

Quality of Life Following Treatment for Cervical and Endometrial Cancer: A Patient-Reported EORTC Analysis from Slovakia

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Abstract

Background

Cervical and endometrial cancers remain major public health concerns despite advances in prevention and treatment. Cervical cancer is largely preventable through HPV vaccination and screening, whereas endometrial cancer incidence continues to rise, particularly among postmenopausal women. Both malignancies and their treatments can profoundly affect quality of life (QoL) and survivorship outcomes. This study evaluated QoL among Slovak women after treatment for cervical and endometrial cancer and identified factors associated with post-treatment well-being.

Methods

A cross-sectional patient-reported outcome study was conducted. A total of 127 women treated for gynaecologic malignancies were included, comprising 74 patients with endometrial cancer and 53 patients with cervical cancer. Participants completed a one-time assessment using the EORTC QLQ-C30 questionnaire together with the disease-specific modules QLQ-EN24 and QLQ-CX24. Disease stages ranged from IA2 to IIIC1 in cervical cancer patients and from IA to IIIC2ii in endometrial cancer patients according to the FIGO classification systems. Eligible participants had histologically confirmed malignancy, ECOG 1–2, and completed primary treatment 6–60 months prior to survivorship assessment. Statistical analyses included Mann–Whitney U tests, Friedman’s ANOVA, and multiple linear regression with significance at $p \leq 0.05$.

Results

The mean age was 57.6 years for endometrial and 49.1 years for cervical cancer patients. All patients underwent surgery, followed by no adjuvant treatment in 29.9%, chemotherapy in 10.3%, radiotherapy in 25.2%, and combined chemoradiotherapy in 34.6% of cases. In cervical cancer patients, the highest QoL scores were observed in cognitive (85.0) and emotional (85.0) functioning, while social and role functioning were moderately affected. Fatigue, financial difficulties, and sexual/vaginal problems were among the most frequently reported symptoms. Among endometrial cancer patients, cognitive (83.9) and physical (77.7) functioning were best preserved, whereas social functioning (52.6) was lowest; insomnia and fatigue were frequently reported. Treatment-related analyses showed that chemotherapy was associated with significantly lower QoL in endometrial cancer patients ($p < 0.001$), while radiotherapy was associated with lower sexual enjoyment ($p < 0.05$). In multivariable analyses, chemotherapy was associated with lower overall health and QoL in both cancer cohorts (cervical: $p = 0.047$; endometrial: $p < 0.001$), whereas radiotherapy was positively associated with overall health and QoL among cervical cancer patients ($p = 0.042$). Increasing age was independently associated with lower overall health and QoL among endometrial cancer patients ($p = 0.041$).

Conclusions

Although physical and emotional functioning were generally preserved, women treated for cervical and endometrial cancer continued to experience significant supportive care needs related to fatigue, social functioning, and sexual health. Chemotherapy showed the strongest association with impaired quality of life. These findings support the implementation of multidisciplinary supportive care programs focused on symptom management, psychosocial support, sexual rehabilitation, and long-term quality-of-life optimization.

1. Introduction

The incidence of cervical cancer is largely preventable through effective screening programs and widespread vaccination against the human papillomavirus (HPV). However, the global burden of this disease remains substantial, particularly in countries with limited access to preventive healthcare. In 2020, approximately 604,000 new cases and 342,000 deaths from cervical cancer were reported worldwide, with incidence and mortality expected to increase in the coming years [1]. In Slovakia, 440 new cases and 130 deaths were registered in 2022 [2]. Recent modelling studies further suggest that global inequalities in cervical cancer burden may continue to increase without intensified HPV vaccination and screening strategies, especially in regions with insufficient preventive coverage and limited healthcare resources [3].

Endometrial carcinoma is one of the most common gynaecological malignancies and is strongly associated with hormonal factors, particularly prolonged oestrogen exposure. The disease is typically diagnosed in postmenopausal women and generally carries a favourable prognosis when detected at an early stage [4]. Globally, an estimated 440,000 new cases and 102,000 deaths from endometrial cancer were reported in 2022 [5], with incidence expected to rise further in the coming decades [6]. Similarly, the incidence of endometrial cancer in Slovakia has steadily increased, with 590 new cases and 190 deaths reported in 2022 [2]. These trends are expected to place increasing pressure not only on oncological treatment capacity but also on survivorship care and quality-of-life management [7].

Early detection and prevention of cervical cancer through cytological and HPV-based screening and vaccination remain key strategies for reducing both incidence and mortality. Appropriate surgical and adjuvant treatment approaches may further improve overall and disease-free survival. In contrast, early detection of endometrial carcinoma remains challenging because no reliable population-based screening strategy is currently available. Therefore, recognition of precancerous lesions and careful assessment of individual risk factors remain essential, particularly in women requiring regular gynaecological surveillance with transvaginal ultrasound and, when indicated, endometrial biopsy.

Patients with cervical and endometrial malignancies frequently experience treatment-related complications that substantially impair long-term quality of life (QoL) and survivorship outcomes. Arthur et al. [8] demonstrated that physical health and social relationships represent some of the most

negatively affected QoL domains in these patients. Shirali et al. [9] further reported significant differences in emotional, cognitive, sexual, and overall QoL between gynaecologic cancer groups, with many patients experiencing anxiety and depression. In cervical cancer survivors, QoL is additionally influenced by factors such as educational level, disease stage, marital status [10], and treatment modality. Radical surgery and concurrent chemoradiotherapy may result in pelvic fibrosis, vaginal shortening, lymphatic dysfunction, sensory impairment, chronic pelvic pain, vaginal dryness, and substantial disturbances in sexuality and emotional well-being. Consequently, a multidisciplinary approach involving physicians, nurses, psychologists, nutritionists, and pain specialists is essential for the holistic care of these patients [11]. Recent multidisciplinary oncological approaches further emphasize that optimal cervical cancer management requires coordinated collaboration among oncologists, surgeons, radiologists, psychologists, specialized nurses, and supportive-care teams in order to balance oncological efficacy with long-term survivorship-related functional and psychosocial outcomes [12]. Contemporary evidence further indicates that substantial disparities in preventable and treatable cancer mortality persist worldwide, particularly in cervical cancer care across low- and middle-resource settings [13]. The implementation of such modern survivorship-oriented strategies requires systematic QoL assessment at both institutional and national levels to optimize supportive care and improve patient outcomes.

The marked increase in endometrial cancer incidence over the past three decades has highlighted the need for deeper evaluation of survivors' QoL [14]. A meta-analysis by Shisler et al. [15] demonstrated that obesity, surgical approach, adjuvant therapy, and time since treatment completion significantly influence QoL in endometrial cancer survivors. Interestingly, surgical radicality itself does not appear to strongly affect perceived QoL, whereas adjuvant chemotherapy and radiotherapy remain major determinants of post-treatment well-being [16]. Given the predominance of pelvic symptoms and sexual dysfunction, proactive strategies aimed at improving sexual health, long-term QoL, and survivorship well-being are essential. Such approaches require multimodal physical and psychological interventions coordinated by sexologists, oncology nurses, and psychologists [17]. Similar patterns of impaired social, role, and sexual functioning, together with persistent symptom burden, were previously identified in Slovak breast cancer survivors using EORTC methodology, further highlighting the need for systematic QoL surveillance and supportive oncology strategies in Central and Eastern Europe [18].

Implementing modern patient-centred practices in Slovakia requires systematic assessment of quality of life across gynaecological oncology centres as well as at the national level. This approach may help guide supportive-care planning and survivorship-oriented management strategies aimed at improving quality of life in women with gynaecological cancers. To initiate this process in Slovakia, detailed evaluation of current QoL surveillance and treatment-related consequences remains necessary. Given the scarcity of comprehensive analyses in Slovakia and the prevalence of uterine malignancies among women in the Slovak population, our study focuses on evaluating quality of life in Slovak cervical and endometrial cancer patients using comparable methodologies. The growing importance of patient-reported outcomes in gynaecologic oncology is further reflected by recent analyses demonstrating increasing incorporation of health-related QoL endpoints into advanced endometrial cancer clinical trials,

despite ongoing methodological inconsistencies in their reporting [19]. Similarly, recent cervical cancer survivorship studies confirmed substantial long-term differences in QoL according to treatment modality, particularly regarding physical functioning, symptom burden, and sexuality following chemoradiotherapy compared with surgery alone [20]. Collectively, these findings further underline the need for robust real-world QoL analyses and standardized survivorship assessment in routine clinical practice, particularly in Central and Eastern European populations where such data remain limited.

Despite growing international evidence regarding survivorship-related quality-of-life impairment in gynaecologic oncology, comprehensive patient-reported QoL data from Central and Eastern European populations, including Slovakia, remain scarce. Therefore, the present study aimed to evaluate quality of life in Slovak cervical and endometrial cancer survivors following surgical and adjuvant treatment using EORTC methodology, representing one of the first comprehensive real-world QoL analyses from this Central and Eastern European EU setting. Particular focus was placed on functional domains, symptom burden, treatment-related factors, and selected sociodemographic determinants influencing survivorship outcomes. In addition, the study sought to identify clinically relevant QoL domains and symptom burdens that may require increased supportive-care attention, including nursing-oriented and multidisciplinary survivorship approaches. The findings may contribute to optimizing long-term follow-up care, improving patient support, and enhancing survivorship-oriented multidisciplinary management in women treated for cervical and endometrial cancer.

2. Methods

2.1. Study Sample

A cross-sectional observational study was conducted. The analysed sample comprised $n = 127$ (100%) female respondents. Initially, 143 subjects were approached; of these, 11 declined participation, and 5 questionnaires were excluded due to incomplete data or failure to meet inclusion criteria (age, ECOG status, comorbidities). Missing item-level responses were managed according to the recommendations provided in the EORTC scoring manual, and analyses were performed using only evaluable data. Study participants were enrolled through convenience sampling during routine follow-up examinations at oncogynaecological outpatient departments. Eligible patients were identified during routine follow-up visits by trained healthcare personnel (oncology nurse) and, following consultation with their attending oncogynaecologist, were informed about the study and invited to participate on a voluntary basis by completing the questionnaire. The EORTC QLQ-C30 together with the respective disease-specific module was completed anonymously and without assistance during the study period extending from March 2024 to April 2025. Data collection was performed only once for each participant during routine post-treatment survivorship follow-up care, and no longitudinal or repeated QoL assessments were conducted. The survey was administered exclusively for research purposes and was not part of routine standard clinical care.

2.2. Participants and Data Collection

The study population was recruited from four oncogynecological outpatient centres located in Slovakia, specifically in the cities of Žilina, Banská Bystrica, and Košice. Participant enrolment was based on a convenience sampling method reflecting patient accessibility and their willingness to participate during scheduled follow-up examinations. Neither random allocation nor a strict consecutive recruitment protocol was implemented.

Inclusion criteria comprised women aged between 25 and 80 years who were 6–60 months after completion of oncological therapy (surgical treatment with or without adjuvant chemotherapy, radiotherapy, biological therapy, or immunotherapy), had histologically confirmed cervical or endometrial cancer, an Eastern Cooperative Oncology Group (ECOG) performance status of 1–2, and signed written informed consent. Exclusion criteria included synchronous or concomitant malignancies, ECOG performance status 3–5, severe chronic comorbidities, marked disability, cognitive dysfunction, or impaired communication ability. To minimize major non-oncological confounding factors potentially influencing QoL independently of gynaecological cancer survivorship, patients with advanced heart failure (NYHA class IV), chronic kidney disease stage 4–5, severe chronic obstructive pulmonary disease, major neurological impairment, dementia, post-stroke disability, severe immobility, or other advanced disabling systemic conditions were not eligible for participation.

The present study adhered to the ethical standards outlined in the Declaration of Helsinki and received approval from the Ethics Committee (Institutional Review Board) of Constantine the Philosopher University in Nitra (approval No. 316198). Before enrolment, all participants were adequately informed about the aims of the research and signed written informed consent forms. All collected data were anonymized and handled in compliance with relevant data protection legislation in order to maintain participant confidentiality. The methodological design aimed to provide a real-world assessment of survivorship-related QoL burden in women treated for cervical and endometrial cancer within routine oncogynecological follow-up practice.

2.3. Data Collection Instruments (Questionnaires)

Three instruments were utilized for data acquisition in the present study. The primary instrument was the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Core 30 (EORTC QLQ-C30, version 3.0), a validated standardized questionnaire designed for the assessment of quality of life in oncological patients. The EORTC framework is based on a modular structure consisting of a general core questionnaire supplemented by disease-specific modules, enabling comprehensive evaluation of both overall and cancer-related aspects of QoL. The EORTC QLQ-C30 contains 30 items organized into five functional scales (physical, role, emotional, cognitive, and social functioning), three symptom scales (fatigue, pain, and nausea/vomiting), one global health status/overall quality of life scale, and six additional single-item symptom assessments addressing dyspnoea, insomnia, appetite loss, constipation, diarrhoea, and financial burden. The majority of questionnaire items are evaluated using a four-point Likert response format ranging from 1 (“not at all”) to 4 (“very much”), whereas the global health status scale is rated on a seven-point scale from 1 (“very poor”) to 7 (“excellent”). In accordance with the EORTC scoring guidelines, higher scores within the functional and global health

scales reflect better functioning and superior quality of life, while elevated scores in symptom-oriented scales represent more pronounced symptom burden and a less favourable clinical condition [21].

The second instrument was the EORTC QLQ-EN24 - module for patients with endometrial cancer. The module comprises three functional scales assessing sexual activity, sexual interest, and sexual enjoyment, and ten symptom scales assessing lymphedema, urological symptoms, gastrointestinal symptoms, poor body image, sexual/vaginal problems, pain in back and pelvis, Tingling/ numbness (paresthesia), muscular pain, hair loss, and taste change. The scoring approach is essentially identical to that used for the functional and symptom scales of the QLQ-C30. All scales and single-item measures are scored from 0 to 100. High scores on functional scales indicate a high (healthy) level of functioning, whereas high scores on symptom scales reflect greater symptom severity (i.e., more problems reported by patients) [22].

The third one was the EORTC QLQ-CX24 - a disease-specific module for patients with cervical cancer. The module comprises two functional scales assessing sexual activity and sexual enjoyment, and seven symptom scales covering disease- and treatment-related symptoms (symptom experience), body image and sexual/vaginal functioning, lymphoedema, peripheral neuropathy, menopausal symptoms, and concerns about sexual health (sexual worry). The scoring approach for the QLQ-CX24 is analogous to that used in the QLQ-C30. All scales and items are scored from 0 to 100, where high scores on functional scales indicate a high (healthy) level of functioning, whereas high scores on symptom scales denote greater symptom severity (i.e., more problems reported by patients) [23].

For all three questionnaires, results were analysed according to the official scoring manuals, and findings are presented in tables and graphs in the Results section.

2.4. Statistical Analysis

Statistical analyses were performed using MedCalc® Statistical Software version 23.3.7 (MedCalc Software Ltd., Ostend, Belgium), MS Excel, and IBM SPSS Statistics for Windows, version 31.0 (IBM Corp., Armonk, NY, USA). The statistical software packages were employed in a complementary manner: MedCalc® was mainly utilized for descriptive and non-parametric statistical procedures, while SPSS served primarily for regression modelling and dataset management. Descriptive statistical parameters were generated for all analysed variables. Distribution normality was verified using the Shapiro–Wilk test. Differences between independent groups were examined using the Mann–Whitney U test, whereas within-subject comparisons of QoL domains were analysed using Friedman’s analysis of variance (ANOVA).

To investigate potential relationships between selected clinical variables and survivorship-related quality-of-life outcomes, multiple linear regression analysis was performed. Owing to the exploratory design of the study, regression outcomes were interpreted mainly as indicators of possible associations rather than evidence of causal or definitive predictive relationships. Variables incorporated into the regression model were selected according to their clinical relevance and availability within the collected dataset.

Binary coding was applied to categorical variables including place of residence, chemotherapy, and radiotherapy. Interaction terms were not included due to the exploratory character of the analysis and the available sample size. Standard diagnostic methods were used to assess regression model assumptions. The threshold for statistical significance was established at $\alpha = 0.05$, with p-values ≤ 0.05 regarded as statistically significant. Reliability and internal consistency of the EORTC QLQ-C30, QLQ-CX24 and QLQ-EN24 questionnaires were assessed by calculating Cronbach's alpha coefficients for each multi-item domain. Coefficient values of 0.70 or higher were considered indicative of acceptable reliability. Because the study had an exploratory design and involved multiple QoL comparisons, no formal adjustment for multiple testing (such as Bonferroni correction or false discovery rate adjustment) was performed. Application of such corrections could increase the probability of type II errors and potentially mask clinically meaningful findings. Consequently, the presented results should be interpreted with consideration of the possible risk of type I error. Graphical visualizations were included for exploratory demonstration of group differences, while fitted regression curves are displayed solely for illustrative purposes and should not be interpreted as proof of a true linear association, particularly for dichotomous predictor variables.

3. Results

3.1. Socio-demographic and Clinical Characteristics

A total of 127 gynaecologic cancer survivors were included in the study, comprising 74 patients with endometrial (uterine) cancer and 53 patients with cervical cancer. The mean age of endometrial cancer patients was 57.6 years (SD = 14.1; range = 26–77), while the mean age of cervical cancer patients was 49.1 years (SD = 8.4; range = 39–65). Disease stages ranged from IA2 to IIIC1 in patients with cervical cancer and from IA to IIIC2ii in patients with endometrial cancer, according to the FIGO 2018 and 2023 classification system [24, 25].

3.2. Treatment modality and cases distribution

According to the 2017–2025 ESMO/ESGO/ESP guidelines [26–29], the distribution of therapeutic modalities reflected contemporary clinical practice and risk profile (Table 1).

Table 1
Distribution of treatment modalities according to tumour type.

Tumour Type	Surgery alone (no CT/RT) (N / %)	Surgery+Adjuvant Chemotherapy (CT) (N / %)	Surgery+Adjuvant Radiotherapy (RT) (N / %)	Surgery+Adjuvant Chemoradiotherapy (CTRT) (N / %)
Endometrial carcinoma (n = 74)	16 / 21.6	7 / 9.5	28 / 37.8	23 / 31.1
Cervical carcinoma (n = 53)	22 / (41.5)	6 / 11.3	4 / 7.6	21 / 39.6
Total cohort (n = 127)	38 / 29.9	13 / 10.3	32 / 25.2	44 / 34.6

In patients with cervical carcinoma (CC), postoperative adjuvant treatment was individualized and risk-adapted according to the final histopathological findings, FIGO stage, pathological risk factors, ECOG performance status, age, comorbidities, postoperative complications, and treatment tolerance. Consequently, not all patients were suitable candidates for concurrent chemoradiotherapy.

Overall, 41.5% of CC patients underwent surgery alone without the need for adjuvant treatment. Combined chemoradiotherapy (CTRT) was used in 39.6% of patients, predominantly according to standard concurrent cisplatin- or carboplatin-based protocols. This modality was mainly indicated in patients with high-risk pathological features, including positive sentinel lymph nodes (SLN+), isolated tumour cells (ITC+), positive surgical margins involving the parametrium or vaginal cuff, LVSI positivity, and larger tumour size. CTRT was primarily administered in stages IA2–IB2 and IIA1 based on definitive histopathological risk assessment, and routinely in patients with stages IB3, IIA2, IIB, and IIIC1–IIIC2 disease.

Adjuvant radiotherapy (RT) alone was administered in 7.6% of patients, mainly within the intermediate-risk group characterized by factors such as tumour size, lymphovascular space invasion (LVSI) positivity, and depth of stromal invasion identified on final histopathology. RT was delivered as external beam radiotherapy (EBRT) and/or image-guided brachytherapy (IGBT). In addition to intermediate-risk disease, RT alone was also preferentially used in patients with contraindications to platinum-based chemotherapy, including advanced age, postoperative complications, hydronephrosis, renal insufficiency, peripheral neuropathy, frailty, or poor treatment tolerance. Conversely, chemotherapy alone, which accounted for 11.3% of patients, was reserved for selected cases in which radiotherapy was considered inappropriate or potentially harmful. These situations included severe postoperative infections, fistula formation, extensive pelvic adhesions, inflammatory bowel disease (e.g., Crohn's disease), or selected

younger sexually active patients after nerve-sparing surgery in whom radiation-associated pelvic toxicity was intended to be minimized.

In patients with endometrial carcinoma (EC), adjuvant treatment was administered according to the updated FIGO staging system incorporating molecular classification, including POLE-mutated (POLE^{mut}), mismatch repair-deficient (MMRd), non-specific molecular profile (NSMP) low/high-grade oestrogen receptor (ER) positive, and p53-abnormal (p53abn) subgroups. Patients were subsequently stratified into low-, intermediate-, high-intermediate-, and high-risk categories based on stage, histopathological characteristics, molecular subtype, ER status, LVSI status, and extent of disease spread. Detailed FIGO and molecular risk stratification criteria are provided in Supplementary Table 21.

Patients classified as low risk, selected younger patients with intermediate-risk low-grade EC, and a limited number of high-intermediate-risk patients with pN0 status after complete lymph node staging, negative LVSI, and low-grade histology underwent surgery alone followed by surveillance without adjuvant therapy. This subgroup represented 21.6% of the cohort.

Adjuvant radiotherapy (RT) alone was administered in 37.8% of patients, predominantly in intermediate-risk EC, most commonly in the form of vaginal image-guided brachytherapy (IGBT). In high-intermediate-risk patients, RT consisted of vaginal IGBT and/or external beam radiotherapy (EBRT). RT alone was also used in selected high-risk patients with contraindications to systemic chemotherapy.

Combined chemoradiotherapy (CTRT), most frequently consisting of carboplatin-paclitaxel regimen combined with EBRT with or without vaginal IGBT, was administered in high-risk patients and accounted for 31.1% of the cohort. Chemotherapy alone was used in 9.5% of patients, mainly in high-risk cases in which vaginal brachytherapy was contraindicated or unsuitable, and to some patients indicated also for immune checkpoint inhibitors treatment. A small subgroup of EC patients, predominantly those with stage III_m–IV_m MMRd tumours, received biological therapy and/or immunotherapy, including pembrolizumab or dostarlimab, mainly in combination with chemotherapy-based regimens. Due to the limited size of this subgroup and the exploratory nature of the study, these treatment modalities were not analysed separately and were incorporated into the overall systemic treatment category.

3.3. Reliability Analysis of the EORTC Questionnaires

The internal consistency of the EORTC QLQ-C30 and disease-specific modules (QLQ-CX24 and QLQ-EN24) was assessed using Cronbach's alpha coefficients calculated separately for cervical (C53) and endometrial (C54) cancer cohorts. Overall, the questionnaires demonstrated acceptable to excellent internal consistency across most multi-item domains, supporting the reliability of the QoL measurements in the analysed study population. Lower internal consistency was observed for the cognitive functioning scale in the cervical cancer cohort, which may be related to the limited number of items within this domain and sample heterogeneity (Table 2).

Table 2
Internal Consistency of the EORTC QLQ-C30 Scales in Patients with
Cervical (C53) and Endometrial (C54) Cancer.

Scale	Cronbach's α (C53)	Cronbach's α (C54)
Physical functioning	0.83	0.89
Role functioning	0.72	0.73
Emotional functioning	0.75	0.68
Cognitive functioning	0.42	0.73
Social functioning	0.82	0.88
Fatigue	0.85	0.82
Nausea & vomiting	0.76	0.63
Pain	0.84	0.82

Values ≥ 0.70 were considered indicative of acceptable internal consistency.

The internal consistency of the EORTC QLQ-CX24 module was evaluated using Cronbach's alpha coefficients for all multi-item scales. Single-item measures were not included in the reliability analysis (Table 3).

Table 3
Internal consistency of the EORTC QLQ-CX24 scales in patients with
cervical cancer.

Scale	Number of Items	Cronbach's α
Symptom Experience	11	0.77
Body Image	3	0.94
Sexual/Vaginal Functioning	4	0.98

Values ≥ 0.70 were considered indicative of acceptable internal consistency.

The internal consistency of the EORTC QLQ-EN24 module was evaluated using Cronbach's alpha coefficients for all multi-item scales. Single-item measures were not included in the reliability analysis. The slightly lower reliability coefficient observed for the gastrointestinal symptom scale may be associated with the limited number of items and reduced response variability (Table 4).

Table 4
Internal consistency of the EORTC QLQ-EN24 symptom scales in patients with endometrial cancer.

Scale	Number of Items	Cronbach's α
Lymphoedema	2	0.84
Urological symptoms	4	0.79
Gastrointestinal symptoms	5	0.65
Poor Body Image	2	0.91
Sexual/Vaginal problems	3	0.88

Values ≥ 0.70 were considered indicative of acceptable internal consistency.

3.4. Evaluation of the EORTC QLQ-C30 and EORTC QLQ-CX24 Questionnaires in Slovak Cervical Cancer Patients

Table 5 presents the mean score values reflecting the functional status of the respondents in relation to the overall health/quality of life item, five functional scales, three symptom scales, and six individual items of the EORTC QLQ-C30 questionnaire.

Table 5

Assessment of quality of life in patients with cervical cancer: overall QoL, functional domains, and symptom scales (EORTC QLQ-C30).

^a Global health status / QoL scale	N	Mean	SD	min	max
	53	63,33	27,63	8,33	100
^a FS Physical functioning	53	84	15,05	53,33	100
^a FS Role functioning	53	71,67	17,18	50	100
^a FS Emotional functioning	53	85	17,01	50	100
^a FS Cognitive functioning	51	85	20,87	50	100
^a FS Social functioning	53	75	27,84	50	100
^b SS Fatigue	52	32,22	24,69	0	88,89
^b SS Nausea & vomiting	53	8,33	15,77	0	50
^b SS Pain	53	6,67	11,34	0	33,33
^c Dyspnoea	53	26,67	20,52	0	66,67
^c Sleep disturbance	53	23,33	34,67	0	100
^c Appetite loss	53	10	15,67	0	33,33
^c Constipation	53	3,33	10,26	0	33,33
^c Diarrhoea	51	6,67	13,68	0	33,33
^c Financial impact	49	30	35,71	0	100
Legend: QoL – quality of life, N – number of respondents, SD – standard deviation, ^a For functional scales (FS) – higher scores indicate better functioning, ^b For symptom scales (SS) and ^c Individual items – higher scores indicate worse functioning					
Note: The number of observations (N) varies across variables due to item-level missing or invalid responses. Only valid responses were included in accordance with the EORTC scoring guidelines.					

Table 5 presents mean scores reflecting the functional status of respondents in relation to the item assessing overall health/quality of life, five functional scales, three symptom scales, and six single items from the EORTC QLQ-C30. The results show that the mean score for self-reported overall health and quality of life was 63.33 (SD = 27.63), indicating that respondents' subjective perception of QoL is slightly above the mid-point.

Respondents achieved a mean score of 84.00 (SD = 15.05) on the physical functioning scale, suggesting that most participants can perform physical activities with minimal limitations. In the role-functioning scale, the mean score was 71.67 (SD = 17.18), indicating that respondents may experience some difficulties in fulfilling everyday tasks such as work duties, household activities, or family responsibilities. The emotional functioning scale had a mean score of 85.00 (SD = 17.01), which indicates preserved emotional stability and an overall capacity to cope with stress and concerns related to their illness.

In the cognitive functioning scale, respondents achieved a mean score of 85.00 (SD = 20.87), indicating that the disease and its treatment do not appear to exert a pronounced negative effect on their cognitive abilities. In the social functioning scale, the mean score was 75.00 (SD = 27.84), which suggests that some respondents may experience feelings of isolation or a reduced capacity to engage in social activities. Taken together, these findings indicate that participants maintain a relatively high quality of life across most assessed scales, particularly physical, emotional, and cognitive functioning. Smaller impairments were observed in role functioning and social functioning, which may be attributable to the direct impact of disease and its treatment or to associated psychological and social factors. These findings underscore the need for increased supportive-care attention and targeted survivorship-oriented strategies aimed at improving social integration and helping patients manage daily responsibilities, ultimately contributing to better overall quality of life.

When evaluating the most severe cancer-related symptoms, respondents reported fatigue and financial difficulties as the most burdensome. Fatigue may result from the malignancy itself or from its treatment, whereas financial difficulties are likely attributable to treatment-related costs or loss of income. The next most severe symptoms were dyspnoea and insomnia; both can substantially impair daily functioning and overall well-being, particularly with respect to rest and the ability to perform routine activities. The least severe symptoms reported were constipation, diarrhoea, pain, vomiting, and loss of appetite.

Using the specific EORTC QLQ - CX24 questionnaire, we obtained the results of the scale responses, which were focused on selected areas related to functional status and symptomatology in patients with cervical cancer, see Table 6.

Table 6
Quality of life assessment in patients with cervical cancer: functional status and symptom scales (EORTC QLQ-CX24).

^aFS Sexual Activity	N	Mean	SD	min	max
	48	20	22,69	0	66,67
^a FS Sexual Enjoyment	44	38,89	37,15	0	100
^b SS Symptom Experience	53	12,73	7,20	0	24,24
^b SS Body Image	53	27,78	21,79	0	66,67
^b SS Sexual/Vaginal Functioning	48	40,28	36,03	0	100
^b SS Lymphoedema	50	20	31,34	0	100
^b SS Peripheral neuropathy	51	23,33	30,78	0	100
^b SS Menopausal symptoms	53	20	27,36	0	66,67
^b SS Sexual Worry	46	46,67	34,88	0	100

Legend: N - number of respondents, SD - standard deviation, ^a For functional scales (FS) - higher scores indicate better functioning, ^bFor symptom scales (SS) - higher scores indicate worse functioning.

Note

The number of observations (N) varies across variables due to missing or invalid responses at the item level. Only valid responses were included in accordance with the EORTC scoring guidelines.

When evaluating individual items of the questionnaire, respondents reported sexual enjoyment as a relatively less affected domain (mean = 38.89, SD = 37.15), which nevertheless indicates that many women had not preserved a positive perception of their sexual satisfaction following their cancer diagnosis and treatment. Respondents scored even lower for sexual activity (mean = 20.00, SD = 22.69).

When asked to rate the most severe symptoms, participants identified concerns about sexual health and sexual/vaginal functioning as the most burdensome, suggesting that even if sexual activity and satisfaction are partially preserved, substantial concerns and difficulties remain that negatively affect quality of life. Less severe symptoms included disease- and treatment-related symptoms, menopausal symptoms, lymphedema, peripheral neuropathy, and body image disturbances.

3.5. Evaluation of the EORTC QLQ-C30 and EORTC QLQ-EN24 Questionnaires in Slovak Endometrial Cancer Patients

Table 7 presents mean scores reflecting respondents' functional status in relation to the item assessing overall health/quality of life, five functional scales, three symptom scales, and six single-item measures from the EORTC QLQ-C30 module.

Table 7
Assessment of quality of life in patients with endometrial cancer: overall QoL, functional domains, and symptom scales (EORTC QLQ-C30).

^a Global health status / QoL scale	N	Mean	SD	min	max
	74	55,13	15,49	33,33	83,33
^a FS Physical functioning	74	77,69	18,67	40,00	100
^a FS Role functioning	70	66,03	20,60	33,33	100
^a FS Emotional functioning	73	74,36	16,65	41,67	100
^a FS Cognitive functioning	71	83,97	20,60	33,33	100
^a FS Social functioning	74	52,56	24,12	0	100
^b SS Fatigue	74	34,62	19,26	0	77,78
^b SS Nausea & vomiting	73	10,90	17,43	0	66,67
^b SS Pain	74	23,72	20,44	0	66,67
^c Dyspnoea	72	26,92	26,44	0	100
^c Sleep disturbance	74	42,31	28,86	0	100
^c Appetite loss	71	19,23	25,00	0	66,67
^c Constipation	74	11,54	20,75	0	66,67
^c Diarrhea	70	2,56	8,97	0	33,33
^c Financial impact	67	26,92	26,44	0	100

Legend: N - number of respondents, SD - standard deviation, ^a For functional scales (FS) - higher scores indicate better functioning, ^bFor symptom scales (SS) and ^cIndividual items - higher scores indicate worse functioning.

Note

The number of observations (N) varies across variables due to missing or invalid responses at the item level. Only valid responses were included in accordance with the EORTC scoring guidelines.

The results indicate that the mean score for self-reported overall health and quality of life was 55.13 (SD = 15.49), suggesting that participants rated their health and QoL at a moderately good level. Respondents achieved a mean score of 77.69 (SD = 18.67) on the physical functioning scale, indicating generally good capacity to perform physical activities. In the role-functioning scale, the mean score was 66.03 (SD = 20.60), a somewhat lower value that suggests the disease may affect patients' ability to fulfil everyday roles (e.g., work, family duties, or leisure activities). The emotional functioning scale had a mean score of 74.36 (SD = 16.65), indicating preserved emotional stability and adequate coping with affective challenges such as anxiety or depressive symptoms. Cognitive functioning scored highest across scales, with a mean of 83.97 (SD = 20.60), implying that disease and treatment have not markedly impaired cognitive abilities such as memory and concentration. Social functioning recorded the lowest mean score of 52.56 (SD = 24.12), suggesting substantial impact of the disease or its treatment on social life (e.g., reduced social contacts, difficulties maintaining interpersonal relationships, or feelings of isolation). Taken together, these results show relatively good QoL in physical, emotional and cognitive functioning scales, with the greatest negative effect observed in social functioning - an area where support from family, community, or healthcare providers may be particularly needed to improve social integration and satisfaction.

When assessing the most severe cancer-related symptoms, respondents most frequently reported insomnia and fatigue, indicating that these problems are common, severe, and potentially disruptive to daily life and the ability to perform routine activities in patients with endometrial cancer. The next most severe symptoms were dyspnoea and financial difficulties, underscoring that cancer affects not only physical health but also patients' economic circumstances, which may in turn hinder access to care. Less severe symptoms included pain, while the least severe were diarrhoea, vomiting, constipation, and loss of appetite.

Using the EORTC QLQ-EN24 module, we obtained results focused on functional scales and symptom severity in patients with endometrial cancer (see Table 8). Respondents rated sexual enjoyment as the least affected area (mean = 41.67, SD = 33.33), indicating that sexual pleasure was relatively less impacted by disease or treatment compared with other functional scales. However, the remaining two sexual scales showed very low mean scores: sexual interest (mean = 20.51, SD = 23.01) and sexual activity (mean = 15.39, SD = 19.20), which indicate a low level of interest in sexual activities and marked reductions in sexual activity itself. This decline likely reflects the influence of health problems or treatment on sexual interest and consequent sexual behaviour.

Table 8
Quality of life assessment in patients with endometrial cancer: functional status and symptom scales (EORTC QLQ-EN24).

^aFS Sexual Interest	N	Mean	SD	min	max
	71	20,51	23,01	0	66,7
^a FS Sexual Activity	70	15,39	19,20	0	66,7
^a FS Sexual Enjoyment	68	41,67	33,33	0	100
^b SS Lymphoedema	72	19,23	25,43	0	100
^b SS Urological symptoms	74	19,55	18,66	0	58,33
^b SS Gastrointestinal symptoms	74	11,54	11,29	0	40
^b SS Poor Body Image	74	36,54	30,97	0	100
^b SS Sexual/Vaginal Problems	71	23,15	21,46	0	77,78
^b SS Pain in back and pelvis	74	15,39	25,10	0	100
^b SS Tingling/numbness	70	21,79	20,75	0	66,67
^b SS Muscular pain	72	32,05	19,76	0	66,67
^b SS Hair loss	74	15,38	26,78	0	100
^b SS Taste change	74	17,95	23,30	0	66,67

Legend: N - number of respondents, SD - standard deviation, ^a For functional scales (FS) - higher scores indicate better functioning, ^bFor symptom scales (SS) - higher scores indicate worse functioning.

Note

The number of observations (N) varies across variables due to missing or invalid responses at the item level. Only valid responses were included in accordance with the EORTC scoring guidelines.

When rating the most severe symptoms, respondents reported poor body image and muscle pain as the most burdensome. Less severe symptoms included gastrointestinal problems, hair loss, back and pelvic pain, taste changes, lymphoedema, urological symptoms, numbness/tingling (paresthesia), and sexual/vaginal problems.

3.6. Identification of differences in QoL across functional scales and symptom severity in cervical and endometrial cancer patients, highlighting clinically relevant QoL domains for supportive-care planning

This study aimed also to determine whether differences exist in quality of life (QoL) among cervical and endometrial cancer patients across various functional scales and symptoms and to establish the hierarchy of their severity, identifying priority areas for subsequent nursing interventions. The Friedman test was used to compare QoL levels across dependent samples. Scales not sufficiently answered by all participants, such as sexual satisfaction, were excluded from the analysis.

Quality of life in the cohort of patients with cervical cancer (QoL)

In the cohort of patients with cervical cancer, the analysis demonstrated significant differences among functional scales in terms of overall quality of life, $\chi^2(5) = 55.900$, $p < 0.001$. Specifically, QoL was highest in the scales of cognitive functioning, emotional functioning, physical functioning, and social functioning. A modest decline in QoL was observed for role functioning. The lowest QoL score was recorded for the sexual activity among cervical cancer patients (see Table 9).

Table 9

Comparison of the quality of life of cervical cancer patients in terms of individual functional scales.

Functional scales of QoL	Description				Friedman analysis of variance	
	MR	M	Mdn	SD	$\chi^2(5)$	p
Cognitive functioning	4,5	85	100	20,87	55,900	< 0,001
Emotional functioning	4,4	85	91,67	17,01		
Physical functioning	4,35	84	83,33	15,05		
Social functioning	3,45	75	83,33	27,84		
Role functioning	3,2	71,67	66,67	17,18		
Sexual activity	1,1	20	16,67	22,69		
Legend: M – arithmetic mean, MR – mean rank, Mdn – median, SD – standard deviation, $\chi^2(5)$ – Friedman's analysis of variance (degrees of freedom in brackets), p – statistical significance						

With respect to the severity of disease-related problems, the analysis showed significant differences among symptom groups in patients with cervical cancer, $\chi^2(14) = 77.404$, $p < 0.001$. Specifically, the most severe symptoms reported were concerns about sexual health, fatigue, dyspnoea, and negative body image. These were followed in severity by financial difficulties, peripheral neuropathy, and disease-related symptoms. The least severe problems reported were constipation, diarrhoea, pain, loss of appetite, vomiting, lymphoedema, menopausal symptoms, and insomnia (see Table 10).

Table 10
Comparison of the QoL of cervical cancer patients in terms of the severity of individual groups of symptoms.

Symptoms	Description				Friedman analysis of variance	
	MR	M	Mdn	SD	$\chi^2(14)$	<i>p</i>
Sexual worry	11,85	46,67	33,33	34,88	77,404	< 0,001
Fatigue	11,15	32,22	27,78	24,69		
Dyspnoea	10,05	26,67	33,33	20,52		
Body image	9,85	27,78	33,33	21,78		
Financial impact	8,85	30	16,67	35,71		
Peripheral neuropathy	8,65	23,33	16,67	30,78		
Symptom experience	8,2	12,73	12,12	7,20		
Sleep disturbance	7,85	23,33	0	34,37		
Menopausal symptoms	7,7	20	0	27,36		
Lymphoedema	7,55	20	0	31,34		
Nausea & Vomiting	6,05	8,33	0	15,77		
Appetite loss	5,95	10	0	15,67		
Pain	5,8	6,67	0	11,34		
Diarrhea	5,55	6,67	0	13,68		
Constipation	4,95	3,33	0	10,26		
Legend: M – arithmetic mean, MR – mean rank, Mdn – median, SD – standard deviation, $\chi^2(14)$ – Friedman's analysis of variance (degrees of freedom in brackets), <i>p</i> – statistical significance						

Quality of life in the cohort of patients with endometrial cancer (QoL)

In the cohort of patients with endometrial cancer, the analysis demonstrated significant differences among functional scales in terms of overall quality of life, $\chi^2(6) = 211.701$, $p < 0.001$. Specifically, QoL was highest in the cognitive, physical, and emotional functioning scales. A modest decline was observed in role functioning. Conversely, a marked decline in QoL was found for social functioning. The lowest QoL scores were recorded for sexual interest and sexual activity (see Table 11).

Table 11

Comparison of the quality of life of endometrial cancer patients in terms of individual functional scales.

Functional scales of QoL	Description				Friedman analysis of variance	
	MR	M	Mdn	SD	$\chi^2(6)$	p
Cognitive functioning	5,99	83,97	91,67	20,6	211,701	< 0,001
Physical functioning	5,35	77,69	80	18,67		
Emotional functioning	5,11	74,36	83,33	16,65		
Role functioning	4,57	66,03	66,67	20,6		
Social functioning	3,54	52,56	50	24,12		
Sexual interest	1,85	20,51	16,67	23,01		
Sexual activity	1,61	15,39	0	19,2		
Legend: M – arithmetic mean, MR – mean rank, Mdn – median, SD – standard deviation, $\chi^2(6)$ – Friedman's analysis of variance (degrees of freedom in brackets), p – statistical significance						

With respect to the severity of disease-related problems, the analysis showed significant differences among symptom groups in patients with endometrial cancer, $\chi^2(17) = 177.594$, $p < 0.001$. Specifically, the most severe symptoms reported were fatigue, sleep disturbance, muscle pain, poor body image, dyspnoea, and financial difficulties (see Table 12).

Table 12
Comparison of the QoL of endometrial cancer patients in terms of the severity of individual groups of symptoms.

Symptoms	Description				Friedman analysis of variance	
	MR	M	Mdn	SD	$\chi^2(17)$	p
Fatigue	13,2	34,62	33,33	19,26	177,594	< 0,001
Sleep disturbance	13,05	42,31	33,33	28,86		
Muscular pain	12,18	32,05	33,33	19,76		
Poor body image	12,01	36,54	33,33	30,97		
Dyspnoea	10,69	26,92	33,33	26,44		
Financial impact	10,36	26,92	33,33	26,44		
Pain	10,07	23,72	25	20,44		
Urological symptoms	9,86	19,55	16,67	18,66		
Tingling/numbness	9,78	21,8	33,33	20,75		
Lymphoedema	8,89	19,23	16,67	25,43		
Appetite loss	8,84	19,23	0	25		
Taste change	8,67	17,95	0	23,3		
Gastrointestinal symptoms	8,22	11,54	6,67	11,29		
Hair loss	7,72	15,39	0	26,78		
Pain in back and pelvis	7,71	15,39	0	25,1		
Constipation	7,32	11,54	0	20,75		
Nausea & Vomiting	7,19	10,9	0	17,43		
Diarrhea	5,24	2,56	0	8,97		
Legend: M – arithmetic mean, MR – mean rank, Mdn – median, SD – standard deviation, $\chi^2(17)$ – Friedman's analysis of variance (degrees of freedom in brackets), p – statistical significance						

These were followed in severity by pain, urological symptoms, tingling/numbness (paresthesia), lymphedema, loss of appetite, and taste changes. The least severe symptoms reported were diarrhoea, vomiting, constipation, back and pelvic pain, hair loss, and other gastrointestinal complaints.

3.7. Examination of the influence of treatment modalities (chemotherapy and radiotherapy) on QoL outcomes across functional domains/scales and symptoms.

To examine whether quality of life in cervical and endometrial cancer patients significantly depends on the type of treatment received, we applied the Mann-Whitney U test. This non-parametric test compared QoL functional domains and symptom severity between patients who underwent chemotherapy or radiotherapy and those who did not. The impact of surgical treatment was not analysed due to its universal application among the cohorts.

Impact of Adjuvant therapy on Functional Scales in Cervical Cancer Patients

For both chemotherapy and radiotherapy, our analysis showed that there were no statistically significant differences in quality of life across any functional scales between cervical cancer patients who did versus those who did not receive these treatments. Because the results were not significant in any evaluated functional domain, they are not presented in tabular form in this section of the article.

Impact of Adjuvant therapy on Symptom Severity in Cervical Cancer Patients

With respect to chemotherapy, the results of this study showed statistically significant differences in the severity of three symptom groups - pain, lymphoedema, and menopausal symptoms - between cervical cancer patients who underwent chemotherapy and those who did not, and a borderline significant difference for insomnia (see Table 13). Specifically, pain, lymphedema, and menopausal symptoms were more severe among cervical cancer patients who did not receive chemotherapy. By contrast, sleep disturbances tended to be more severe in patients who did receive chemotherapy; however, this association reached only borderline statistical significance.

Table 13
Comparison of symptom severity in cervical cancer patients according to whether they received chemotherapy

Symptoms	Chemotherapy						Mann-Whitney U test	
	No (N = 26)			Yes (N = 27)				
	AM	Mdn	SD	AM	Mdn	SD	U	p
Fatigue	35,19	27,78	27,96	27,78	33,33	19,70	46,0	0,875
Nausea & Vomiting	11,11	0,00	19,25	4,17	0,00	7,72	42,0	0,566
Pain	11,11	8,33	12,98	0,00	0,00	0,00	24,0	0,022
Dyspnoe	27,78	33,33	23,92	25,00	33,33	15,43	46,0	0,859
Sleep disturbance	16,67	0,00	38,92	33,33	33,33	25,20	26,0	0,054
Appetite loss	11,11	0,00	16,41	8,33	0,00	15,43	44,0	0,698
Constipation	0,00	0,00	0,00	8,33	0,00	15,43	36,0	0,075
Diarrhea	5,56	0,00	12,98	8,33	0,00	15,43	44,0	0,656
Financial impact	22,22	0,00	38,49	41,67	50,00	29,55	30,0	0,134
Symptom experience	12,63	12,12	6,44	12,88	15,15	8,69	44,0	0,753
Body image	33,33	33,33	24,16	19,44	22,22	15,43	32,0	0,198
Sexual/Vaginal functioning	50,00	45,83	38,32	20,83	20,83	24,06	8,0	0,170
Lymphoedema	33,33	33,33	34,82	0,00	0,00	0,00	16,0	0,005
Peripheral neuropathy	33,33	33,33	34,82	8,33	0,00	15,43	26,0	0,060
Menopausal symptoms	33,33	33,33	28,43	0,00	0,00	0,00	16,0	0,005
Sexual worry	38,89	33,33	37,15	58,33	50,00	29,55	32,0	0,197
Legend: N – number of respondents, AM - group mean, SD - standard deviation, Mdn - median, U - Mann-Whitney U test, p - statistical significance								

The analysis of the impact of radiotherapy on quality of life (QoL) in cervical cancer patients, performed using the Mann-Whitney U test, revealed statistically significant differences in the severity of three symptom groups - pain, lymphoedema, and peripheral neuropathy - between patients who underwent radiotherapy and those who did not (see Table 14). Specifically, pain, lymphedema, and peripheral neuropathy were more severe in patients who did not receive radiotherapy compared with those who did. All comparisons reached statistical significance ($p < 0.01$).

Table 14
Comparison of symptom severity in cervical cancer patients according to whether they received radiotherapy.

Symptoms	Radiotherapy						Mann-Whitney U test	
	No (N = 28)			Yes (N = 25)				
	AM	Mdn	SD	AM	Mdn	SD	U	p
Fatigue	40,00	33,33	28,30	24,44	22,22	18,74	36,0	0,279
Nausea & Vomiting	13,33	0,00	20,49	3,33	0,00	7,03	38,0	0,260
Pain	13,33	16,67	13,15	0,00	0,00	0,00	20,0	0,005
Dyspnoe	33,33	33,33	22,22	20,00	33,33	17,21	34,0	0,165
Sleep disturbance	20,00	0,00	42,16	26,67	33,33	26,29	36,0	0,230
Appetite loss	13,33	0,00	17,21	6,67	0,00	14,05	40,0	0,342
Constipation	0,00	0,00	0,00	6,67	0,00	14,05	40,0	0,146
Diarrhea	6,67	0,00	14,05	6,67	0,00	14,05	50,0	1,000
Financial impact	26,67	0,00	40,98	33,33	33,33	31,43	42,0	0,514
Symptom experience	13,94	12,12	6,26	11,52	12,12	8,18	42,0	0,538
Body image	33,33	33,33	26,71	22,22	33,33	14,81	38,0	0,344
Sexual/Vaginal functioning	50,00	45,83	38,32	20,83	20,83	24,06	8,0	0,170
Lymphoedema	40,00	33,33	34,43	0,00	0,00	0,00	10,0	0,001
Peripheral neuropathy	40,00	33,33	34,43	6,67	0,00	14,05	18,0	0,007
Menopausal symptoms	26,67	33,33	26,29	13,33	0,00	28,11	34,0	0,168
Sexual worry	46,67	33,33	35,83	46,67	33,33	35,83	50,0	1,000
Legend: N – number of respondents, AM - group mean, SD - standard deviation, Mdn - median, U - Mann-Whitney U test, p - statistical significance								

Impact of Adjuvant therapy on Functional Scales in Endometrial Cancer Patients

In the cohort of patients with endometrial cancer, the analysis of chemotherapy revealed a statistically significant difference for a single outcome - overall health and quality of life (see Table 15). Specifically, endometrial cancer patients who did not receive chemotherapy reported significantly higher overall health and QoL scores compared with those who did undergo chemotherapy.

With respect to radiotherapy, the analysis identified a significant difference in only one functional domain: sexual enjoyment (see Table 16). Patients who did not receive radiotherapy reported significantly higher levels of sexual pleasure than patients who did undergo radiotherapy.

Table 15

Comparison of QoL in terms of individual functional scales in endometrial cancer patients depending on whether they underwent chemotherapy

Functional scales	Chemotherapy						Mann-Whitney U test	
	No (N = 44)			Yes (N = 30)				
A	AM	Mdn	SD	AM	Mdn	SD	U	p
Physical functioning	75,79	80,00	18,50	81,90	90,00	18,57	210,0	0,242
Role functioning	65,79	66,67	19,35	64,29	66,67	22,51	246,0	0,663
Emotional functioning	75,88	83,33	17,95	72,62	75,00	14,41	214,0	0,268
Cognitive functioning	85,09	83,33	18,09	80,95	100,00	26,84	266,0	1,000
Social functioning	54,39	66,67	21,81	51,19	50,00	32,99	240,0	0,580
Sexual interest	22,81	33,33	24,64	14,29	0,00	17,12	222,0	0,315
Sexual activity	15,79	0,00	16,87	14,29	0,00	25,20	234,0	0,446
Sexual enjoyment	40,74	33,33	21,56	44,44	33,33	45,54	52,0	0,885
Global health status / QoL scale	61,90	66,67	16,25	52,19	50,00	13,93	161,0	0,028
Legend: N – number of respondents, AM - group mean, SD - standard deviation, Mdn - median, U - Mann-Whitney U test, p - statistical significance								

Table 16

Comparison of QoL in terms of individual functional scales in endometrial cancer patients depending on whether they underwent radiotherapy.

Functional scales	Radiotherapy						Mann-Whitney U test	
	No (N = 23)			Yes (N = 51)				
	AM	Mdn	SD	AM	Mdn	SD	U	p
Physical functioning	81,43	80,00	15,33	72,78	80,00	21,07	262,0	0,169
Role functioning	66,67	66,67	19,25	63,89	58,33	21,23	282,0	0,295
Emotional functioning	71,73	79,17	17,17	78,82	83,33	16,30	252,5	0,113
Cognitive functioning	86,31	83,33	17,00	81,25	100,00	24,23	324,0	0,811
Social functioning	56,55	66,67	24,15	50,00	50,00	26,01	292,0	0,405
Sexual interest	19,05	16,67	21,14	22,22	16,67	25,38	320,0	0,745
Sexual activity	19,05	16,67	21,14	11,11	0,00	16,05	272,0	0,175
Sexual enjoyment	55,56	50,00	25,95	27,78	33,33	23,92	34,0	0,018
Global health status / QoL scale	54,17	50,00	14,96	55,56	54,17	15,48	309,0	0,614
Legend: N – number of respondents, AM - group mean, SD - standard deviation, Mdn - median, U - Mann-Whitney U test, p - statistical significance								

Impact of Adjuvant therapy on Symptom Severity in Endometrial Cancer Patients

With respect to chemotherapy, the analysis revealed statistically significant differences in symptom severity between endometrial cancer patients who did versus those who did not receive chemotherapy for the following domains: lymphoedema, urological symptoms, gastrointestinal symptoms, sexual/vaginal problems, back and pelvic pain, paresthesia, hair loss, and taste changes (see Table 17). All these symptoms were more severe in patients who underwent chemotherapy.

Table 17

Comparison of symptom severity in endometrial cancer patients according to whether they received chemotherapy.

Symptom	Chemotherapy						Mann-Whitney U test	
	No (N = 44)			Yes (N = 30)				
	AM	Mdn	SD	AM	Mdn	SD	U	p
Fatigue	33,92	33,33	17,70	38,10	33,33	22,53	249,0	0,718
Nausea & Vomiting	9,65	0,00	14,82	15,48	8,33	23,08	232,0	0,425
Pain	21,93	16,67	20,54	28,57	33,33	20,07	220,0	0,323
Dyspnoea	26,32	33,33	23,45	30,95	33,33	33,24	260,0	0,892
Sleep disturbance	40,35	33,33	30,17	42,86	50,00	27,51	250,0	0,726
Appetite loss	17,54	0,00	25,39	23,81	33,33	24,21	222,0	0,306
Constipation	12,28	0,00	22,49	9,52	0,00	15,63	264,0	0,958
Diarrhea	3,51	0,00	10,37	0,00	0,00	0,00	238,0	0,211
Financial impact	26,32	33,33	23,45	28,57	33,33	34,24	256,0	0,822
Lymphoedema	14,91	0,00	21,15	30,95	33,33	32,59	174,0	0,043
Urological symptoms	15,79	8,33	18,56	29,76	33,33	15,23	138,0	0,007
Gastrointestinal symptoms	8,42	6,67	9,26	20,00	20,00	12,26	118,0	0,002
Poor body image	36,84	33,33	28,78	35,71	33,33	37,47	252,0	0,767
Sexual/Vaginal problems	16,05	11,11	14,37	44,44	33,33	26,29	20,0	0,019
Pain in back and pelvis	10,53	0,00	24,64	28,57	33,33	22,10	136,0	0,001
Tingling/numbness	14,04	0,00	16,68	42,86	33,33	15,63	80,0	< 0,001
Muscular pain	29,83	33,33	18,65	38,10	33,33	22,10	212,0	0,186
Hair loss	7,02	0,00	17,60	38,10	33,33	34,24	114,0	< 0,001
Taste change	8,77	0,00	14,88	42,86	33,33	24,21	78,0	< 0,001
Legend: N – number of respondents, AM - group mean, SD - standard deviation, Mdn - median, U - Mann-Whitney U test, p - statistical significance								

In the cohort of patients with endometrial cancer, analysis of radiotherapy revealed statistically significant differences in the severity of four symptom groups - fatigue, financial difficulties, lymphoedema, and numbness/tingling - between patients who underwent radiotherapy and those who

did not (see Table 18). According to our analysis, these symptoms were more severe in patients who received radiotherapy.

Table 18
Comparison of symptom severity in endometrial cancer patients according to whether they received radiotherapy.

Symptom	Radiotherapy						Mann-Whitney U test	
	No (N = 23)			Yes (N = 51)				
	AM	Mdn	SD	AM	Mdn	SD	U	p
Fatigue	30,16	33,33	16,80	40,74	33,33	20,11	231,5	0,048
Nausea & vomiting	16,07	16,67	20,53	5,56	0,00	10,62	233,0	0,301
Pain	20,83	16,67	16,12	27,08	33,33	24,48	296,0	0,444
Dyspnoea	17,86	0,00	21,24	38,89	33,33	27,22	191,0	0,674
Sleep disturbance	42,86	33,33	29,89	38,89	33,33	28,94	318,0	0,726
Appetite loss	25,00	33,33	26,64	12,50	0,00	21,56	248,0	0,068
Constipation	10,71	0,00	20,39	12,50	0,00	21,56	322,0	0,741
Diarrhea	2,38	0,00	8,74	2,78	0,00	9,41	332,0	0,874
Financial impact	20,24	0,00	24,58	34,72	33,33	26,88	234,0	0,041
Lymphoedema	10,71	0,00	13,77	29,17	16,67	31,95	226,0	0,032
Urological symptoms	17,86	16,67	16,93	21,53	16,67	20,69	300,0	0,499
Gastrointestinal symptoms	10,48	6,67	9,15	12,78	10,00	13,47	326,0	0,851
Poor body image	30,95	33,33	27,11	43,06	33,33	34,37	280,0	0,291
Sexual/vaginal problems	20,37	22,22	12,38	25,93	22,22	28,16	70,0	0,905
Pain in back and pelvis	16,67	0,00	27,96	13,89	0,00	21,80	328,0	0,861
Tingling/numbness	16,67	0,00	21,28	27,78	33,33	18,82	234,0	0,036
Muscular pain	30,95	33,33	20,14	33,33	33,33	19,66	316,0	0,663
Hair loss	21,43	0,00	32,98	8,33	0,00	14,74	282,0	0,223
Taste change	16,67	0,00	24,85	19,44	16,67	21,80	302,0	0,479
Legend: N – number of respondents, AM - group mean, SD - standard deviation, Mdn - median, U - Mann-Whitney U test, p - statistical significance								

3.8. Evaluation of the impact of sociodemographic factors on individual QoL perception among cervical and endometrial cancer patients

To investigate the associations between selected sociodemographic and treatment-related factors and overall health and quality of life (QoL) in patients with cervical and endometrial cancer, we conducted a multiple linear regression analysis. In the regression model, the dependent variable was the level of overall health and QoL, while independent variables included patient age (a non-modifiable factor), education level, place of residence, and treatment modalities - chemotherapy and radiotherapy (modifiable factors). Surgical treatment was excluded from the model as it was undergone in all patients. Age and education were measured on an interval scale, while place of residence (urban vs. rural), chemotherapy (no/yes), and radiotherapy (no/yes) were measured on a nominal scale.

In the cohort of patients with cervical cancer, chemotherapy ($B = -42.817$, $p = 0.047$) and radiotherapy ($B = 46.774$, $p = 0.042$) showed statistically significant associations with overall health and quality of life.

Based on the direction of these effects, overall health and quality of life were higher among cervical cancer patients who did not undergo chemotherapy, and higher among those who did receive radiotherapy. Radiotherapy showed a larger standardized association with overall health and QoL in cervical cancer patients ($\beta = 0.869$) than chemotherapy ($\beta = -0.779$). The combination of all independent variables included in the regression model explained 22.5% of the variance in overall health and quality of life among cervical cancer patients (Adj. $R^2 = 0.225$). Although individual treatment variables showed statistically significant associations, the overall regression model did not reach statistical significance ($F(5,14) = 2.104$, $p = 0.125$). These findings should therefore be interpreted cautiously in view of the small subgroup size and exploratory design. The results are summarized in Table 19.

Table 19
Prediction of overall health and quality of life in cervical cancer patients.

Predictors	Global health status / QoL scale				
	B	SE	β	t	p
Constant	173,457	51,92		3,341	0,005
Age	-1,518	0,806	-0,446	-1,883	0,081
Education level	-21,521	14,27	-0,357	-1,508	0,154
Place of residence ^a	6,326	13,254	0,115	0,477	0,641
Chemotherapy ^b	-42,817	19,686	-0,779	-2,175	0,047
Radiotherapy ^c	46,774	20,935	0,869	2,234	0,042
MODEL	Adj.R ² = 0,225		F(5,14) = 2,104		p = 0,125
^a reference group are patients living in the city (urban), ^b reference group are patients who did not undergo chemotherapy, ^c reference group are women who did not undergo radiotherapy					
B – unstandardized regression coefficient, SE - standard error of B, β - standardized regression coefficient, Adj.R ² - indicator of the degree of explained variance of the dependent variable of the model, F - predictive power of the regression model, p - statistical significance					

When assessing the relationship between overall quality of life (QoL) and level of education, place of residence, and age in patients with cervical cancer, no statistically significant associations were found. However, a declining trend in QoL with increasing age was observed. We identified that the age groups 43–50 years and ≥ 60 years reported the lowest levels of QoL (Fig. 1). This finding is important for designing subsequent targeted interventions aimed at specific age groups and for specifying the functional scales and symptom domains that should be prioritized to improve patients' quality of life.

Scatterplot of individual overall QoL scores plotted against age, overlaid with a smoothed moving-average curve. A two-dimensional density heat map was added to visualize areas with higher concentrations of observations, where warmer colours indicate greater point density. The visualization is presented for exploratory and descriptive purposes only and does not imply a statistically significant relationship between age and QoL. Abbreviations: QoL – quality of life.

In the cohort of patients with endometrial cancer, chemotherapy showed the strongest association with overall health and quality of life (QoL) ($B = -21.661$, $p < 0.001$), with higher QoL scores observed among patients who did not undergo chemotherapy. Age was also independently associated with overall health and QoL after adjustment for the other variables included in the model ($B = -0.243$, $\beta = -0.235$, $p = 0.041$), indicating a modest decline in QoL with increasing age (see Table 20).

Table 20
Prediction of overall health and quality of life in endometrial cancer patients.

Predictors	Global health status / QoL scale				
	B	SE	β	t	p
Constant	81,842	9,215		8,882	0
Age	-0,243	0,115	-0,235	-2,103	0,041
Education level	-4,805	2,866	-0,198	-1,677	0,101
Place of residence ^a	3,234	3,36	0,11	0,962	0,341
Chemotherapy ^b	-21,661	3,838	-0,636	-5,644	< 0,001
Radiotherapy ^c	-3,8	3,128	-0,13	-1,215	0,231
MODEL	Adj.R ² = 0,456		F(5,44) = 9,202		p < 0,001
^a reference group are patients living in the city (urban), ^b reference group are patients who did not undergo chemotherapy, ^c reference group are women who did not undergo radiotherapy					
B – unstandardized regression coefficient, SE - standard error of B, β - standardized regression coefficient, Adj.R ² - indicator of the degree of explained variance of the dependent variable of the model, F - predictive power of the regression model, p - statistical significance					

In contrast, education level, place of residence, and radiotherapy were not significantly associated with overall health and QoL in the multivariable model. Although age showed a statistically significant inverse association with QoL after adjustment for the other variables, the unadjusted relationship between age and QoL did not reach statistical significance ($r = -0.20$, $p = 0.093$), despite an overall declining trend with increasing age (Fig. 2). We also observed that the age intervals 33–38 years, 56–64 years, and ≥ 70 years showed the lowest reported QoL among these patients (Fig. 3). This finding is highly relevant for the design of subsequent targeted interventions aimed at specific age groups and for the refined specification of functional scales and symptom domains that should be prioritized to improve patients' quality of life.

Scores are expressed on a standardized 0–100 scale in accordance with the EORTC scoring guidelines, with higher values reflecting better overall health and quality of life. The graph demonstrates the distribution of individual patient scores according to age. The solid central line represents the fitted linear regression equation ($y = a + bx$). The shaded red line denotes the 95% confidence interval surrounding the regression line, whereas the outer dashed boundaries indicate the 95% prediction interval. The x-axis displays age, while the y-axis corresponds to overall health and QoL scores. Abbreviation: QoL, quality of life.

Scatterplot of individual overall QoL scores plotted against age, overlaid with a smoothed moving-average curve. A two-dimensional density heat map was added to visualize areas with higher concentrations of observations, where warmer colours indicate greater point density. The visualization is presented for exploratory and descriptive purposes only and does not imply a statistically significant relationship between age and QoL. Abbreviations: QoL – quality of life.

Our analysis revealed noteworthy findings regarding the dependence of overall quality of life (QoL) on place of residence and level of education in patients with uterine malignancies (cervical and endometrial cancer combined). For both cancer types, patients with higher educational attainment and those residing in urban areas exhibited a trend toward lower overall QoL.

4. Discussion

Gynaecologic malignancies are increasing worldwide and remain a persistent challenge for both prevention and clinical management [30–32]. Continuous engagement of healthcare professionals, including physicians and oncology nurses, is essential not only for the early detection of recurrence after primary treatment but also for maintaining an optimal health-related quality of life among survivors [33]. In Slovakia, only limited research has been conducted on QoL among gynaecologic cancer patients, and the present study contributes to filling this knowledge gap by providing one of the first national data sets addressing this issue. According to the Global Burden of Disease 2023 analysis, cancer remains one of the leading causes of mortality worldwide, with a substantial increase in the global number of cancer cases and deaths projected by 2050, particularly in low- and middle-income countries. These trends are expected to place increasing pressure not only on oncological treatment capacity but also on long-term survivorship care and quality-of-life management [7].

Age-related associations with overall QoL differed between the two cancer cohorts. In cervical cancer patients, age was not significantly associated with overall QoL in the multivariable regression model, although the exploratory age-based visualization suggested lower QoL particularly in the 43–50 years and ≥ 60 years age groups. In contrast, among endometrial cancer survivors, increasing age was independently associated with lower overall health and QoL in the multivariable model after adjustment for treatment-related and sociodemographic factors. Nevertheless, the corresponding unadjusted age–QoL correlation did not reach statistical significance, while exploratory visualization indicated lower QoL in the 33–38 years, 56–64 years, and ≥ 70 years age intervals. These age-specific patterns should be interpreted cautiously, but they suggest that survivorship needs may differ across life stages. This is particularly relevant in cervical cancer, where recent international data have demonstrated distinct age-specific patterns in cervical precancer and cancer burden, especially among vulnerable populations such as women living with HIV [34]. Age-sensitive QoL surveillance may therefore help identify patient groups requiring more individualized survivorship-oriented psychosocial, sexual, and supportive-care interventions. Comparable age-related survivorship challenges have also been reported among endometrial cancer survivors, including persistent anxiety/depression, mobility impairment, and reduced ability to perform usual daily activities across different age groups [35].

Assessing QoL in cancer patients is crucial because it reflects how treatment technology, drug availability, healthcare organization, socioeconomic conditions, and social support systems influence post-treatment well-being. Consistent evidence indicates that survivors in Western European countries report higher QoL compared with those in Central and Eastern Europe (CEE), where healthcare infrastructure and resource allocation remain less developed [36, 37].

4.1. Cervical Cancer

Cervical cancer (CC) remains one of the most common malignancies in women, accounting for approximately 6.5% of all female cancers globally and ranking fourth in incidence among women [38]. Early detection and modern multimodal therapy have markedly improved both survival and QoL outcomes. Harmonization of European treatment standards through international guidelines [29] has further increased survival rates, highlighting the growing importance of post-treatment QoL as a core outcome measure. Because different treatment modalities as surgery, radiotherapy, chemotherapy, or concurrent chemoradiotherapy (CCRT), exert distinct long-term effects, systematic long-term QoL monitoring among survivors is essential.

Comparable findings were reported by Stuopelytė et al. [39], who assessed QoL in patients with FIGO stage IB–IIIB CC treated with CCRT using the EORTC QLQ-CX24 instrument. They observed good symptom control but significantly impaired sexual activity and enjoyment, along with poorer body image and self-perception as women. These outcomes closely parallel our Slovak cohort (FIGO IA2–IIIC1), where patients reported high levels of concern regarding sexual health, vaginal discomfort, and menopausal symptoms, as well as peripheral neuropathy and lymphedema. Such patterns likely reflect cumulative toxicity from combined radiotherapy (brachytherapy and teletherapy) and repeated chemotherapy cycles.

A longitudinal study by Pasek et al. [40] in Poland demonstrated the dynamic nature of QoL in CC survivors. Across four follow-up phases - from baseline to five years post-treatment -physical functioning decreased progressively, while emotional functioning initially improved before declining again. Overall QoL scores were lowest at the final assessment, underscoring the lasting impact of late treatment effects. Although our study employed a cross-sectional design, similar retrospective trends were observed across age groups, supporting the need for prospective, long-term QoL surveillance.

These findings collectively stress the importance of structured survivorship programs integrating QoL monitoring into standard oncologic follow-up. Continuous, multi-year evaluation allows early identification of problematic domains and guides targeted psychosocial and nursing interventions. Such a framework is particularly urgent in CEE, where disparities in cancer outcomes persist. Vrdoljak et al. [41] noted that, while cancer incidence is often higher in Western Europe, mortality remains disproportionately elevated in CEE due to insufficient prevention, delayed diagnosis, and limited access to multidisciplinary care. Their expert panel at the 11th Central European Oncology Congress proposed comprehensive reforms, including National Cancer Control Plans (NCCPs), national cancer registries,

multidisciplinary centres, enhanced prevention programs (notably cervical cancer screening), and the professional development of oncology nurses and allied staff.

These priorities remain directly applicable to Slovakia, where organized cervical cancer screening continues to function poorly despite repeated legislative updates [42]. Without a functioning preventive framework, structured QoL-oriented survivorship care is difficult to implement. In contrast, Norway provides a successful model of integrated, patient-centred oncology care. There, oncology nurses play a central role in continuous monitoring through direct contact, telephone helplines, and digital “onco-nurse” communication platforms. Patients are encouraged to self-report changes in symptoms and QoL through mobile and web-based tools [43, 44]. National systems such as Ehandbok, NDLA, and Varnett provide standardized nursing protocols, ensuring that up-to-date evidence-based care is accessible to all healthcare professionals [45–47].

Adopting a similar framework in Slovakia would represent a fundamental transition from a reactive, disease-centred system to a proactive, patient-centred model that combines preventive, medical, and psychosocial dimensions of survivorship care. Similar challenges extend to endometrial cancer survivors, where evolving treatment modalities and improved survival have shifted attention toward long-term QoL.

4.2. Endometrial Cancer

Endometrial cancer (EC), similarly to cervical cancer, is increasingly characterized by favourable long-term survival in many patients due to earlier detection and major advances in surgical, molecularly stratified, and adjuvant treatment approaches. Consequently, growing attention is being directed toward survivorship care and long-term QoL preservation, particularly in the domains of sexual, social, and physical functioning.

Cianci et al. [17] conducted a comprehensive meta-analysis on sexual health and QoL in EC patients, highlighting the need for proactive, multimodal interventions that address both physical and psychological aspects of survivorship. Our findings corroborate this evidence: Slovak patients demonstrated the lowest QoL scores in sexual activity ($M = 15.39$) and sexual interest ($M = 20.51$), confirming that sexuality remains the most compromised functional area after treatment.

The impact of adjuvant therapy on QoL is multifactorial and strongly dependent on treatment modality. Historically, many EC patients underwent surgery followed by combined chemoradiotherapy, a regimen that prolonged survival but often caused chronic gastrointestinal toxicity, lymphedema, neuropathy, and other irreversible side effects [48]. Modern treatment protocols, guided by molecular classification and nodal status, now favour minimally invasive surgery (laparoscopic or robotic) followed by chemotherapy when indicated, while radiotherapy is reserved for high-risk molecular subtypes [49]. Recent molecular profile-based treatment strategies further support individualized adjuvant management in endometrial cancer. The PORTEC-4a trial demonstrated that molecularly integrated risk stratification can safely reduce both overtreatment and undertreatment while maintaining oncological safety, thereby potentially

minimizing long-term treatment-related toxicity and preserving long-term quality of life [50]. Collectively, these therapeutic refinements represent an important step toward more personalized survivorship-oriented oncological care.

In our analysis, chemotherapy was associated with significantly reduced overall health and QoL, with frequent symptoms including hair loss, taste alteration, neuropathy, back pain, and sexual/vaginal discomfort - consistent with systemic toxicity. Conversely, radiotherapy was primarily associated with paraesthesia and lymphedema due to local fibrosis. Such differences underscore the importance of individualized nursing and rehabilitation strategies tailored to the treatment received.

Other studies confirm similar findings. Facondo et al. [51] and Lorusso et al. [52] demonstrated that specific treatment regimens can mitigate symptom severity and improve selected QoL dimensions. Thus, both the form and intensity of adjuvant therapy should be considered critical factors in future QoL assessments.

Emerging research also emphasizes the influence of modifiable patient characteristics.

Oldenburg et al. [53] identified significant associations between higher BMI and several adverse QoL outcomes in endometrial cancer survivors, including poorer physical functioning, greater fatigue, and increased lymphoedema symptoms. These findings suggest that lifestyle interventions targeting physical activity and weight management may represent relevant components of survivorship care. Although BMI was not included as a variable in our study, we analysed other modifiable (education, residence) and non-modifiable (age) factors potentially influencing QoL. In our multivariable analysis, increasing age was independently associated with lower overall health and QoL among endometrial cancer survivors after adjustment for treatment-related and sociodemographic factors, although the corresponding unadjusted age-QoL correlation did not reach statistical significance.

Comparable survivorship patterns have also been reported in prospective endometrial cancer cohorts from tertiary oncological centres. Warring et al. [54] demonstrated that obesity, lymphoedema, and treatment-related symptom burden were significantly associated with poorer global health status and reduced physical functioning among endometrial cancer survivors, emphasizing the importance of long-term patient-reported outcome monitoring and supportive-care interventions. The collective evidence, including our results, demonstrates that QoL should be recognized as an essential, routinely monitored outcome in oncogynecological care. Regular evaluation and publication of QoL data can identify modifiable determinants, such as lifestyle, social support, and educational status, that can be effectively addressed through tailored interventions. For instance, promoting weight reduction may help prevent lymphedema and improve mobility, while educational and psychological support programs may enhance cognitive, emotional, and social functioning.

QoL indicators should also be context-sensitive, adapted to hospital settings, regional health systems, and patient populations. Banning et al. [16] confirmed that disease aggressiveness significantly influences QoL among EC survivors, but this effect is mediated primarily by socioeconomic and

psychosocial variables rather than race or ethnicity. These results underscore that most QoL determinants are modifiable and can be effectively addressed through structured survivorship and nursing programs.

Ultimately, both our study and international evidence converge on a common conclusion: the future of gynaecologic oncology lies not only in early detection and effective therapy but also in comprehensive long-term survivorship care. The present study indicates that social functioning, fatigue, and sexuality remain among the most affected domains following treatment for cervical and endometrial cancer. Similar impairments in these areas were previously identified in Slovak breast cancer survivors in our EORTC-based analysis, suggesting that they may represent persistent unmet supportive-care needs across multiple oncological populations within the Slovak healthcare setting [18]. Collectively, these results emphasize the importance of multidisciplinary survivorship care involving oncology nurses, psychologists, physiotherapists, and specialists in sexual rehabilitation. Recent global analyses further indicate that a substantial proportion of cancer-related deaths worldwide remain potentially avoidable through improved prevention, earlier detection, and timely access to effective treatment, with particularly large disparities observed in cervical cancer care across low- and middle-resource settings [13]. These international trends further support the need for integrated survivorship strategies focused not only on oncological outcomes but also on long-term quality-of-life management and supportive care. Systematic QoL assessment, integrated with personalized nursing and psychosocial interventions, may therefore represent an important pathway toward improving holistic outcomes in women treated for cervical and endometrial cancer.

Financial difficulties emerged as one of the more prominent patient-reported burdens in both cervical and endometrial cancer survivors within our cohort. While sexual dysfunction, fatigue, menopausal symptoms, and peripheral neuropathy are well-recognized consequences of oncological treatment, the relatively high perception of financial burden observed in our population may represent an important and underexplored survivorship issue in Central and Eastern European settings. In countries with lower socioeconomic resources and less developed survivorship-support systems, cancer-related financial distress may be amplified by reduced access to structured social assistance, rehabilitation programs, patient organizations, occupational reintegration support, and long-term psychosocial care compared with Western and Northern European countries. Financial toxicity in cancer survivors may therefore reflect not only direct treatment-related expenses, but also reduced work capacity, prolonged sick leave, loss of income, travel-related costs, and impaired social reintegration after treatment completion. Previous studies have shown that cancer-related financial toxicity is closely associated with socioeconomic vulnerability, employment disruption, and reduced quality of life among cancer survivors [55, 56]. These findings suggest that survivorship care should extend beyond symptom-oriented medical management and include psychosocial, occupational, and socioeconomic supportive strategies. Multidisciplinary supportive-care interventions involving psychologists, physiotherapists, social workers, rehabilitation specialists, sexologists, nutritionists, and specialized oncology nurses may help address both the physical and socioeconomic consequences of cancer treatment and improve long-term quality-of-life outcomes.

Beyond survivorship care, oncology nurses may also play an important role in secondary prevention and public health education related to HPV-associated malignancies. Recent population-based evidence from Sweden demonstrated that high-coverage school-based HPV vaccination programmes substantially reduced the incidence of high-grade cervical lesions even among unvaccinated women through a strong herd effect [57]. Collectively, these data highlight the broader societal impact of HPV vaccination strategies and reinforce the potential role of oncology nurses in promoting preventive awareness and intergenerational cervical cancer prevention. Oncology nurses may therefore contribute to vaccination counselling not only for patients themselves after treatment but also for their daughters, sisters, and other family members in order to reduce the future risk of HPV-related precancerous lesions and cervical cancer development.

Our results further emphasize the crucial role of psychological and social support in women with uterine malignancies. Numerous studies have demonstrated that psychosocial interventions, patient education, and rehabilitation programs significantly improve emotional well-being, coping capacity, and overall quality of life (QoL) among gynaecologic cancer survivors. In a large meta-analysis, Dhakal et al. [58] reported that structured psychosocial interventions markedly reduced anxiety and depression in women with cervical cancer, highlighting their importance for mental health recovery. Similarly, Ko et al. [59] found that cognitive-behavioural therapy effectively decreased distress, depression, and anxiety in patients with gynaecologic malignancies, including endometrial cancer. Complementing these findings, Yen et al. [60] demonstrated that digital and telemedicine-based interventions improve psychological well-being, alleviate distress, and enhance health-related QoL—illustrating the potential of telehealth to expand access to supportive care while maintaining treatment continuity. A longitudinal study by Mandato et al. [61] further showed that perceived social support and effective communication with healthcare providers strongly influence QoL trajectories during the first postoperative year in women treated for endometrial cancer.

Collectively, these findings support the integration of psychosocial and digital components into standard oncological care. Structured psychological counselling, online self-monitoring platforms, and teleconsultations with oncology nurses may substantially improve long-term well-being, especially in resource-limited healthcare systems such as Slovakia. These findings may be particularly relevant in the context of increasing global inequalities in cervical cancer burden and survivorship care, especially in healthcare systems with limited preventive, psychosocial, and supportive oncology resources [3].

Consistent with our findings and global evidence, QoL assessment must become an integral part of comprehensive survivorship care. Routine survivorship-oriented symptom screening, prompt intervention when new symptoms arise, and coordinated multidisciplinary collaboration - including oncologists, surgeons, psychologists, physiotherapists, nutritionists, and oncology nurses - are indispensable not only for optimizing survival outcomes but also for ensuring the highest attainable QoL throughout the cancer journey.

While this study provides the first comprehensive evaluation of QoL in Slovak uterine cancer patients following surgical and adjuvant therapy and offers valuable insights for regional meta-analyses across Central and Eastern Europe, certain limitations must be acknowledged. The relatively small sample size and cross-sectional design do not allow for longitudinal assessment of QoL evolution relative to disease stage or treatment duration. Nevertheless, these data represent a significant contribution toward establishing systematic QoL monitoring and evidence-based survivorship programs in Slovakia.

Unfortunately, Slovakia currently lacks a fully integrated oncology system linking prevention, diagnosis, treatment, and survivorship care. Practices that are already standard in Western Europe, such as structured survivorship planning, QoL-based nursing assessment, and patient-led symptom reporting remain largely unrealized. Specialized oncology nursing education is urgently needed, as general clinical preparation is insufficient for managing the complexity of modern therapies such as immunotherapy, targeted and anti-angiogenic treatments, and minimally invasive or robotic surgery. Oncology education should therefore be incorporated at the pre-licensure level, supported by competency frameworks, continuing education programs, and strong nursing leadership embedded within national cancer control strategies.

However, persistent barriers - such as workforce shortages, lack of specialized faculty, and insufficient accreditation of oncology nursing as a recognized subspecialty - pose significant challenges. Strengthening the oncology nursing workforce is essential to meet the growing global cancer burden. As highlighted by Galassi et al. [62] and supported by the WHO and leading professional societies, investing in oncology nursing capacity is among the most effective ways to improve patient outcomes and health system resilience.

Finally, our study reaffirms that women treated for cervical and endometrial cancer experience impaired QoL across multiple functional domains due to both physical limitations and treatment-related effects. Psychological and social factors significantly shape post-treatment well-being, underscoring the growing importance of oncology nurses as providers of continuous, individualized survivorship support. Tailored interventions addressing both physical and psychosocial domains are essential for improving not only long-term survival but also the lived experience of women after gynaecological cancer treatment. Such multidisciplinary supportive-care strategies may involve oncology nurses, psychologists, physiotherapists, social workers, rehabilitation specialists, sexologists, and nutritionists working together to address the complex survivorship needs of these patients. The successful administration of standardized EORTC questionnaires during routine follow-up demonstrates the practical feasibility of implementing structured QoL assessment and may provide a clinically useful approach for identifying survivorship-related physical, psychosocial, and sexual health needs in everyday clinical practice.

In interpreting the present findings, several limitations should be acknowledged. First, the study employed a cross-sectional design with a single time-point assessment, which does not allow evaluation of temporal changes in quality of life during survivorship or causal interpretation of observed associations. Second, the relatively modest sample size and the use of convenience sampling from

selected oncogynaecological outpatient centres may restrict the generalizability of the findings to the broader Slovak or Central and Eastern European population. Although the study included patients with different stages of cervical and endometrial cancer and various treatment modalities, subgroup sizes remained relatively small for more detailed stratified analyses. In addition, all QoL data were based on patient-reported questionnaires and may therefore be influenced by subjective perception, recall bias, emotional state, cultural context, and individual response variability. The broad post-treatment interval (6–60 months) represents another important limitation, since symptom burden and survivorship perception may substantially differ depending on the time elapsed after completion of therapy. Furthermore, because of the exploratory nature of the study and the analysis of multiple QoL domains, no formal correction for multiple testing was applied, which may increase the risk of type I statistical error. Finally, potentially relevant clinical and lifestyle-related variables, such as BMI, detailed comorbidity burden, hormonal status, socioeconomic background, and pre-treatment QoL levels, were not systematically analysed and could have influenced the observed outcomes. Nevertheless, despite these limitations, the study provides one of the first comprehensive patient-reported QoL analyses in Slovak women treated for cervical and endometrial cancer and contributes important real-world survivorship data from a Central and Eastern European setting.

5. Conclusion

This study provides one of the first comprehensive analyses of quality of life (QoL) among Slovak women treated for cervical and endometrial cancer, emphasizing the urgent need to integrate QoL evaluation into standard oncological practice. Despite the limited availability of national data and the scarcity of region-specific literature, our findings highlight that gynaecologic cancer survivors continue to experience substantial physical, psychological, and social challenges after treatment. These issues have long been underestimated in Slovakia, reflecting systemic gaps in oncology nursing and survivorship care.

Modern nursing practice in advanced healthcare systems offers a clear path forward. Slovakia must move toward evidence-based, multidisciplinary care models that incorporate structured QoL monitoring, symptom management, and psychosocial support. Nurses play a pivotal role in this transformation through competent management of treatment-related side effects, wound care, early detection of complications, and patient education on hygiene, fertility, and sexual health. Equally important is the psychological and social support that oncology nurses can provide, helping patients cope with anxiety, depression, and altered body image, while engaging family members in care and promoting community reintegration.

Holistic, patient-centred nursing interventions should address all dimensions of well-being - physical, emotional, and social. Continuous education, specialization, and certification in oncology nursing are essential to ensure safe and effective care. Only through sustained professional development, research dissemination, and international collaboration can Slovak oncology nursing evolve toward modern standards and substantially improve the post-treatment quality of life of gynaecologic cancer survivors.

5.1. Recommendations and Implications for Practice

5.1.1. Rationale for the Recommendations

Despite substantial progress in oncological diagnostics and therapy, the Slovak healthcare system continues to underestimate the importance of survivorship care and quality-of-life management in cancer patients. Existing oncology follow-up protocols remain predominantly disease-centred, focusing almost exclusively on recurrence detection, while psychosocial, sexual, emotional, and functional domains of survivorship receive minimal clinical attention. In gynaecologic oncology, this gap is even more pronounced - nursing care is insufficiently integrated, and specialized roles such as oncology nurses are either absent or underutilized in both hospital and community practice.

International evidence demonstrates that structured QoL monitoring, interdisciplinary survivorship programs, and the active involvement of oncology nurses significantly improve physical recovery, emotional well-being, and treatment adherence among cancer survivors. These strategies enhance communication between patients and healthcare providers, reduce long-term symptom burden, and facilitate faster reintegration of survivors into social and professional life.

Given these findings, Slovakia urgently requires a systemic reform that extends beyond screening, diagnosis, and acute treatment to include continuous, coordinated, and patient-centred survivorship care. The following recommendations outline essential steps toward building a comprehensive, multidisciplinary, and data-driven model of oncological care - one that ensures not only prolonged survival but also improved quality of life for women living after gynaecologic malignancies.

5.1.2. Recommendations for Clinical Practice

Based on the findings of this study, the following recommendations are proposed to strengthen education, clinical practice, and health system organization in gynaecologic oncology nursing in Slovakia.

5.1.2.1. Educational Recommendations

1. Develop structured educational and certification programs in oncology nursing for both hospital- and community-based care settings.
2. Integrate oncology nursing into pre-licensure curricula and establish continuing education pathways for nurses specializing in cancer care.
3. Provide disease-specific patient education materials outlining the most common treatment-related effects on QoL and the functional domains most affected.
4. Inform patients about the availability of specialized nursing assessments aimed at identifying and addressing QoL domains and treatment-related symptoms.
5. Promote scientific research and publication in the field of QoL in gynaecologic oncology, with progressive integration into international research networks to support evidence-based nursing

interventions.

5.1.2.2. Clinical Recommendations

1. Implement systematic QoL monitoring and evaluation using internationally validated instruments such as the EORTC QLQ-C30 and cancer-specific modules.
2. Expand post-treatment follow-up protocols beyond recurrence detection to include structured QoL assessments by trained oncology nurses.
3. Establish permanent oncology nurse positions within hospital departments to coordinate post-treatment care, including palliative, pain, and symptom management, and to conduct interval QoL evaluations (6–18 months).
4. Ensure that each mandatory follow-up visit within the first five years post-treatment includes a structured QoL assessment and an individualized care plan.
5. Develop standardized nursing protocols and intervention guidelines (clinical, psychological, and social) tailored to impaired QoL domains and the most frequent symptoms of each gynaecologic cancer type.

5.1.2.3. Systemic Recommendations

1. Create community oncology nurse positions under regional healthcare authorities to maintain continuous patient contact and collaboration with home care (ADOS) services.
2. Introduce reimbursement codes for teleconsultations (telephone or video) between oncology nurses and patients, recognized by health insurance providers as professional nursing interventions.
3. Develop digital tools and mobile applications for patient self-monitoring of QoL, symptoms, and treatment side effects, with secure communication channels to oncology teams.
4. Implement a unified national eHealth platform for oncology follow-up, replacing the current fragmented and non-interoperable systems.
5. Provide financial and institutional support for oncology nurses to address the current deficit in structured survivorship care and professional recognition.
6. Enhance social and rehabilitation programs for gynaecologic cancer survivors at national and local levels, ensuring long-term sustainability beyond NGO-based initiatives.
7. Establish a national benchmarking system for QoL outcomes based on treatment modality and surgical approach, providing feedback to healthcare institutions for continuous quality improvement.

5.1.3. Clinical and Research Implications

These findings underscore that early diagnosis and effective therapy play a key role in maintaining optimal QoL in uterine cancer patients. Attention should therefore be given not only to medical follow-up for the early detection of potential recurrence but also to comprehensive post-treatment QoL evaluation

and patient education regarding symptom management, treatment side effects, and rehabilitation options.

Specialized interventions - including physiotherapy, nutritional counselling, healthy lifestyle promotion, psychological support, group therapy, and professional guidance focused on alleviating anxiety, depression, and stress - may have a substantial positive impact on QoL and help patients better cope with the disease.

Finally, this study highlights the necessity for ongoing research into long-term QoL outcomes in Slovak uterine cancer patients and emphasizes the importance of integrating Slovak oncology centres into international QoL research networks to strengthen survivorship care, support evidence-based nursing interventions, and harmonize national practice with global standards. Implementation of these recommendations could serve as a foundation for establishing a comprehensive national survivorship care model in Slovakia, ensuring that quality of life becomes a central pillar of modern oncological care.

Abbreviations

- ADOS

Slovak Ambulatory Home Nursing Care Service (Ambulancia domácej ošetrovateľskej služby)

- AM

Group Mean

- ANOVA

Analysis of Variance

- CEE

Central and Eastern Europe

- CC

Cervical Cancer

- CCRT

Concurrent Chemoradiotherapy

- EC

Endometrial Cancer

- ECOG

Eastern Cooperative Oncology Group

- EORTC

European Organisation for Research and Treatment of Cancer

- ESMO

European Society for Medical Oncology

- ESGO

European Society of Gynaecological Oncology

- ESP

European Society of Pathology

- FIGO

International Federation of Gynecology and Obstetrics

- FS

Functional Scale

- GDPR

General Data Protection Regulation

- HPV

Human Papillomavirus

- MR

Mean Rank

- M

Arithmetic Mean

- Mdn

Median

- N

Number of Respondents

- NYHA

New York Heart Association

- PROs

Patient–Reported Outcomes

- QoL

Quality of Life

- QLQ

C30–Quality of Life Questionnaire–Core 30

- QLQ

CX24–Cervical Cancer Module

- QLQ

EN24–Endometrial Cancer Module

- SD

Standard Deviation

- SS

Symptom Scale

- U

Mann–Whitney U Test

- WHO

World Health Organization

Declarations

Supplementary information

Supplementary Table 21 provides baseline demographic, clinicopathological, FIGO staging, and molecular risk stratification characteristics of patients with cervical and endometrial cancer.)

Authors' contributions

Pe.Z., L.K., and P.Z. participated in Roles/Writing - original draft; Writing - review & editing; Conceptualization; Methodology; Project administration and Visualization; J.V., J.B., P.M., P.Z., and M.M. were involved in the clinical management of the patients; L.K., Pe.Z. and P.Z. contributed to manuscript preparation, Data analysis and Literature review; P.Z., Pe.Z., and J.V. participated in the final Writing - review & editing. All authors read and approved the final manuscript.

Data Availability Statement

The anonymized datasets supporting the findings of this study are available from the corresponding author upon reasonable request. Individual-level identifiable patient data are not publicly available due to applicable GDPR requirements and participant confidentiality.

Public Involvement Statement

Patients participated in the study as respondents providing patient-reported outcome data through independent completion of standardized QoL questionnaires (EORTC QLQ-C30 and the respective disease-specific module) following oncological treatment. Neither patients nor members of the public were involved in the formulation of the study design, research objectives, selection of outcome measures, statistical analyses, interpretation of findings, manuscript drafting, or dissemination of the study results.

Guidelines and Standards Statement

This manuscript was drafted in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) Statement guidelines for reporting cross-sectional observational studies [63].

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Consent for Publication

Not applicable.

Consent to Participate and Informed Consent Statement

Written informed consent was obtained from all individual participants included in the study. All participants provided consent for participation and for the publication of anonymized data and study

findings.

Ethics approval

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and received approval from the Ethics Committee (Institutional Review Board) of Constantine the Philosopher University in Nitra (approval No. 316198).

Competing Interests

Authors Petra Zuborova and Pavol Zubor were employed by the company OBGY Health & Care Ltd. and author Petra Zuborova and Jozef Visnovsky were employed by the VISNOVSKI Ltd. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The authors declare that this study did not receive funding from OBGY Health & Care Ltd. or VISNOVSKI Ltd.

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Figures

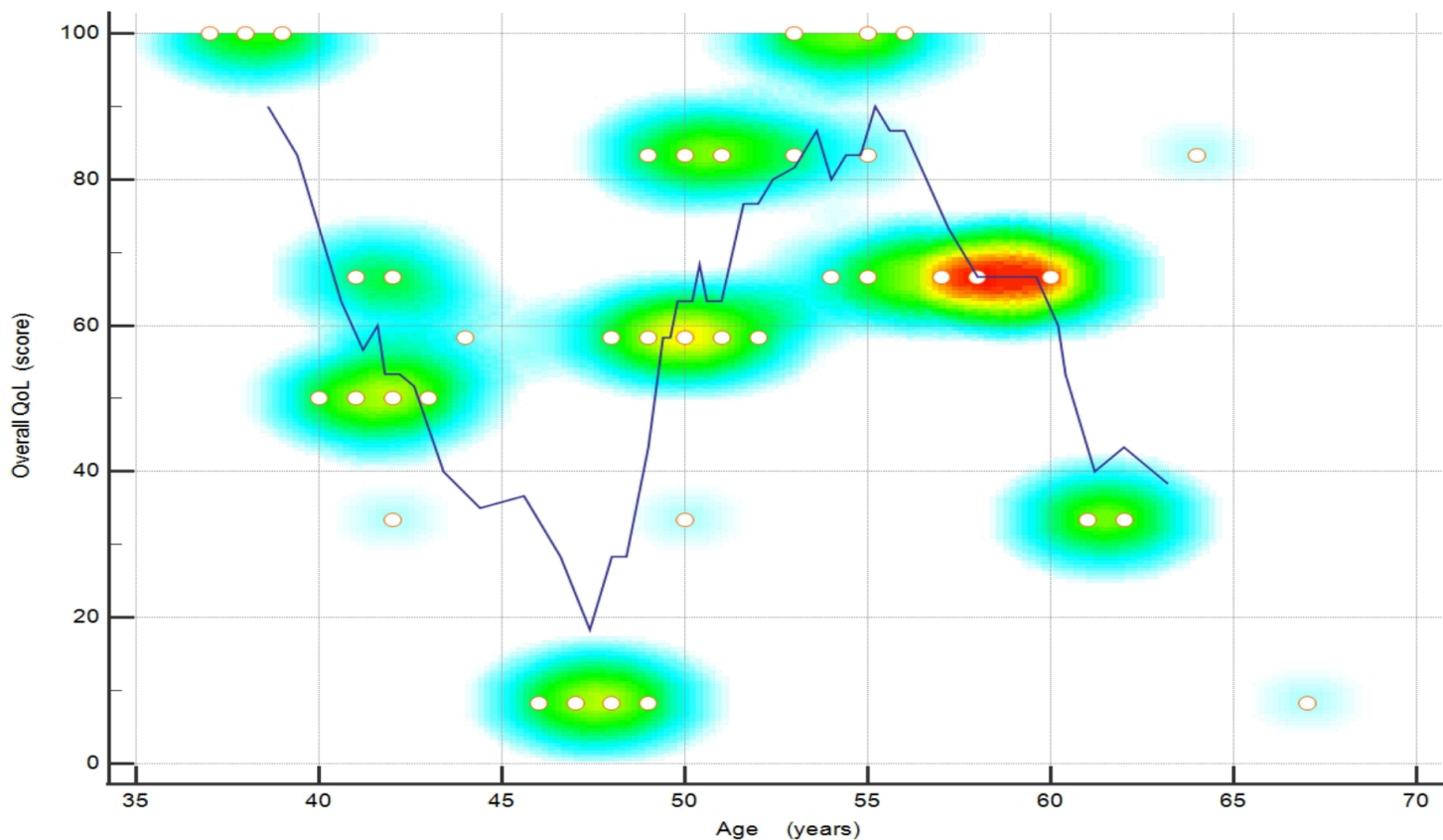


Figure 1

Distribution of overall quality-of-life scores among cervical cancer survivors by age.

Scatterplot of individual overall QoL scores plotted against age, overlaid with a smoothed moving-average curve. A two-dimensional density heat map was added to visualize areas with higher concentrations of observations, where warmer colours indicate greater point density. The visualization is presented for exploratory and descriptive purposes only and does not imply a statistically significant relationship between age and QoL. Abbreviations: QoL – quality of life.

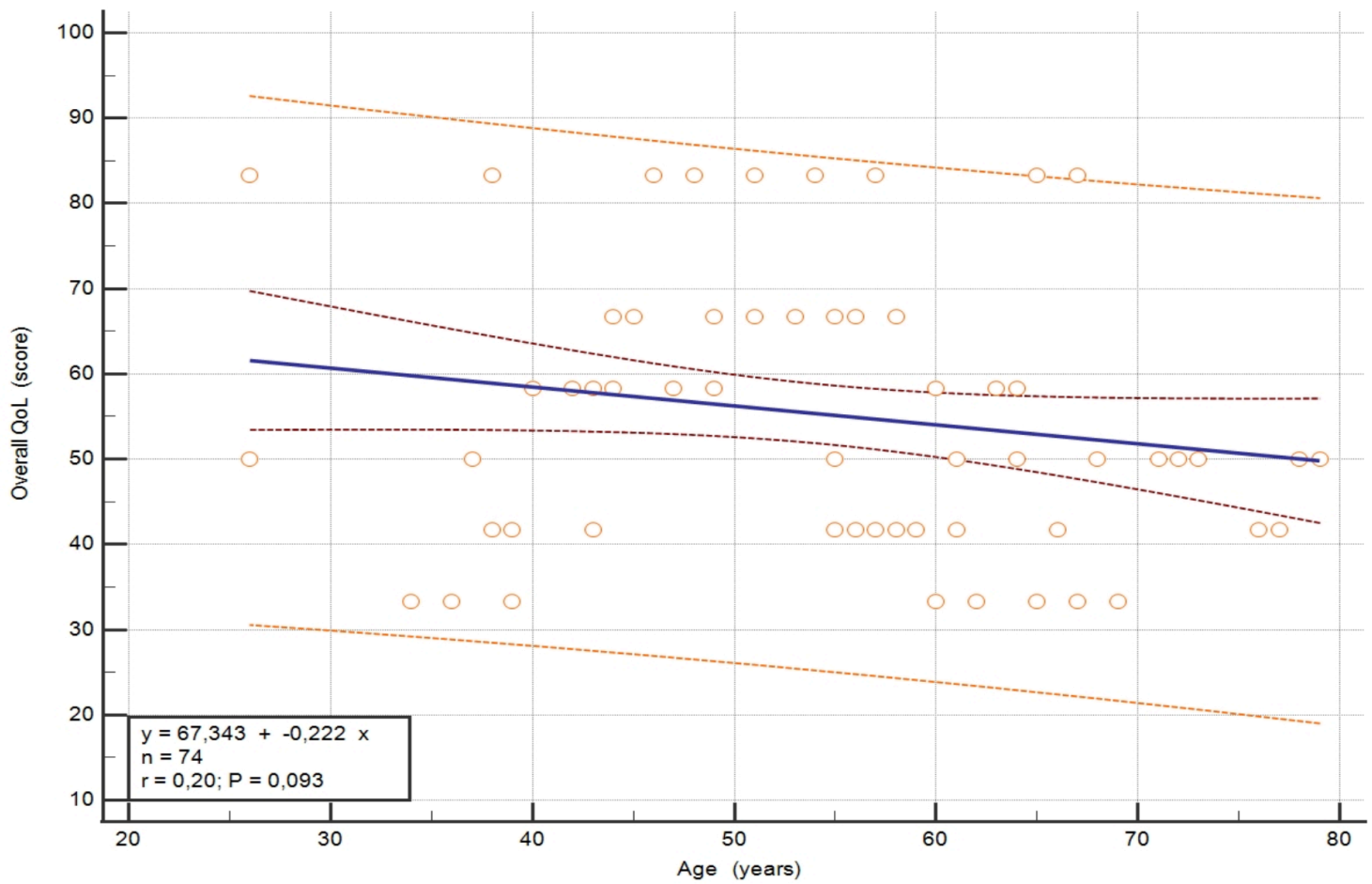


Figure 2

Association between overall quality of life (QoL) and age in patients with endometrial cancer.

Scores are expressed on a standardized 0–100 scale in accordance with the EORTC scoring guidelines, with higher values reflecting better overall health and quality of life. The graph demonstrates the distribution of individual patient scores according to age. The solid central line represents the fitted linear regression equation ($y = a + bx$). The shaded red line denotes the 95% confidence interval surrounding the regression line, whereas the outer dashed boundaries indicate the 95% prediction interval. The x-axis displays age, while the y-axis corresponds to overall health and QoL scores. Abbreviation: QoL, quality of life.

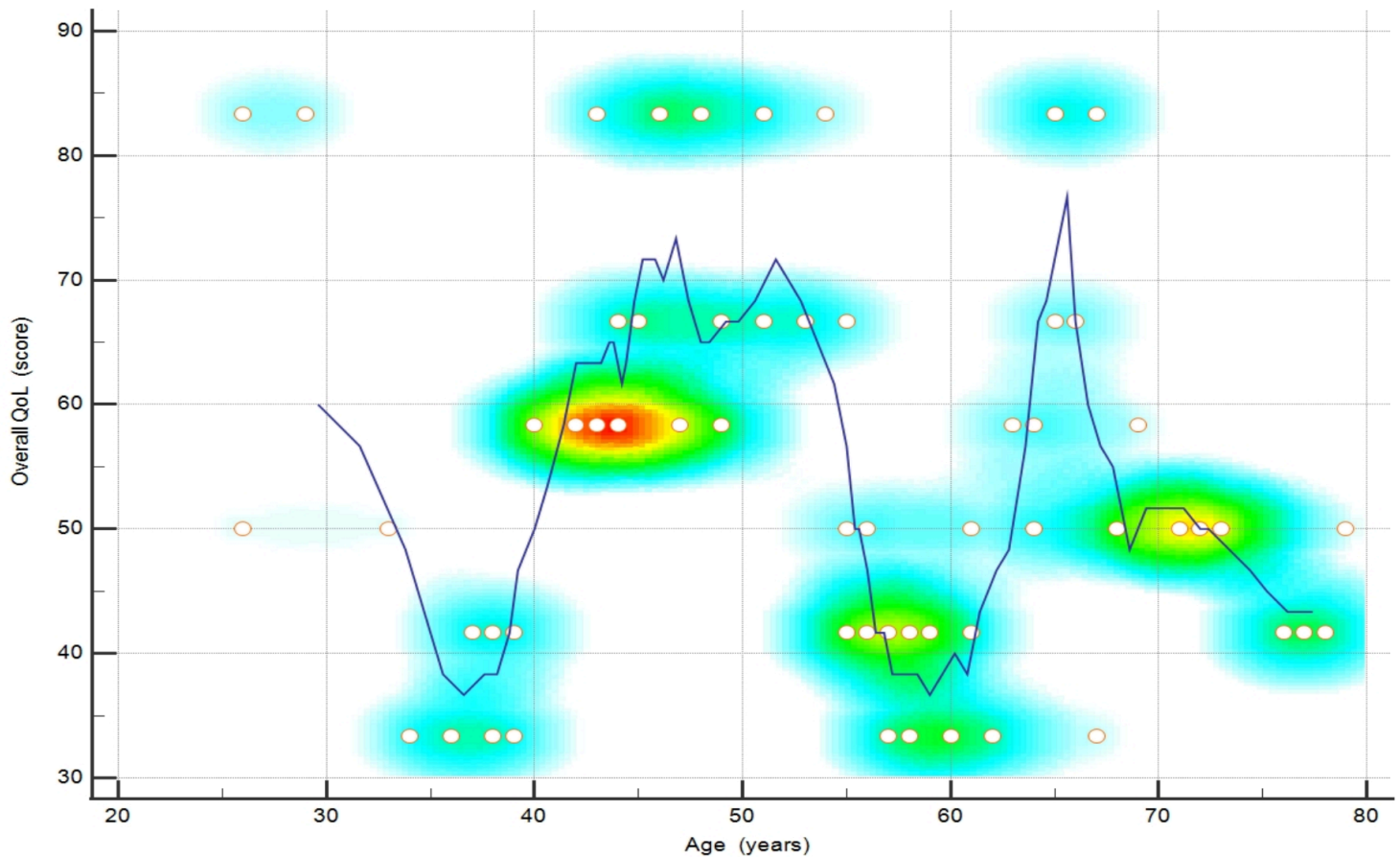


Figure 3

Distribution of overall quality-of-life scores among endometrial cancer survivors by age.

Scatterplot of individual overall QoL scores plotted against age, overlaid with a smoothed moving-average curve. A two-dimensional density heat map was added to visualize areas with higher concentrations of observations, where warmer colours indicate greater point density. The visualization is presented for exploratory and descriptive purposes only and does not imply a statistically significant relationship between age and QoL. Abbreviations: QoL – quality of life.

Supplementary Files

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