 12 months

Having either one (7.25 95% CI 2.11, 12.39) or two or more (13.89 95% CI 8.33, 19.45) *limiting comorbidities* and *tumour grade* three (6.80 95% CI 1.06, 12.54) were associated with a higher score (worse QOL) on the QLACS-GSS at 12 months. Having a lower *SES* (defined as an SES score of two or more (see S2)) was associated with an increase in QLACS-GSS of 8.85 (95% CI 2.07, 15.64) i.e. worse QOL. A one unit increase in *HADS anxiety score* and *HADS depression score* was associated with an increase in QLACS-GSS of 0.62 (95% CI 0.04, 1.23) and 1.86 (95% CI 0.92, 2.79), respectively. Two baseline characteristics were associated with a lower QLACS-GSS at 12 months (better QOL): being *over the age of 50* (-11.83 95% CI -18.89, 4.78); and a higher *self-efficacy* score (-2.90 95% CI -4.33, -1.47). Being treated with surgery following cancer diagnosis was also associated with a lower QLACS-GSS at 12 months (better QOL) (-10.21 95% CI -19.09, -1.33).

3.5. Model four: association between baseline characteristics and QLQ-C30 summary score at 12 months

Baseline characteristics that were associated with a lower QLQ-C30 summary score (worse QOL) at 12 months include having either one (-4.60 95% CI -7.26, -1.94) or two or more (-8.54 95% CI -11.41, -5.67) *limiting comorbidities* and being *obese* (-2.84 95% CI -5.64, -0.04). A one unit increase in *HADS depression score* was associated with a decrease in QLQ-C30 summary score of 0.98 (95% CI -1,46, -0.50). Living in the most *deprived* quintile (-4.66 95% CI -8.49, -0.84) and having a lower *SES* (-6.35 95% CI -9.85, -2.84) were both associated with worse QOL at 12 months. Two baseline characteristics were associated with a higher QLQ-C30 summary score (better QOL) at 12 months: a one unit increase in *self-efficacy* was associated with an increase in QLQ-C30 summary score of 1.81 (95% CI 1.07, 2.55). Receiving surgery as a treatment was also associated with an increase in QLQ-C30 summary score (5.78 95% CI 1.19,10.37).

4. Discussion

HORIZONS is the first prospective cohort study of women diagnosed with a gynaecological cancer, recruited at the point of diagnosis, examining an extensive range of factors and outcomes based on a conceptual framework. While our findings are consistent with other studies that link psychosocial status at diagnosis to QOL in the long term [15], this study is important because it provides evidence to support the delivery

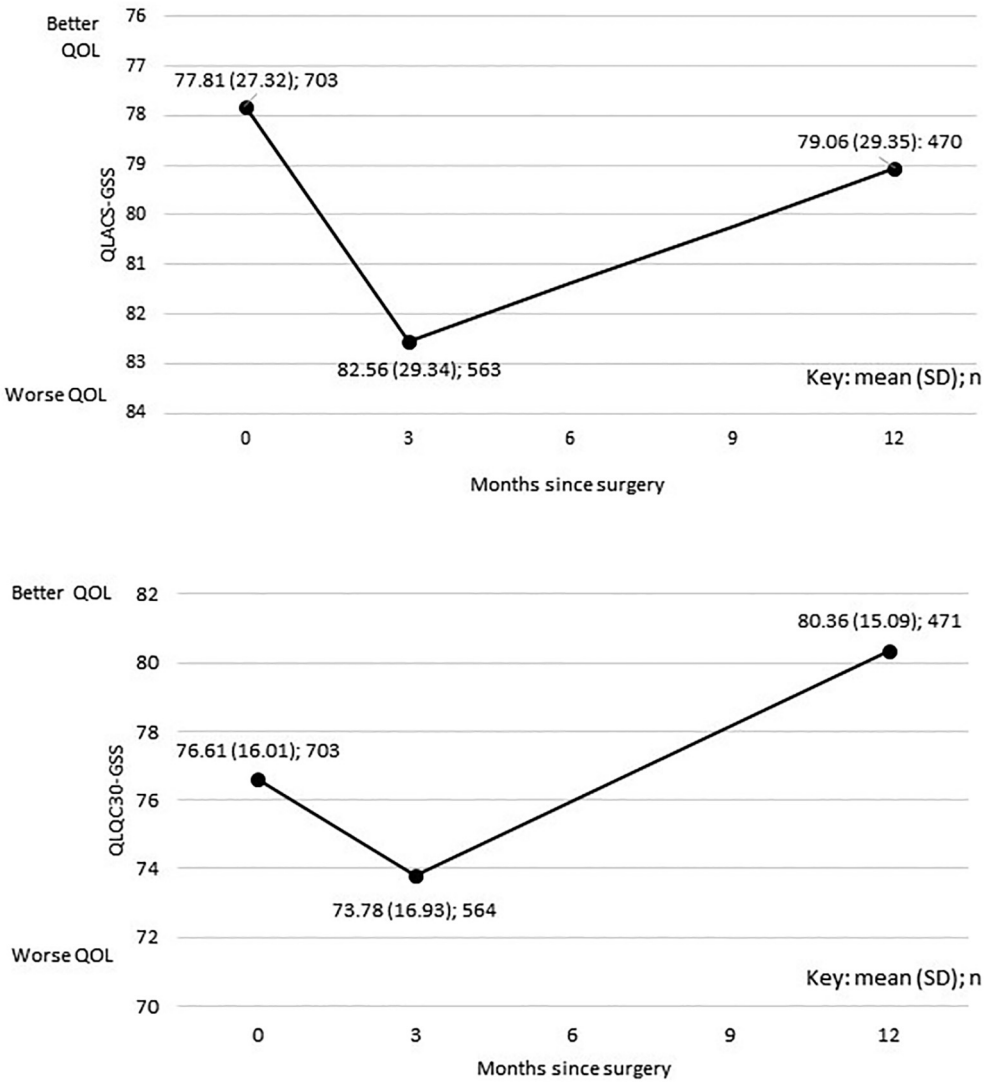

Fig. 2. Quality of life in the first year.

of personalised care by identifying who is likely to experience reduced quality of life in the first year following diagnosis and therefore who may need extra support. We have identified pre-treatment factors which are associated with patient-focussed outcomes and are amenable to change which should inform targeted interventions.

For the cohort as a whole, there was a significant reduction in QOL between baseline and 3 months. The results at 12 months differed slightly depending on which instrument was used to assess QOL. On the QLACS-GSS, although QOL improved between three and 12 months, the difference was not statistically significant and QOL did not return to baseline levels. On the QLQ-C30 summary score, QOL was significantly better at 12 months compared to baseline. Whilst the QLQ-C30 summary score includes some scales which are likely to have long term applicability, it also includes symptoms which are more prevalent during the treatment phase, e.g. nausea and vomiting. The QLACS-GSS was developed specifically to evaluate QOL in longer term survivors and so covers some additional areas, such as sexual functioning. It also frames some items in terms of how bothersome a symptom or issue is rather than whether it is simply present or absent. Although the QLACS-GSS and the QLQ-C30 summary score are both useful QOL tools, it may be that the QLACS-GSS is more sensitive to longer term QOL issues than the QLQ-C30 summary score. These findings serve as a reminder of how QOL tool selection can influence results, the importance of selecting the right instrument depending on purpose and the benefit of using complementary measures.

Clinicians may find it helpful to share the QOL trajectories with patients, so they know what, "on average", to expect, including the dip in QOL at 3 months. Of course, it is important to explain to patients that there are individuals whose QOL does not follow the same pattern. In addition, the regression models can potentially help clinicians identify women at risk of worse QOL around diagnosis and at 12 months.

At baseline, factors associated with worse QOL for both outcome measures were limiting comorbidities, anxiety and depression. In addition, having a cancer stage >1 or living in the most deprived areas were associated with low QLQ-C30 summary scores. Women with a better self-reported health status and higher self-efficacy had better QOL on both measures, and unexpectedly, so did women who were obese. Previous research in a mixed gynaecological sample has found that obesity is associated with worse QOL [29]. We also found that being single/separated/divorced was associated with a higher QLQ-C30 summary score, being older than 50 years and being physically active were associated with better QOL as assessed by the QLACS-GSS, consistent with a previous longitudinal study which found that younger women with gynaecological cancer reported lower QOL than older women [30]. Some of these findings may be due to the women with endometrial cancer, who made up about two thirds of the total cohort. They were more

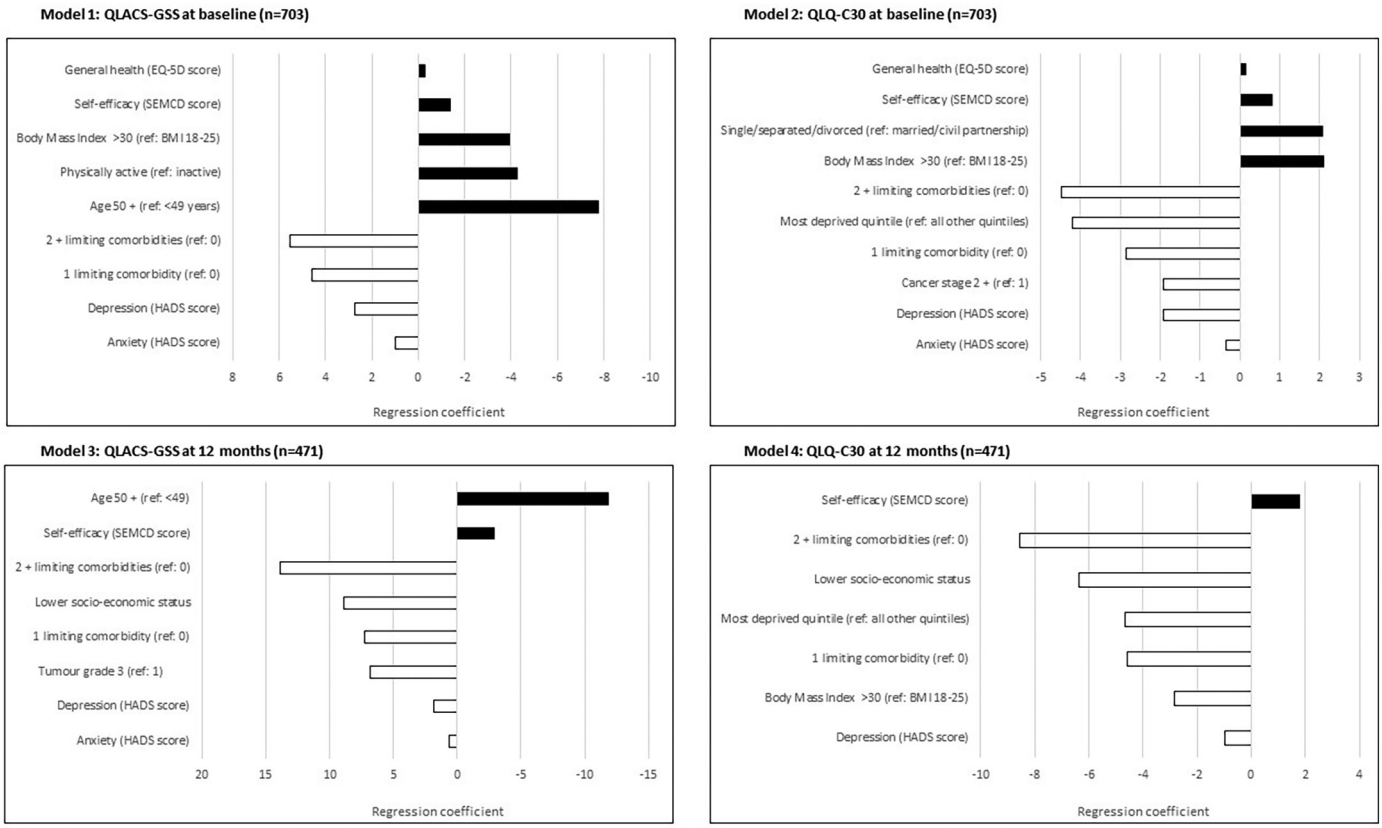

Fig. 3. Significant baseline characteristics associated with quality of life at baseline and 12 months.

likely to be older and obese, and they tended to be diagnosed at an earlier stage. Details are shown in the supplementary material, Tables S5 and S6.

At 12 months, baseline factors associated with worse QOL on both measures were limiting comorbidities, depression and low SES. In addition, being obese or living in the most deprived areas at baseline were associated with worse QOL (lower QLQ-C30 summary scores) at 12 months. A grade 3 tumour was associated with worse QOL as assessed by the QLACS-GSS at 12 months. The different findings for obesity at baseline and 12 months suggest that obese women tolerated treatment less well. An example of the potential impact of obesity is that just 54% of women with endometrial cancer who were morbidly obese had a laparoscopic hysterectomy compared with 63% of those who were not morbidly obese. Obesity has also been associated with worse QOL in previous studies with endometrial cancer survivors [31]. High self-efficacy at baseline was associated with better QOL on both measures at 12 months. Being older than 50 years at baseline was associated with better QOL at 12 months as assessed by the QLACS-GSS.

While not a baseline characteristic, we included mode of treatment received within 6 months of baseline in our regression analysis. We found that having surgery was associated with better QOL at 12 months on both QOL measures. We suggest that the small minority of participants who did not receive surgery may have been less fit than those who did receive surgery, and that this may then be reflected in poorer QOL at 12 months.

Our findings support the hypothesis that self-efficacy is a key protective factor for QOL: it was a significant factor for both measures and at both time points. Women with higher self-efficacy may experience the same challenges as women with lower self-efficacy, but they are more confident about managing and/or resolving those challenges. Our research has previously demonstrated the link between self-efficacy and recovery of health and wellbeing post cancer treatment in people diagnosed with colorectal cancer, and that without intervention, self-efficacy levels do not change [25,26,32]. However, self-efficacy is amenable to change, and interventions designed to improve levels of self-efficacy soon after diagnosis could be beneficial in both the short and longer term [33].

Our findings also support the hypothesis that depression is a key risk factor for poor QOL: poor mental health, as assessed by the HADS, was identified as a factor for putting women at risk for poor QOL at baseline and at 12 months. Comorbidities which limit everyday life were also a key risk factor. The most common reported comorbidity which impacts everyday life was osteoarthritis, followed by depression (as diagnosed by a health professional) and asthma. These conditions are all treatable, as long as they are identified. Our previous research with colorectal cancer patients also found that poor mental health and comorbidities which limit everyday life were associated with poor outcomes [25,26,34]. The findings highlight the need for individually tailored care plans that address all modifiable factors for women with complex needs.

Being active was associated with better QOL at baseline as measured by the QLACS-GSS. The influence of lifestyle factors on treatment tolerance and recovery, and the importance of intervening pre-treatment, are now getting increased recognition through the move to include prehabilitation in routine cancer care [35]. Prehabilitation comprises physical and psychological assessments carried out following diagnosis but before the start of acute treatment to "…establish a baseline functional level, identify impairments, and provide interventions that promote physical and psychological health to reduce the incidence and/or severity of future impairments" [36]. While there are few published studies on prehabilitation specifically for gynaecological patients, multimodal prehabilitation programmes specifically for this group are now being developed [37].

Finally, some factors associated with poor QOL, such as low socioeconomic status and living in a deprived area, confirm the significant consequences of inequality on health outcomes. In order to deliver personalised care, it is important that clinicians are aware of the impact these factors, and social factors, such as having caring responsibilities, have on outcomes. To help ameliorate the impact of such factors, clinicians can signpost people living with and beyond cancer to agencies to provide the necessary support e.g. advice about financial aid.

The data in this study were collected before the COVID-19 pandemic. Some of the identified risk factors for poor QOL are likely to have been exacerbated by the pandemic and ongoing service changes.

4.1. Strengths and limitations

The strength of this analysis lies in its unique dataset: a large national prospective cohort study, with inclusion/exclusion criteria based solely on diagnostic criteria, meaning the included sample is more representative of the population than clinical trials. However, despite the aim to include representative population sample the ethnic diversity of those included does not reflect that of the UK population. This needs to be addressed in future studies that specifically aim to investigate QOL in different ethnicities and tackle barriers to trial inclusion in these populations. Participants were recruited at diagnosis, which permitted collection of baseline data before the start of treatment. Follow-up of the study cohort is ongoing and will allow further investigation of QOL in the years following diagnosis.

The inclusion of different gynaecological cancers is both a strength – giving a voice to women with rarer diagnoses – but also a limitation as the cancers are different in prognosis and behaviour and there are differences in the patient demographics.

In common with other long-term cohort studies, particularly those which collect large amounts of data directly from participants, there was a reduction in participation levels over time. The response rate to questionnaires at 12 months was 59%; this compares to rates of between 37.7% and 95.6% in other gynaecological cancer cohort studies of varying study design [12,14,18]. Descriptive analyses were used to compare decliners and consenters and also the differences between those who responded at 12 months and those who did not. Decliners and consenters were similar by cancer type, age and ECOG status but differed by cancer stage, with consenters more likely to have Stage 1 cancers. There was no significant difference between responders at 12 months and non-responders regarding ECOG status. However, compared to non-responders at 12 months, responders were more likely to have endometrial cancer and more likely to be aged 61–70 years. Differences between responders and non-responders were controlled for in the regression analysis.

4.2. Implications for clinical practice

We recommend that every woman with a diagnosis of gynaecological cancer is screened for depression, anxiety and self-efficacy to manage the consequences of cancer and its treatment soon after diagnosis and offered appropriate psychological support. An assessment of whether comorbidities limit daily activities should also be carried out and a care plan, tailored to the individual, should be developed and reviewed regularly to support the delivery of personalised care. Extra support may be required for younger women, those with low socioeconomic status and those who live in deprived areas, along with additional effort to promote existing interventions and support. These activities could form part of a holistic needs assessment and could be included in a prehabilitation programme.

5. Conclusion

The results from this unique study have identified poor mental health and comorbidities which limit everyday life as key risk factors for poor QOL at diagnosis and 12 months later. The key protective factor is self-efficacy.

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Appendix A. Supplementary data

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