

ORIGINAL RESEARCH

Establishment of a predictive survival prognosis model for epithelial ovarian cancer: a study based on the SEER database

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Abstract

Background: This study aimed to develop a predictive model for survival prognosis in epithelial ovarian cancer (EOC) patients using the Surveillance, Epidemiology, and End Results (SEER) database and identify key factors influencing survival outcomes, providing a reference for personalized treatment and clinical decision-making. **Methods:** Data from EOC patients diagnosed between 2000 and 2021 were analyzed. Variables included age, pathological grade, International Federation of Gynecology and Obstetrics (FIGO) stage, operation, surgical intervention, marital status, income level, tumor size, time from diagnosis to treatment, radiotherapy, chemotherapy and lymph node positivity. Prognostic factors were identified through univariate and multivariate COX proportional hazards regression. A nomogram predictive model was constructed using significant variables. Internal validation assessed the model's performance using calibration plots and Receiver Operating Characteristic (ROC) curves. **Results:** COX regression identified pathological grade, FIGO stage, operation, radiotherapy status and time from diagnosis to treatment as significant prognostic factors. The nomogram demonstrated strong calibration between predicted and observed outcomes. ROC analysis yielded Area Under Curve (AUC) values of 0.853 (1-year), 0.840 (2-year) and 0.847 (3-year), indicating good predictive accuracy. The model visually quantified each variable's contribution to survival. **Conclusions:** Pathological grade, FIGO staging, radiotherapy status and treatment delay are critical prognostic indicators in EOC. The developed nomogram provides valuable guidance for individualized treatment planning and supports evidence-based clinical decisions.

Keywords

Epithelial ovarian cancer; SEER database; Overall survival; Prognosis; Prognostic factors

1. Introduction

Epithelial ovarian cancer (EOC) is one of the most aggressive malignancies among gynecological tumors globally, accounting for more than 90% of all ovarian cancer cases [1]. EOC includes various subtypes such as serous, mucinous, endometrioid and clear cell. This heterogeneity in pathological and molecular characteristics poses significant challenges to effective clinical management [2, 3]. Due to its insidious onset and nonspecific early symptoms such as mild abdominal distension, digestive discomfort and general malaise, approximately 75% of patients are diagnosed at an advanced stage (Stage III or IV) [4]. Consequently, the overall prognosis remains poor, especially in advanced-stage cases, with a 5-year survival rate of less than 30% [5]. Despite advancements in surgical techniques, chemotherapy, targeted therapy and immunotherapy, improvements in survival outcomes have been modest, underscoring the urgent need for more

precise and individualized treatment approaches [6, 7]. The Surveillance, Epidemiology and End Results (SEER) database, maintained by the United States National Cancer Institute (NCI), is one of the most comprehensive and authoritative cancer registries worldwide [8, 9]. It compiles extensive cancer-related data from multiple geographic regions across the U.S., including patient demographics, tumor pathology, treatment modalities and survival outcomes. This makes it an invaluable resource for conducting large-scale epidemiological and prognostic studies in oncology [10].

In this study, we utilize the SEER database to explore the key prognostic factors affecting survival in patients with EOC. By establishing a COX proportional hazards regression model and combining it with a nomogram for survival prediction, we aim to identify variables most closely associated with prognosis. This may serve as a reference for personalized treatment strategies and contribute to the advancement of precision medicine in the management of EOC.

2. Materials and methods

2.1 Acquisition of case data

The data for this study were obtained from the Surveillance, Epidemiology and End Results (SEER) database, one of the most authoritative cancer registries in the United States. The SEER program covers approximately 30% of the U.S. population and provides comprehensive data on cancer incidence, patient demographics, tumor characteristics, treatment and survival outcomes [11]. For this study, case data for patients diagnosed with EOC between 2000 and 2021 were collected by logging into the official SEER database website (<http://seer.cancer.gov/>) and using SEER*Stat software version 8.3.9.2 (National Cancer Institute, Bethesda, Rockville, MD, USA).

2.2 Inclusion and exclusion criteria for patients

2.2.1 Inclusion criteria

(a) Patients diagnosed with EOC, identified by the International Classification of Diseases for Oncology, Third Edition (ICD-O-3) anatomical site code of C56.9 in the SEER database; (b) Age between 18 and 80 years; (c) Had complete follow-up data defined as ≥ 12 months of post-diagnosis survival information, along with comprehensive clinical profiles (including demographic characteristics, pathological details, treatment modalities and survival status).

2.2.2 Exclusion criteria

(a) Patients diagnosed solely via autopsy or death certificate; (b) Missing key clinical data, including but not limited to age, marital status, income, tumor size, tumor laterality, lymph node status, radiotherapy, chemotherapy, time from diagnosis to treatment, number of positive regional lymph nodes, Grade pathological, FIGO stage, operation and surgical status.

2.3 Data extraction

Relevant information was extracted from the case records of patients meeting the inclusion criteria, including but not limited to patient age, race, tumor grade (Grade Pathological), tumor stage (Stage), lymph node status (number of positive regional lymph nodes), treatment modalities (surgery, radiation therapy, chemotherapy, *etc.*), and follow-up duration. Tumor staging was based on the American Joint Committee on Cancer (AJCC) staging system, and tumor grading was extracted according to the Grade Pathological (2018+) field in the SEER database.

After data export, cleaning and processing were conducted, with Age recode (1 <60 years, 2 ≥ 60 years); Grade Pathological (1 well differentiated, 2 moderately differentiated, 3 poorly differentiated, 9 unknown); FIGO staging (phase 1, phase 2, phase 3 and phase 4); Operation (0 no operation, 1 operation); Marital status at diagnosis (0 unmarried, including unmarried cohabiting partners, 1 married, including divorced and widowed); Median household income inflation-adjusted to 2022 (1 <100,000, 2 $\geq 100,000$); Radiation recode (0 no, 1 yes); Chemotherapy recode (0 no, 1 yes); Time from di-

agnosis to treatment in days recode (1 <7 days, 2 ≥ 7 days); Tumor Size Summary (1 <80 mm, 2 ≥ 80 mm); Laterality (1 unilateral, 2 bilateral, 3 paired); Lymph node positivity (0 all regional lymph nodes negative, 1 positive regional lymph nodes detected).

2.4 Statistical analysis

Statistical analysis was conducted using SPSS (version 26.0.1.1, IBM Corp., Armonk, NY, USA) and R software (version 4.2.2; R Foundation for Statistical Computing, Vienna, Austria). Categorical variables were presented as frequencies and percentages (n, %) and compared between groups using the chi-square test. The primary end point of the study was overall survival (OS). Survival analysis was performed using the Kaplan-Meier method to compare survival outcomes across different variable groups, and survival curves were generated using SPSS. The log-rank test was used to assess statistical significance between survival curves. To identify prognostic factors associated with overall survival in EOC patients, univariate COX proportional hazards regression was initially conducted. Variables with statistical significance in univariate analysis were further included in a multivariate COX regression model to determine independent prognostic factors. Results were expressed as hazard ratios (HRs) with corresponding 95% confidence intervals (CIs). The nomograms were constructed using R software based on the significant variables identified in multivariate analysis to visually predict individual patient survival probabilities. The model's performance was internally validated using calibration curves to assess agreement between predicted and observed outcomes, and ROC curves were generated to evaluate predictive accuracy. All statistical tests were two-sided, and a $p < 0.05$ was considered statistically significant.

3. Results

3.1 Comparison of general characteristics

After screening the database, the study included 915 patients diagnosed with EOC in the final analysis. The patient selection process is illustrated in Fig. 1. Among these patients, 95 (10.38%) were deceased at the time of the final follow-up, while 820 (89.62%) remained alive. Comparative analysis between the deceased and surviving groups revealed statistically significant differences in several variables including radiation status, chemotherapy, diagnosis to treatment Time, Regional lymph nodes positivity, operation and Grade pathological ($p < 0.05$), Table 1.

3.2 Factors influencing OS prognosis in EOC patients

A univariate COX proportional hazards regression analysis was performed to evaluate the impact of individual clinical variables on the overall survival (OS) of EOC patients. Survival time was treated as the time variable, and OS status (alive or deceased) was used as the event indicator. Variables that demonstrated statistically significant differences between the

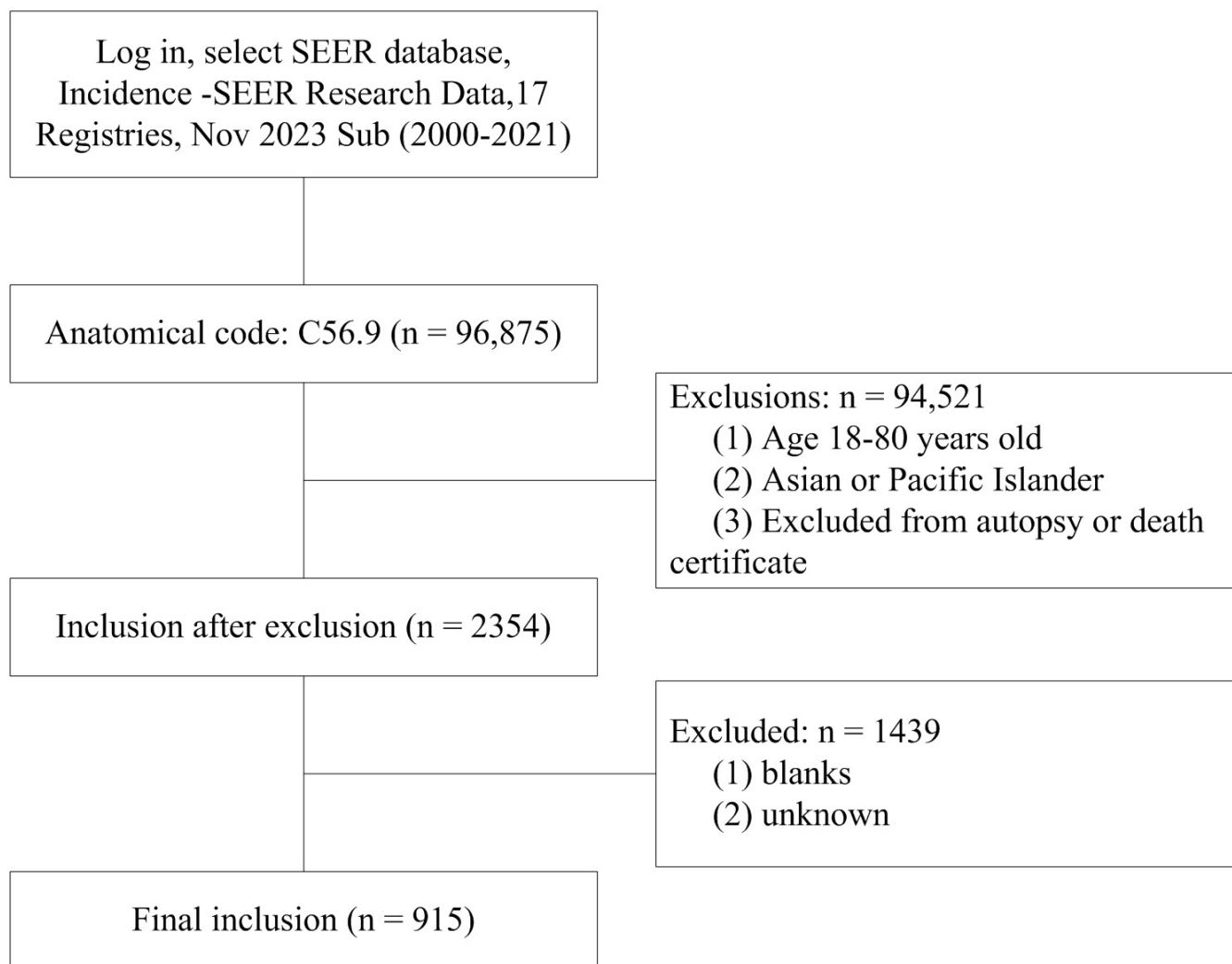


FIGURE 1. Flowchart of case inclusion. SEER: Surveillance, Epidemiology and End Results.

deceased and surviving groups in the baseline comparison were included in the analysis. Stratification was conducted based on Grade pathological. The results indicated that FIGO stage, operation, radiotherapy and the time interval from diagnosis to treatment were significantly associated with the OS prognosis of EOC patients ($p < 0.05$), as shown in Table 2. Further survival curves revealed that patients with Grade 3 tumors exhibited a notably more rapid decline in survival probability within the first 36 months compared to patients with lower-grade tumors. Additionally, patients with Grade 2 tumors had worse survival outcomes than those with Grade 1 tumors, highlighting the impact of tumor differentiation on prognosis, as illustrated in Fig. 2.

3.3 Construction of the nomogram for prediction model

Based on the results of the multivariate COX regression analysis, a nomogram for predicting the 1-year, 2-year and 3-year OS of EOC patients was established using R software, incorporating the three prognostic factors of FIGO staging, operation, time interval from diagnosis to treatment, and tumor differentiation grade, See Fig. 3.

3.4 Model validation

The performance of the nomogram prediction model was assessed using both calibration curves and ROC curves. The calibration curve demonstrated a high degree of agreement between the predicted and actual survival outcomes, indicating that the model was well-calibrated for 1-year, 2-year and 3-year overall survival in EOC patients (Fig. 4). The ROC curve was employed to assess the discriminatory ability of the model. The area under the curve (AUC) values for 1-year, 2-year and 3-year OS predictions were 0.853, 0.840 and 0.847, respectively. These results suggest that the model has good predictive accuracy. In a secondary analysis or subgroup setting (if applicable), AUC values of 0.624, 0.615 and 0.667 were observed, indicating a moderate predictive performance in that context (Fig. 5).

4. Discussion

Ovarian cancer remains one of the most common and lethal malignancies affecting the female reproductive system. Its global incidence continues to rise, posing a substantial threat to women's health. A major challenge in the management of ovarian cancer is the lack of specific symptoms in the

TABLE 1. Comparison of general characteristics between the deceased group and the survived group.

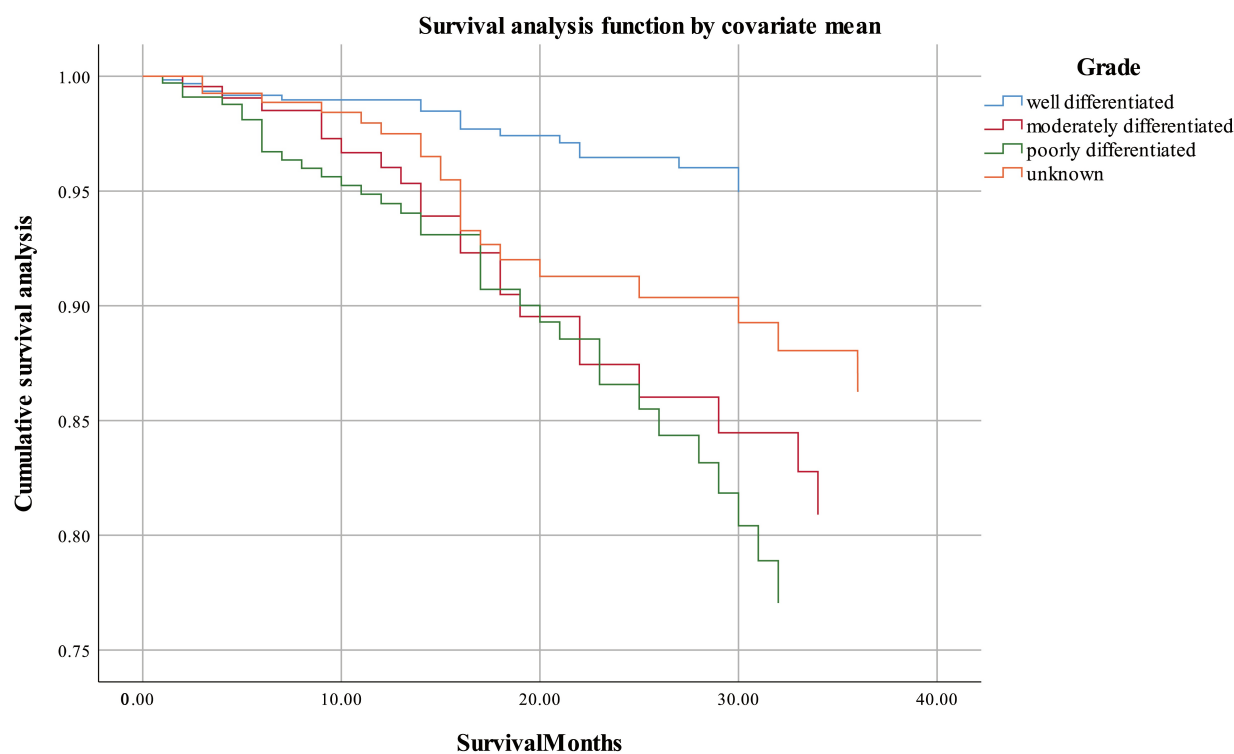
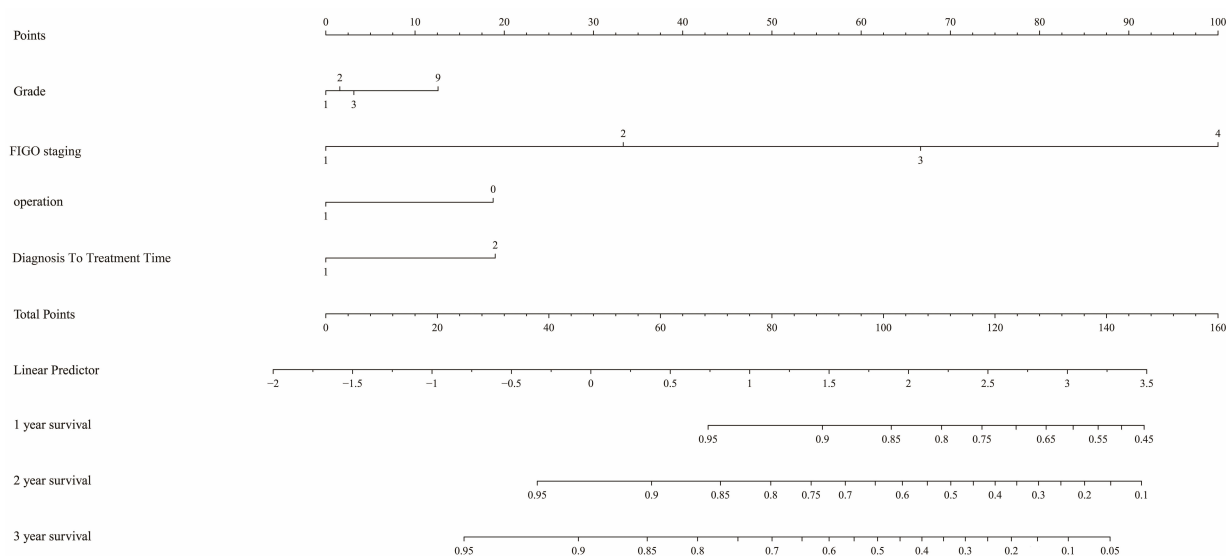
Type	Deceased group (n = 95)	Survived group (n = 820)	χ^2	<i>p</i>
Age				
<60 yr	62 (65.3)	558 (68.0)	0.302	0.582
≥60 yr	33 (34.7)	262 (32.0)		
Marital				
Unmarried	27 (28.4)	177 (21.6)	2.296	0.130
Married	68 (71.6)	643 (78.4)		
Income				
<100,000\$	50 (52.6)	454 (55.4)	0.257	0.612
≥100,000\$	45 (47.4)	366 (44.6)		
Radiation				
No	88 (92.6)	805 (98.2)	11.132	0.001
Yes	7 (7.4)	15 (1.8)		
Chemotherapy				
No	18 (18.9)	245 (29.9)	4.966	0.026
Yes	77 (81.1)	575 (70.1)		
Diagnosis To Treatment Time				
<7 d	54 (56.8)	641 (78.2)	21.207	<0.001
≥7 d	41 (43.2)	179 (21.8)		
Tumor Size				
<80 mm	25 (26.3)	257 (31.3)	1.009	0.315
≥80 mm	70 (73.7)	563 (68.7)		
Tumor Laterality				
Unilateral	72 (75.8)	678 (82.7)	3.439	0.179
Bilateral	21 (22.1)	135 (16.5)		
Paired	2 (2.1)	7 (0.9)		
Regional Lymph Nodes Positive				
No	65 (68.4)	686 (83.7)	13.437	<0.001
Yes	30 (31.6)	134 (16.3)		
Pathological Grade				
Well differentiated	18 (18.9)	439 (53.5)	53.284	<0.001
Moderately differentiated	21 (22.1)	118 (14.4)		
Poorly differentiated	35 (36.8)	111 (13.5)		
Unknown	21 (22.1)	152 (18.5)		
FIGO staging				
1	0 (0.0)	264 (32.2)	160.734	<0.001
2	26 (27.4)	275 (33.5)		
3	41 (43.2)	263 (32.1)		
4	28 (29.5)	18 (2.2)		
Operation				
No	19 (20.0)	64 (7.8)	15.351	<0.001
Yes	76 (80.0)	756 (92.2)		

FIGO: International Federation of Gynecology and Obstetrics.

TABLE 2. Univariate COX regression analysis of overall survival in EOC patients.

Type	β	SE.	Wald χ^2	p	HR	95% CI
FIGO staging	1.049	0.135	60.765	<0.001	2.856	2.194–3.718
Operation	−0.662	0.267	6.154	0.013	0.516	0.306–0.870
Radiation	0.954	0.398	5.735	0.017	2.596	1.189–5.667
Chemotherapy	0.166	0.271	0.375	0.540	1.180	0.694–2.007
Diagnosis To Treatment Time	0.728	0.216	11.367	0.001	2.072	1.357–3.164
Regional Positive lymph nodes	0.353	0.232	2.308	0.129	1.423	0.903–2.244

SE.: Standard Error; HR: Hazard Ratio; CI: Confidence Interval; FIGO: International Federation of Gynecology and Obstetrics.

**FIGURE 2. Survival curves.****FIGURE 3. Nomogram for OS in EOC patients. FIGO: International Federation of Gynecology and Obstetrics.**

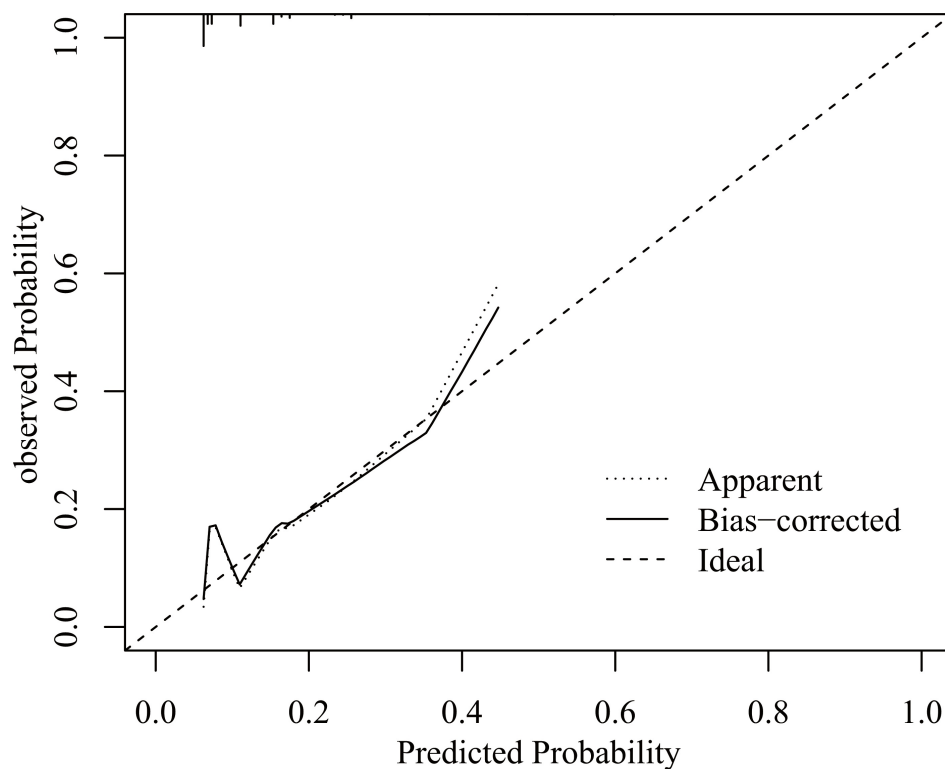


FIGURE 4. Calibration curve of the COX regression model.

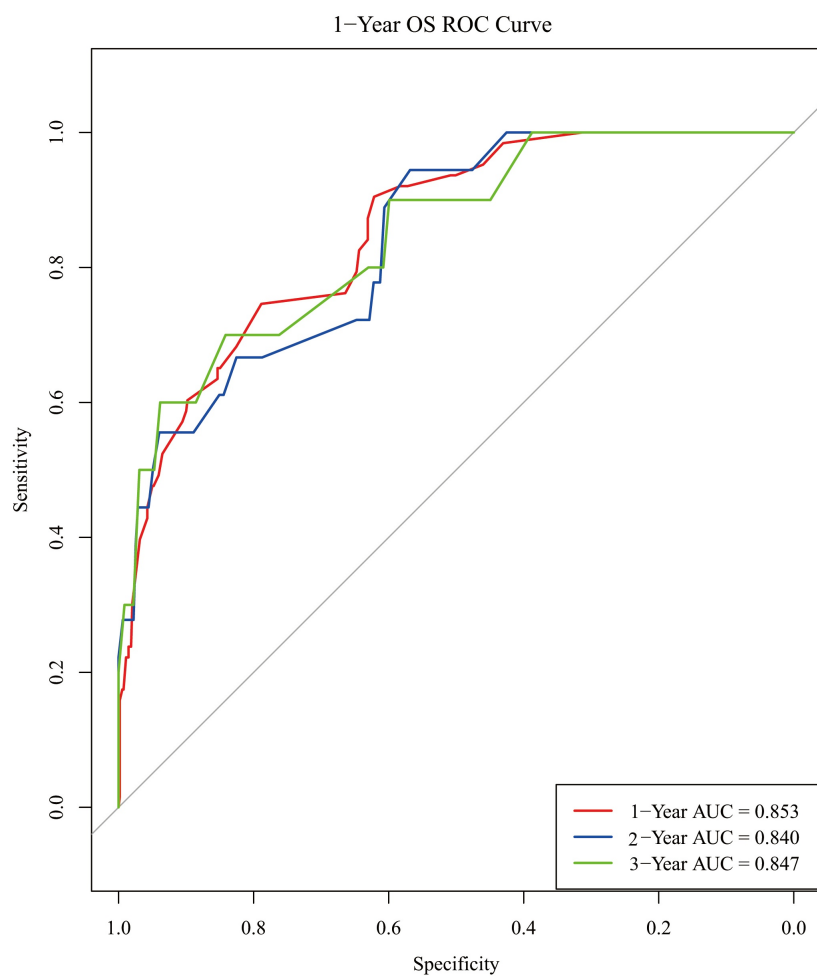


FIGURE 5. ROC curves for predicting 1-year, 2-year and 3-year OS using the model. OS: overall survival; AUC: area under the curve; ROC: Receiver Operating Characteristic.

early stages, leading to delayed diagnoses, with most patients presenting at advanced or late stages, where treatment options are limited and the prognosis is generally poor [12, 13]. Based on histological subtypes, ovarian cancer can be classified into various types, such as epithelial, sex cord-stromal and germ cell tumors, with EOC being the most prevalent EOC accounts for approximately 90% of all ovarian cancers cases [14]. Due to the complexity of its biological characteristics and pathological subtypes, EOC exhibits significant heterogeneity in terms of etiology, disease progression and treatment response. Although cytoreductive surgery combined with platinum-based chemotherapy remains the standard treatment regimen for EOC, the survival benefits differ markedly between individuals [15, 16]. This variability underscores the need for reliable prognostic tools that can help tailor treatment approaches and improve patient outcomes [17]. Accurate prognostic assessment in the early stages of EOC, not only aids in identifying high-risk patients for more aggressive treatment strategies but also avoids unnecessary treatments for low-risk patients, thereby reducing treatment burden and adverse reactions.

In this study, an in-depth analysis of the survival prognosis of EOC patients was conducted based on data from the SEER database, comparing multiple variables between the survival and deceased groups. There was no significant difference in age, marital status, income, tumor size, left and right distribution of tumor and lymph node status between the two groups. Age is widely recognized as an important factor in the prognosis of ovarian cancer [18], but the results of this study showed that mortality rates were comparable between patients aged ≥ 60 years and those under 60 years. This contrasts with previous studies that have suggested advancing age is associated with reduced immune function, diminished treatment tolerance, and subsequently worse survival outcomes in ovarian cancer patients. After adjusting for potential confounding factors, patients aged 70 and older had a 1.4-fold increased risk of cancer-specific mortality [19]. The reason for the insignificant difference between the survival and deceased groups in this study may be related to the age threshold. Additionally, Zhuxuan Fu's research [20] suggested that the specific mechanism by which age affects the prognosis of EOC patients may involve lifetime ovulation duration and menopause age. Therefore, assessing patient prognosis solely based on age may yield different results among studies. Additionally, broader evidence indicates that the association between age and prognosis in EOC may not be uniformly strong across all populations or study designs [21]. Pathological grade is an important indicator reflecting the malignancy of a tumor. Previous studies have shown that married patients often have better social support systems and better psychological states, which may help improve prognosis [22]. However, this study did not directly indicate differences in marital status between the survival and deceased groups, suggesting that the specific impact of marital status on ovarian cancer prognosis may vary between studies and requires comprehensive consideration of other factors for analysis. In this study, income did not have a significant impact on survival, which may be related to regional differences and income distribution characteristics in the SEER data. Although previous studies have shown that

individuals with better economic conditions may have access to better medical resources, the prognosis of EOC patients may depend more on the effectiveness of treatment itself [23]. Tumor size can reflect the severity of the disease to some extent, as larger tumors are often linked to higher malignancy and aggressiveness, making them more prone to metastasis and recurrence. However, in this study showed, no statistically significant difference in tumor size was observed between the survival and deceased groups. This suggests that factors such as tumor differentiation grade and degree of invasion may play a more critical role in determining prognosis, and that tumor size alone may not be a reliable predictor of patient outcomes. Prognostic differences have also been noted between unilateral and bilateral tumors. Studies have shown that patients with bilateral ovarian cancer generally have poorer prognoses, which may be related to the fact that bilateral cancer usually represents more severe disease progression [24]. Although this study did not find a significant association between laterality and survival, the presence of bilateral tumors may still warrant closer clinical attention when assessing prognosis. In contrast, regional lymph node positivity was confirmed as a critical prognostic indicator in this study.

The results of this study revealed statistically significant differences between the survival and deceased groups in several key variables, including radiotherapy, chemotherapy, time from diagnosis to treatment, regional lymph node positivity, pathological grade, FIGO staging and surgical intervention. Notably, the proportion of patients with poorly differentiated tumors was significantly higher in the deceased group than in the survival group. Consistent with previous research, tumor cells with lower pathological grades (*i.e.*, poorly differentiated) exhibit higher proliferative capacity and greater aggressiveness, contributing to a worse prognosis [25]. Chemotherapy, as one of the primary treatment methods for ovarian cancer, was associated with significantly improved survival outcomes in this study. Patients who received chemotherapy had notably higher survival rates than those who did not, aligning with earlier findings that support the role of chemotherapy in eliminating residual cancer cells and preventing recurrence [26]. These results underscore the importance of initiating chemotherapy as early as possible following diagnosis to enhance treatment effectiveness. Conversely, patients who received radiotherapy showed significantly lower survival rates. This is likely due to the clinical context in which radiotherapy is typically employed: it is not a first-line treatment for ovarian cancer and is generally reserved for locally advanced or symptomatic cases to reduce tumor burden and alleviate discomfort [27]. As such, patients selected for radiation therapy are often in the advanced or terminal stages, which may account for their poorer survival outcomes.

The study found that patients who began treatment within 7 days of diagnosis had better survival outcomes. Early treatment initiation likely contributes to slowing disease progression, thereby improving prognosis [28]. In contrast, treatment delays may lead to tumor progression and metastasis, thereby reducing treatment effectiveness and prognosis. These findings emphasize the critical importance of minimizing the diagnostic-to-treatment interval as a key strategy in improving survival in ovarian cancer patients. Furthermore, the presence

of positive regional lymph nodes was associated with lower survival rates, reinforcing its role as a marker of poor prognosis. This aligns with the previous studies that have shown that lymph node metastasis is indicative of increased tumor aggressiveness and advanced disease stage [29]. Therefore, lymph node status should be carefully assessed and integrated into prognostic evaluations to guide clinical decision-making.

Further development of the COX proportional hazards model identified four independent prognostic factors, including grade pathological, FIGO staging, operation and time from diagnosis to treatment. Based on these variables, a nomogram was constructed to predict overall survival in epithelial ovarian cancer (EOC) patients. The model calibration curve had high consistency and good prediction accuracy. Compared with the existing prognostic models (such as FIGO staging, C-Reactive Protein (CRP), albumin lymphocyte index), our nomogram introduces a new clinical tool that incorporates both the treatment timing and surgical intervention status. Zhang Y [30] reported that advanced tumor stage is associated with lower surgical compliance, which itself is a crucial and independent predictor of overall survival in patients undergoing ovarian cancer (OC) treatment. Wang W [31] suggested that tumor staging is an independent prognostic factor for epithelial ovarian cancer (EOC) patients, and the combination of tumor staging with the CRP-albumin-lymphocyte index can effectively predict patients' overall survival. High-grade EOC patients generally have poorer prognoses because these tumors are more prone to recurrence and metastasis. Therefore, Grade Pathological emerged as a significant prognostic factor in the COX regression model, with a measurable impact on both the survival duration and overall survival rate in EOC patients. In the traditional treatment, surgery remains the first-line treatment option for ovarian cancer. Patients who do not undergo surgical intervention often present with more advanced disease, have poor general health, or possess tumor characteristics that preclude complete resection, making them ineligible for surgery. In such cases, radiotherapy is typically administered as a palliative measure, aiming to relieve symptoms and achieve local disease control, rather than to provide curative intent. As a result, the overall prognosis for patients who do not undergo surgery is generally poor, reflecting both the severity of their disease and the limitations of non-surgical treatment modalities [32]. Although radiotherapy may offer short-term symptom relief and local disease control, its impact on prolonging overall survival in patients with advanced EOC appears to be limited [33]. Timely initiation of treatment following diagnosis is widely recognized as a critical factor in cancer management. This study showed that patients who received treatment within 7 days after diagnosis had significantly better survival prognoses than those who experienced treatment delays. Given that epithelial ovarian cancer (EOC) is frequently diagnosed at an intermediate or advanced stage, and is characterized by rapid disease progression, early intervention is vital for improving overall survival [34]. Studies have shown that the extent of residual disease following initial cytoreductive surgery is a key prognostic indicator in advanced ovarian cancer [35]. Additionally, opportunistic salpingectomy has been shown

to positively impact survival outcomes, particularly in serous ovarian cancer [36]. Delays in initiating treatment may reduce the likelihood of optimal surgical resection and limit the effectiveness of therapeutic interventions. The results of this study further confirm the importance of timely treatment in EOC management and highlight the need for clinicians to minimize diagnostic-to-treatment intervals wherever possible. This model facilitates the identification of high-risk patients (e.g., those experiencing delayed treatment, and presenting with high-grade tumors) who may benefit from intensified monitoring. However, challenges remain in accounting for real-world variability in treatment practice and validating the model across diverse patient populations.

5. Conclusions

This study used large-scale, multicenter data from the Surveillance, Epidemiology and End Results (SEER) database to develop and validate a predictive model for the survival prognosis of patients with EOC. The results demonstrated that treatment delay following diagnosis, tumor stage and operation, radiotherapy are significant factors influencing patient outcomes. Using COX regression models and ROC curve analysis, the predictive efficacy of the model was assessed at multiple time points, confirming its robustness and validity in predicting 1-year, 3-year and 5-year survival rates. Compared with existing literature, this study offers updated data support for enhancing precision medicine and prognosis assessment in EOC. By identifying high-risk patient groups, the model enables clinicians to formulate targeted and individualized treatment plans, with the potential to improve both survival rates and quality of life for EOC patients. However, this study has certain limitations. Firstly, the data from the SEER database are from specific regions in the United States, potentially limiting their applicability to other populations. Secondly, the database lacks detailed molecular biological indicators, preventing in-depth exploration of the impact of molecular factors such as gene mutations on prognosis. Therefore, future studies should integrate multicenter datasets and include molecular-level variables to further improve the predictive accuracy and applicability of survival models for EOC.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

XLY, YF—designed the study and carried them out; prepared the manuscript for publication and reviewed the draft of the manuscript. XLY, YF, YL—supervised the data collection; analyzed the data; interpreted the data. All authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This article does not contain any studies with human participants or animals performed by any of the authors.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- [1] Zamwar UM, Anjankar AP. Aetiology, epidemiology, histopathology, classification, detailed evaluation, and treatment of ovarian cancer. *Cureus*. 2022; 14: e30561.
- [2] Aksan A, Boran N, Sinem Duru Coteli A, Ustun Y. Ultra-radical surgery versus standard-radical surgery for the primary cytoreduction of advanced epithelial ovarian cancer; long-term tertiary center experiences. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2024; 302: 125–133.
- [3] Atjimakul T, Saeai N, Tunthanathip T, Thongsuksai P. Significance of pretreatment hemoglobin-albumin-lymphocyte-platelet index for the prediction of suboptimal surgery in epithelial ovarian cancer. *World Journal of Oncology*. 2024; 15: 268–278.
- [4] Azcona L, Heras M, Arencibia O, Minig L, Marti L, Baciú A, *et al.* Prognostic factors in young women with epithelial ovarian cancer: the Young Ovarian Cancer-Care (YOC-Care) study. *International Journal of Gynecological Cancer*. 2024; 34: 285–292.
- [5] González-Martín A, Harter P, Leary A, Lorusso D, Miller R, Pothuri B, *et al.* Newly diagnosed and relapsed epithelial ovarian cancer: ESMO clinical practice guideline for diagnosis, treatment and follow-up. *Annals of Oncology*. 2023; 34: 833–848.
- [6] Bao R, Olivier M, Xiang J, Ye P, Yan X. The significance of lymph node dissection in patients with early epithelial ovarian cancer. *Annali Italiani di Chirurgia*. 2024; 95: 628–635.
- [7] Benoit L, Boudebza A, Bentivegna E, Nguyen-Xuan HT, Azais H, Bats AS, *et al.* What is the most pertinent definition of malnutrition in epithelial ovarian cancer to assess morbidity and mortality? *Gynecologic Oncology*. 2024; 181: 12–19.
- [8] Chen S, Lu H, Jiang S, Li M, Weng H, Zhu J, *et al.* An analysis of clinical characteristics and prognosis of endometrioid ovarian cancer based on the SEER database and two centers in China. *BMC Cancer*. 2023; 23: 608.
- [9] de Oca MKM, Wilson LE, Previs RA, Gupta A, Joshi A, Huang B, *et al.* Healthcare access dimensions and guideline-concordant ovarian cancer treatment: SEER-medicare analysis of the ORCHiD study. *Journal of the National Comprehensive Cancer Network*. 2022; 20: 1255–1266.e11.
- [10] Yang Z, Liu X, Yang X, Liao QP. Second primary malignancies after ovarian cancer: a SEER-based analysis (1975–2016). *Taiwanese Journal of Obstetrics and Gynecology*. 2022; 61: 80–85.
- [11] Cole S, Gianferante DM, Zhu B, Mirabello L. Osteosarcoma: a surveillance, epidemiology, and end results program-based analysis from 1975 to 2017. *Cancer*. 2022; 128: 2107–2118.
- [12] Cai J, Han X, Li M, Liu X, Zhang F, Wu X. Association of low Angiomotin-p130 and high YAP1 nuclear expression with adverse prognosis in epithelial ovarian cancer. *Histology and Histopathology*. 2025; 40: 57–65.
- [13] Cao SY, Fan Y, Zhao CY, Zhang YF, Mu Y, Li JK. Comparison of recurrence and survival between patients with pathological stage I epithelial ovarian cancer after laparoscopic or laparotomic surgery: retrospective analysis of a propensity-matched cohort. *Journal of Minimally Invasive Gynecology*. 2024; 31: 919–928.
- [14] Huang J, Chan WC, Ngai CH, Lok V, Zhang L, Lucero-Prisno III DE, *et al.* Worldwide burden, risk factors, and temporal trends of ovarian cancer: a global study. *Cancers*. 2022; 14: 2230.
- [15] de Jong D, Thangavelu A, Broadhead T, Chen I, Burke D, Hutson R, *et al.* Prerequisites to improve surgical cytoreduction in FIGO stage III/IV epithelial ovarian cancer and subsequent clinical ramifications. *Journal of Ovarian Research*. 2023; 16: 214.
- [16] Guan Z, Zhang C, Lin X, Zhang J, Li T, Li J. Oncological outcomes of fertility-sparing surgery versus radical surgery in stage—epithelial ovarian cancer: a systematic review and meta-analysis. *World Journal of Surgical Oncology*. 2024; 22: 170.
- [17] Komazaki H, Takahashi K, Tanabe H, Shoburu Y, Kamii M, Tsuda A, *et al.* A retrospective study of dose-dense paclitaxel and carboplatin plus bevacizumab as first-line treatment of advanced epithelial ovarian cancer. *Journal of Gynecologic Oncology*. 2024; 35: e76.
- [18] Ali AT, Al-Ani O, Al-Ani F. Epidemiology and risk factors for ovarian cancer. *Menopause Review*. 2023; 22: 93–104.
- [19] Ekmann-Gade AW, Høgdall CK, Seibæk L, Noer MC, Fagö-Olsen CL, Schnack TH. Incidence, treatment, and survival trends in older versus younger women with epithelial ovarian cancer from 2005 to 2018: a nationwide Danish study. *Gynecologic Oncology*. 2022; 164: 120–128.
- [20] Fu Z, Taylor S, Modugno F. Lifetime ovulations and epithelial ovarian cancer risk and survival: a systematic review and meta-analysis. *Gynecologic Oncology*. 2022; 165: 650–663.
- [21] Whelan E, Kalliala I, Semertzidou A, Raglan O, Bowden S, Kechagias K, *et al.* Risk factors for ovarian cancer: an umbrella review of the literature. *Cancers*. 2022; 14: 2708.
- [22] Li H, Wu J, Xu Q, Pang Y, Gu Y, Wang M, *et al.* Functional genetic variants of GEN1 predict overall survival of Chinese epithelial ovarian cancer patients. *Journal of Translational Medicine*. 2024; 22: 577.
- [23] Okunade KS, John-Olabode SO, Soibi-Harry AP, Okoro AC, Adejimi AA, Ademuyiwa IY, *et al.* Prognostic performance of pretreatment systemic immune-inflammation index in women with epithelial ovarian cancer. *Future Science OA*. 2023; 9: FSO897.
- [24] Zhou Y, Wang A, Sun X, Zhang R, Zhao L. Survival prognosis model for elderly women with epithelial ovarian cancer based on the SEER database. *Frontiers in Oncology*. 2023; 13: 1257615.
- [25] Soovares P, Pasanen A, Similä-Maatala J, Bützow R, Lassus H. Clinical factors and biomarker profiles associated with patient outcome in endometrioid ovarian carcinoma-emphasis on tumor grade. *Gynecologic Oncology*. 2022; 164: 187–194.
- [26] Srinivasamurthy BC, Ramamoorthi S. The progression and prospects of the gene expression profiling in ovarian epithelial cancer. *Gynecology and Minimally Invasive Therapy*. 2024; 13: 141–145.
- [27] Wang H, Wang S, Wang P, Han Y. Survival outcomes of lymph node dissection in early-stage epithelial ovarian cancer: identifying suitable candidates. *World Journal of Surgical Oncology*. 2024; 22: 294.
- [28] Zheng Y, Zhang W, Chen Y, Yang X, Dong R. Impact of perioperative red blood cell transfusion on the prognosis of patients with epithelial ovarian cancer. *Heliyon*. 2023; 9: e23081.
- [29] Zhou Y, Xu J. Impact of PARP inhibitors on progression-free survival in platinum-sensitive recurrent epithelial ovarian cancer: a retrospective analysis. *World Journal of Surgical Oncology*. 2024; 22: 276.
- [30] Zhang Y, Yao W, Zhou J, Zhang L, Chen Y, Li F, *et al.* Impact of surgical compliance on survival prognosis of patients with ovarian cancer and associated influencing factors: a propensity score matching analysis of the SEER database. *Heliyon*. 2024; 10: e33639.
- [31] Wang W, Gu J, Liu Y, Liu X, Jiang L, Wu C, *et al.* Pre-treatment CRP-albumin-lymphocyte index (CALLY index) as a prognostic biomarker of survival in patients with epithelial ovarian cancer. *Cancer Management and Research*. 2022; 14: 2803–2812.
- [32] Zhao M, Gao Y, Yang J, He H, Su M, Wan S, *et al.* Predictive value of the adult comorbidity evaluation 27 on adverse surgical outcomes and survival in elderly with advanced epithelial ovarian cancer undergoing cytoreductive surgery. *European Journal of Medical Research*. 2024; 29: 179.
- [33] Yokoi A, Machida H, Shimada M, Matsuo K, Shigeta S, Furukawa S,

- et al.* Efficacy and safety of minimally invasive surgery versus open laparotomy for epithelial ovarian cancer: a systematic review and meta-analysis. *Gynecologic Oncology*. 2024; 190: 42–52.
- [34] Perampalam P, MacDonald JJ, Zakirova K, Passos DT, Wasif S, Ramos-Valdes Y, *et al.* Netrin signaling mediates survival of dormant epithelial ovarian cancer cells. *eLife*. 2024; 12: RP91766.
- [35] Bryant A, Hiu S, Kunonga PT, Gajjar K, Craig D, Vale L, *et al.* Impact of residual disease as a prognostic factor for survival in women with advanced epithelial ovarian cancer after primary surgery. *Cochrane Database of Systematic Reviews*. 2022; 9: CD015048.
- [36] Hanley GE, Pearce CL, Talhouk A, Kwon JS, Finlayson SJ, McAlpine

JN, *et al.* Outcomes from opportunistic salpingectomy for ovarian cancer prevention. *JAMA Network*. 2022; 5: e2147343.

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