RESEARCH ARTICLE

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Longitudinal Analysis of the Overall Survival Rates and Transitional Probabilities of Endometrial Cancer Patients: A Comprehensive Retrospective Study in Thailand

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Abstract

Background: This investigation delineated the survival rates and transitional probability trends of patients with endometrial cancer. This information is pivotal for optimizing patient management and counseling strategies. **Methods:** We conducted a retrospective cohort analysis of patients diagnosed with stage I or II endometrial cancer between November 2006 and October 2012 and those diagnosed with stage III or IV endometrial cancer between January 2012 and May 2017 at Siriraj Hospital, Bangkok, Thailand. Our examination included baseline demographics, clinical characteristics, and adjuvant therapy data. Survival rates and transitional probabilities were assessed using the Kaplan–Meier method for survival curve construction and Markov models, respectively. **Results:** After exclusions, 229 individuals with early-stage endometrial cancer and 119 with advanced-stage histologically verified endometrial cancer were included in the final cohort. Throughout a median follow-up duration of 12.8 years, the 5-year overall survival rates were 89.05% for the early-stage cohort and 50.42% for the advanced-stage cohort. The transitional probability analysis revealed an elevated likelihood of achieving a curative state in early-stage patients, contrasting with a greater propensity for disease progression or distant metastasis in advanced-stage patients. **Conclusions:** The findings from this study offer critical insights into the overall survival rates and transitional probabilities of endometrial cancer patients. These insights underscore the importance of strategies focused on preventing recurrence and enhancing treatment. Moreover, the results serve as a cornerstone for clinicians in devising individualized treatment plans and facilitating cost-effective analyses in the context of endometrial cancer care.

Keywords: Endometrial Neoplasms- Survival analysis- Markov Chains

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Introduction

Endometrial cancer ranks as a leading cause of malignancy among women worldwide. In Thailand, it is the third most prevalent cancer within the female reproductive system, with an incidence rate of 7.6 per 100 000, a figure that is anticipated to increase [1]. In contrast to West Africa, where endometrial cancer lags behind cervical and ovarian cancer in gynecologic malignancy frequency [2]. Risk factors for this cancer include hypertension, elevated serum estradiol levels, nulliparity, obesity, and diabetes [3]. Determination of the cancer stage is meticulously conducted via surgical-pathological evaluation, adhering to the guidelines set forth by the International Federation of Gynecology and Obstetrics (FIGO) staging system [4]. Studies have revealed that between 75% and 80% of patients diagnosed with endometrial carcinoma in its early stages benefit from favorable treatment outcomes. In stark contrast, individuals identified with advanced-stage disease, which is characterized by extrauterine spread, face a grim prognosis and diminished treatment efficacy [5, 6]. Numerous studies have extensively investigated and documented a wide range of prognostic factors that influence survival. These include histological variants, FIGO stage, tumor grade, the extent of myometrial invasion, the occurrence of lymphovascular space invasion, and the patient's age at diagnosis. [5-9, 10, 11].

Surgical intervention remains the cornerstone for managing patients with endometrial carcinoma, with most cases effectively managed through hysterectomy and bilateral salpingo-oophorectomy. The efficacy of adjunctive pelvic and para-aortic lymphadenectomy in treatment protocols remains a subject of ongoing debate. The application of adjuvant radiotherapy and/or chemotherapy is contingent upon the assessed risk of recurrence and pertinent clinical factors [6].

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Partitioned survival analysis is a pivotal methodology in oncology for delineating patient prognosis, evaluating treatment efficacy, and informing economic assessments. This approach, underpinned by a series of survival curves derived from time-to-event data typically gleaned from clinical trials, has been extensively documented within the realm of endometrial cancer research. Notably, traditional survival curve models, which are instrumental in tracking clinical event occurrences, often operate in isolation without integrating a structural nexus among these events [12]. In contrast, state transition models offer a more nuanced framework by charting the trajectory of patients across various health states over specified time intervals, anchored by defined transition probabilities, thereby enhancing the robustness of sensitivity analyses.

Understanding the long-term survival rates and the probabilities of transition between disease stages is essential for the effective management and counseling of patients with endometrial cancer. This research sought to elucidate the patterns of overall survival and transitional probabilities associated with this malignancy.

Materials and Methods

The investigation was carried out at the Division of Gynecologic Oncology within the Department of Obstetrics and Gynaecology at the Faculty of Medicine, Siriraj Hospital. The Siriraj Institutional Review Board granted approval for this study (reference number Si-331/2023). A retrospective cohort analysis was performed on patients diagnosed with early-stage endometrial cancer (stages I and II) between November 2006 and October 2012, and on individuals diagnosed with advanced-stage cancer (stages III and IV) between January 2012 and May 2017. These time frames correspond to a marked change in the standard chemotherapy regimen for advanced-stage endometrial cancer. During these intervals, treatment protocols were updated to include a combination of platinum and taxane agents.

At our institution, the protocol for surgical staging included total hysterectomy with bilateral salpingo-oophorectomy and peritoneal lavage for cytological analysis. For patients deemed at risk of extrauterine spread characterized by high-grade tumors, significant tumor size, extensive myometrial invasion, or nonendometrioid subtypes a pelvic and/or para-aortic lymphadenectomy was mandated. These surgical interventions were exclusively conducted by specialized gynecologic oncologists. The decision to administer adjuvant therapy was predicated on the assessed recurrence risk. Specifically, adjuvant radiation therapy was deemed unnecessary for low-risk individuals (defined by FIGO stage 1A, endometrioid type grade 1 or 2) and recommended for those at intermediate to high risk (characterized by age over 60, deep myometrial invasion, grade 3 or nonendometrioid type, or the presence of lymphovascular space invasion). For patients diagnosed with advanced-stage disease (stage III or IV) with extrauterine involvement, a combination of chemotherapy and/or radiotherapy constituted the primary adjuvant treatment approach.

Patients were stratified into the following five clinical states for the purpose of this study:

Early stage

Patients with stage 1 or 2 endometrial cancer

Advanced stage

Patients with stage 3 or 4 endometrial cancer

Curative state

Patients deemed to have achieved a clinically complete response, as evidenced by vaginal and/or radiographic assessments

*Locoregionally recurrent stat*e

Patients who experienced recurrence within the pelvic region after being in a curative state

Distant recurrent/progression state

patients who, following a curative phase, exhibited recurrence beyond the pelvic area or demonstrated disease progression during treatment. (these two states have same role of treatment, prognosis and also similar expenses)

For the first 2 years posttreatment, a gynecologic oncologist monitored patients through a structured follow-up regimen involving thorough history-taking and pelvic and physical examinations every 3 to 4 months. This was followed by evaluations every 6 months for the next 3 years and then annual assessments. Imaging studies were performed as clinically warranted. Disease recurrence was identified through the detection of measurable disease that was confirmed via pathology or cytology. "Overall survival" was defined as the duration from initial diagnosis to either the occurrence of death or the most recent follow-up, while "progression-free survival" was measured from the point of diagnosis to the identification of disease recurrence/progression or the latest follow-up. Data for these follow-ups were sourced from hospital records or through direct telephone contact with patients or their relatives. The mortality data for the patients were retrieved from the National Population Database maintained by the National Health Security Office of Thailand.

Markov state transition model overview

The Markov model was an economic model representing the natural history of endometrial cancer disease, which the patient could proceed with, as shown in Figure 1. As mentioned earlier, the Markov model shows the health states of endometrial cancer, which was composed of 5 states. The model justified initiating treatment for a patient diagnosed with endometrial cancer, which was classified by cancer staging, including 'Early' and 'Advanced' stages for stages 1 or 2 and stages 3 or 4, respectively. After treatment completion, the outcomes were classified as 'curative' or 'Distant Recurrence/ Progression' from physical examination and imaging as clinically indicated. If the patient achieved curative treatment, there was a possibility of transitioning to the 'Locoregionally Recurrent' state in case of disease recurrence in the pelvic area or 'Distant Recurrent/

Progression' in case of disease recurrence outside the pelvic area. Furthermore, patients in the locoregionally recurrent state could be transferred back to curative status if treatment was successful. In cases of unsuccessful treatment, patients would either remain in the same health state or progress to the 'Distant Recurrence/Progression' state if the disease is advanced. On the other hand, patients identified as being in the 'Distant Recurrence/Progression' state could transfer back to curative status if treatment was successful; otherwise, they remained in the same state. Finally, death probably progressed from any health state.

Transitional probabilities

Transitional probabilities refer to the likelihood that a patient with endometrial cancer would move from one health state to another over a year, as shown in the Markov model in Figure 1. These annual probabilities were crucial for modeling disease progression and mortality, including transitional probability for early and advanced state to recurrent state ('Locoregionally Recurrent' or 'Distant Recurrence/Progression') and transitional probability of death. The probabilities were computed from survival analysis using retrospective clinical data from 2006-2012 for early-stage endometrial cancer patients and 2012-2017 for advance-stage endometrial cancer patients.

Sample size calculation

The sample size was determined based on a previously reported 5-year overall survival rate for endometrial cancer patients, which was estimated to be 82.3% [7]. To achieve a 95% confidence level with a type I error of 0.05, a minimum of 325 patients were needed. The following formula was used to estimate prevalence:

$$n = \frac{Np(1-p)z^2_{1-\frac{\alpha}{2}}}{d^2(N-1)+p(1-p)z^2_{1-\frac{\alpha}{2}}}$$

After accounting for an anticipated 15% data loss, we stratified the sample into early and advanced stages at a 2:1 ratio. This approach, based on prevalence data from the Division of Gynecologic Oncology at the Faculty of Medicine Siriraj Hospital, yielded 249 early-stage cases and 125 advanced-stage cases.

Statistical analysis

Patient baseline and clinical characteristics, including surgical data, histopathology, and adjuvant treatment details, were summarized using descriptive statistics via IBM SPSS Statistics, version 25 (IBM Corp, Armonk, NY, USA).

Overall and progression-free survival rates were calculated through survival analysis in Stata Statistical Software, release 17 (StataCorp LLC, College Station, TX, USA). Kaplan–Meier survival curves were generated to compare survival rates between early- and advanced-stage patients. Cox proportional hazards regression analysis was employed to explore clinical prognostic factors influencing overall survival and to assess survival differences between patients with and without progression or distant metastasis. The survival analysis was further extrapolated to calculate probabilities of events and annual transitional probabilities across five health states over follow-up time: initial stage (encompassing both early and advanced stages), cured, distant recurrence or progression, locoregional recurrence, and death. A parametric survival-time model using the Weibull distribution was applied to derive time-dependent transitional probabilities. The survival function, S(t), is:

$$S(t)=exp\{-H(t)\}$$

with

$$H(t)=\lambda t^{\gamma}$$

$$tp(u)=1-exp\{\lambda(t-u)^{\gamma}-\lambda t^{\gamma}$$

where S(t) = probability of survival as a function of time; H(t) = cumulative hazard function of the Weibull distribution; λ (lambda) = scale parameter; t = time in 1-year increments; γ (gamma) = shape parameter; tp(u) = transitional probability of an event during the cycle (1-year); and u = cycle length of the model [13].

Results

In this investigation, 374 patients were initially enrolled. After excluding patients with incomplete data, the study included 228 patients who were diagnosed with early-stage endometrial cancer and 119 with advanced-stage endometrial cancer, all of whom were histologically confirmed. The mean age of the patients was 58.59 ± 10.28 years. The median body mass index was 26.15 kg/m^2, with an interquartile range of 22.64–30.18. Among the cohort, 68% had a history of multiparity, and 71.2% were postmenopausal at the initial diagnosis. Detailed demographic data and patient characteristics are presented in Table 1.

The predominant histological finding in both the early and advanced stages of endometrial cancer was grade 1 endometrioid carcinoma, accounting for 43.5% of cases. Notably, lymphovascular space invasion and myometrial invasion exceeding half of the uterine wall thickness were more prevalent in patients with advanced-stage disease (52.1% and 65.5%, respectively). Comprehensive details on the FIGO stages, histological subtypes, and other pertinent clinical factors are detailed in Table 2.

During the median follow-up period of 12.8 years, the 5-year overall survival rates were 89.05% for patients with early-stage endometrial cancer and 50.42% for those with advanced-stage disease. Kaplan–Meier survival curves illustrating these comparisons between patients with early-stage disease and patients with advanced-stage disease are depicted in Figure 1. Furthermore, the 5-year progression-free survival rates were 78.5% for early-stage patients and 47.9% for advanced-stage patients (Figure 2). The analysis revealed a significantly poorer prognosis for patients who experienced disease progression or distant recurrence than for those who did not, with hazard ratios of 5.14 (95% CI 2.71–9.75) for early-stage patients and 6.97 (95% CI 3.92–12.39) for advanced-stage patients (Figures 3 and 4, 5, respectively).

Table 3 presents the outcomes of univariate and multivariate analyses conducted to identify factors

Table 1. Baseline Demographics and Clinical Features of 347 Patients with Endometrial Cancer

	Total (n=347)	Early (n=228)	Advanced (n=119)
Age, mean ± SD	58.59 ± 10.28	57.44 ± 9.98	60.79 ± 10.52
BMI, median (Q1, Q3)	26.15 (22.64, 30.18)	26.48 (14.61, 68.12)	24.97 (22.22, 29.05)
Parity, n (%)			
Nulliparous	111 (32)	68 (29.8)	43 (36.1)
Multiparous	236 (68)	160 (70.2)	119 (63.9)
Menopausal status, n (%)			
Premenopause	100 (28.8)	76 (33.3)	24 (20.2)
Menopause	247 (71.2)	152 (66.7)	95 (79.8)
Underlying disease, n (%)			
Diabetes mellitus	73 (21.1)	48 (21)	25 (21)
Hypertension	145 (41.8)	86 (37.7)	59 (49.6)
Dyslipidemia	42 (18.4)	35 (29.4)	77 (22.2)

BMI, body mass index (kg/m^2); SD, standard deviation

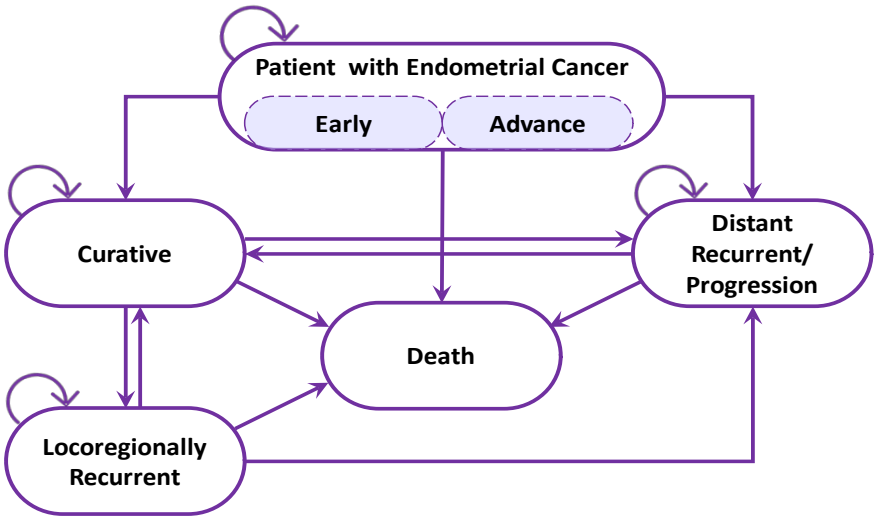

Figure 1. The Markov Model Representing the Natural History of Endometrial Cancer Disease

impacting overall survival rates. Factors associated with overall survival were identified as age over 60 years, menopausal status at diagnosis, high-grade histological subtypes, tumors exceeding 4 cm in size, substantial

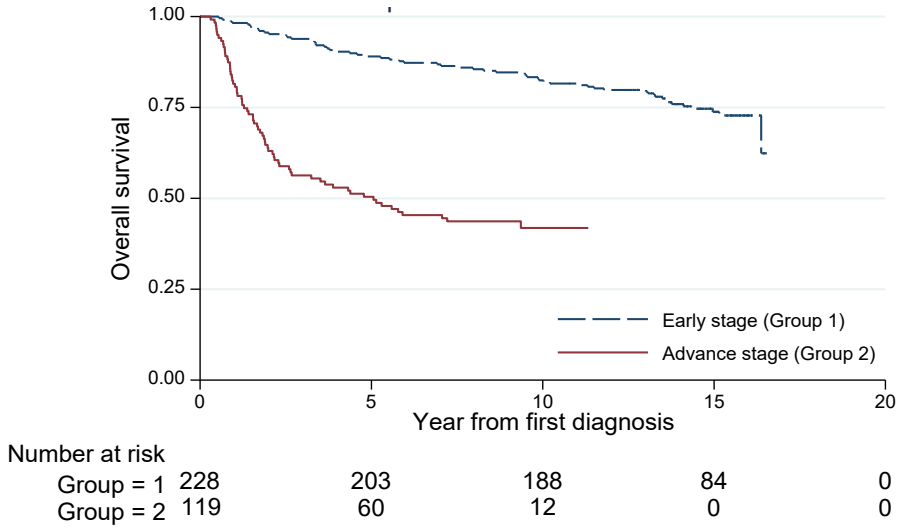

Figure 2. Kaplan–Meier Survival Curves Comparing Overall Survival Between Patients with Early-Stage and Advanced-Stage Endometrial Cancer

Table 2. Comprehensive Clinical Profile of 347 Endometrial Cancer Patients

	Total (n=347)	Early (n=228)	Advanced (n=119)
FIGO stage (2009), n (%)			
IA	150 (43.2)	150 (65.8)	–
IB	54 (15.6)	54 (23.7)	–
II	25 (7.2)	25 (10.5)	–
IIIA	18 (5.2)	–	18 (15.9)
IIIB	7 (2)	–	7 (5.9)
IIIC	61 (17.6)	–	61 (51.3)
IVA	1 (0.3)	–	1 (0.8)
IVB	31 (8.9)	–	31 (26.1)
Cell type, n (%)			
Endometrioid G1	151 (43.5)	134 (58.5)	17 (14.3)
Endometrioid G2	78 (22.5)	44 (19.3)	34 (28.6)
Endometrioid G3	32 (9.2)	18 (7.9)	14 (11.8)
Serous	34 (9.8)	7 (3.1)	27 (22.7)
Clear cell	7 (2)	4 (1.8)	3 (2.5)
Mixed	30 (8.6)	18 (7.9)	12 (10.2)
Others	15 (4.3)	3 (1.3)	12 (10.1)
Tumor size (cm), mean ± SD	4.05 ± 2.86	3.42 ± 2.31	6.11 ± 3.35
Substantial LVSI, n (%)	87 (25.1)	35 (11)	62 (52.1)
Myometrial invasion, n (%)			
Less than half	202 (58.2)	173 (75.9)	29 (24.4)
More than half	133 (28.3)	55 (24.1)	78 (65.5)
N/A[1]	12 (3.5)	0	12 (10.1)
Adjuvant treatment, n (%)			
Radiation	96 (27.7)	91 (39.9)	5 (4.2)
Chemotherapy	79 (22.8)	12 (5.3)	67 (56.3)
Sequential RT then CMT	44 (12.7)	3 (1.3)	41 (34.5)

[1] N/A due to neoadjuvant chemotherapy or postradiation; CMT, chemotherapy; FIGO, International Federation of Gynecology and Obstetrics; LVSI, lymphovascular invasion; RT, radiotherapy; SD, standard deviation

lymphovascular space invasion, myometrial invasion beyond 50%, cervical stromal invasion, positive peritoneal cytology, metastasis in pelvic and para-aortic lymph nodes, the presence of comorbidities, and receipt of

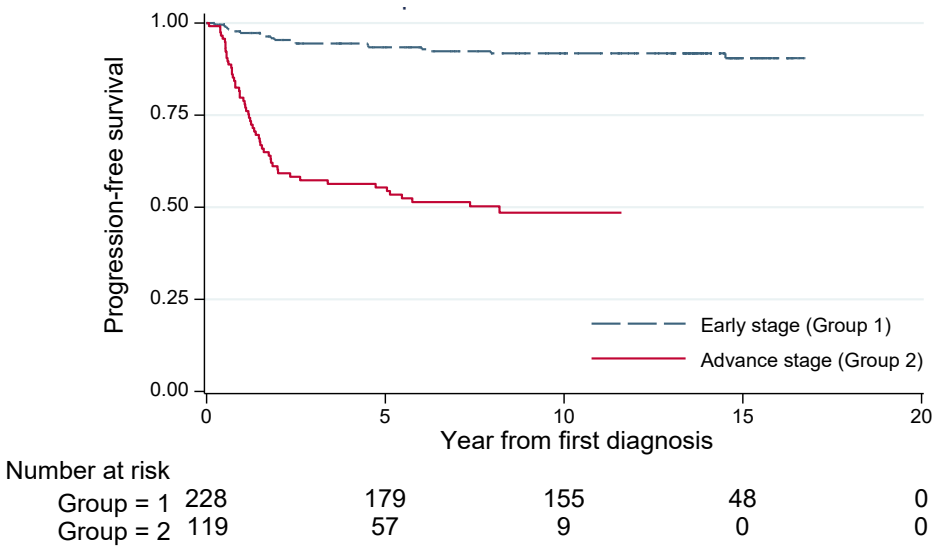

Figure 3. Kaplan–Meier Curves for Progression-Free Survival Among Patients with Early-Stage and Advanced-Stage Endometrial Cancer

Table 3. Univariate and Multivariate Analyses Identifying Prognostic Indicators for Overall Survival in Endometrial Cancer Patients

Factors	Overall survival			
	Univariate analysis		Multivariate analysis	
	HR (95% CI)	P	HR (95% CI)	P
Age ≥ 60 years	2.78 (1.92–4.00)	<0.001	1.07 (0.51–2.21)	0.864
Menopausal status	3.433 (2.03–5.08)	<0.001	1.67 (0.59–4.70)	0.341
Parity	0.88 (0.61–1.28)	0.51	0.94 (0.47–1.89)	0.859
BMI > 25 kg/m^2	0.79 (0.55–1.11)	0.174	0.69 (0.38–1.24)	0.215
High grade[1]	3.84 (2.70–5.47)	<0.001	2.01 (1.02–3.95)	0.044
Tumor size ≥ 4 cm	2.71 (1.84–3.99)	<0.001	1.46 (0.69–3.11)	0.325
LVSI	2.95 (2.00–4.34)	<0.001	0.94 (0.46–1.92)	0.856
Myometrial invasion ≥ 50%	3.44 (2.35–5.02)	<0.001	2.05 (0.85–4.95)	0.11
Cervical stromal invasion	3.25 (2.23–4.73)	<0.001	2.74 (1.29–5.82)	0.009
Peritoneal washing positive	7.02 (4.31–11.44)	<0.001	2.52 (0.97–6.55)	0.057
PLN positive	3.64 (2.33–5.670)	<0.001	1.06 (0.43–2.60)	0.9
PAN positive	4.18 (2.23–7.81)	<0.001	1.66 (0.59–4.63)	0.334
Diabetes mellitus	1.61 (1.09–2.37)	0.016	2.27 (0.99–5.18)	0.052
Hypertension	1.96 (1.38–2.78)	<0.001	0.87 (0.41–1.82)	0.705
Dyslipidemia	1.82 (1.24–2.66)	0.002	1.65 (0.59–4.70)	0.341
Adjuvant treatment	3.12 (2.00–4.85)	<0.001	0.43 (0.17–1.13)	0.087

[1] High grade includes endometrioid grade 3 and nonendometrioid subtypes; BMI, body mass index (kg/m^2); CI, confidence interval; HR, hazard ratio; PAN, para-aortic lymph node; PLN, pelvic lymph node

adjuvant treatment. Subsequent multivariate analysis revealed that high-grade histological subtypes and cervical stromal invasion were significant prognostic indicators for overall survival.

Our analysis of transitional probabilities indicated that patients diagnosed with early-stage endometrial

Table 4. Probabilities of Events for Patients Initially Diagnosed with Early-Stage Endometrial Cancer

From/to	Early	Cured	DR/Pro	LR	Death
Early	0	1	0	0	0
Cured	0	0.71	0.05	0.03	0.21
DR/Pro	0	0.23	0	0	0.77
LR	0	0.83	0.17	0	0
Death	0	0	0	0	1

DR/Pro, distant recurrence or progression; LR, locoregional recurrence

Table 5. Probabilities of Events for Patients Initially Diagnosed with Advanced-Stage Endometrial Cancer

From/to	Advanced	Cured	DR/Pro	LR	Death
Advanced	0	0.72	0.19	0	0.08
Cured	0	0.52	0.35	0.05	0.08
DR/Pro	0	0.04	0.02	0	0.94
LR	0	0.5	0.25	0.25	0
Death	0	0	0	0	1

DR/Pro, distant recurrence or progression; LR, locoregional recurrence

Table 6. Transition Probabilities for Patients Initially Diagnosed with Early-Stage and Advanced-Stage Endometrial Cancer Using Parametric Survival Analysis with Weibull Distribution

Input parameters	Mean value	95% CI*
1. Transition from Early/advance to recurrent Early-stage endometrial cancer		
Constant in survival analysis for baseline hazard	-7.0018	(-10.1440 , -3.8597)
Eligible age coefficient in survival analysis for baseline hazard	0.0531	(0.0043 , 0.1020)
Lambda parameter survival analysis (depends on chosen coefficients)	58	
Ancillary parameter in Weibull distribution	0.5685	(0.3677 , 0.8790)
Advance-stage endometrial cancer		
Constant in survival analysis for baseline hazard	-3.6858	(-5.3409 , -2.0307)
Eligible age coefficient in survival analysis for baseline hazard	0.0324	(0.0071 , 0.0577)
Lambda parameter survival analysis (depends on chosen coefficients)	0.0779	
Ancillary parameter in Weibull distribution	0.6971	(0.5404 , 0.8533)
2. Transition from Early/advance to death Early-stage endometrial cancer		
Constant in survival analysis for baseline hazard	-8.5882 (0.9604)	(-10.4706 , -6.7057)
Eligible age coefficient in survival analysis for baseline hazard	0.0743 (0.0137)	(0.0475 , 0.1010)
Lambda parameter survival analysis (depends on chosen coefficients)	0.0025	
Ancillary parameter in Weibull distribution	1.0937 (0.1333)	(0.8613 , 1.3888)
Advance-stage endometrial cancer		
Constant in survival analysis for baseline hazard	-4.5421 (0.7874)	(-6.0854 , -2.9987)
Eligible age coefficient in survival analysis for baseline hazard	0.0449 (0.0117)	(0.0220 , 0.0678)
Lambda parameter survival analysis (depends on chosen coefficients)	0.0512	
Ancillary parameter in Weibull distribution	0.7798 (0.0823)	(0.6341 , 0.9590)

Note; 95% CI: 95% confident interval

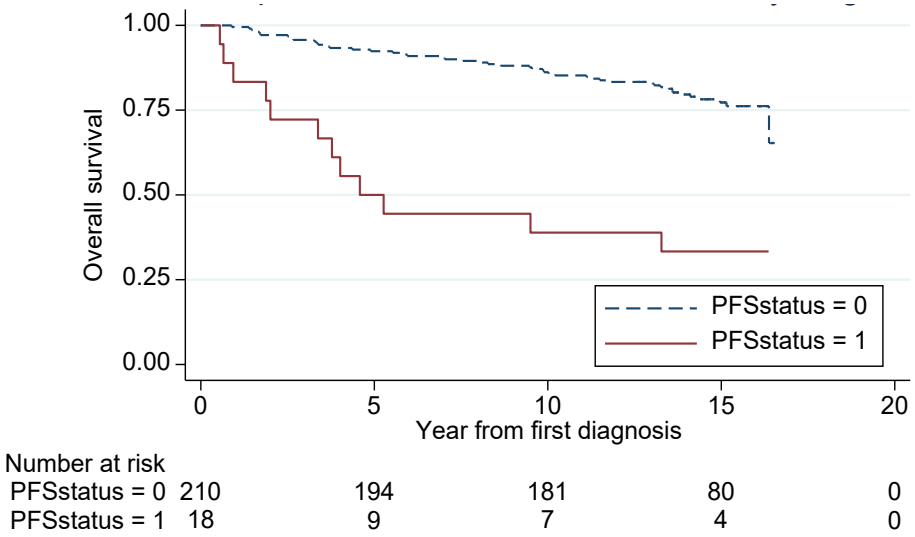

Figure 5. Adjusted Kaplan–Meier Curves for Overall Survival in Advanced-Stage Endometrial Cancer Patients, Considering Progression and Distant Metastasis. HR, hazard ratio; PFS, progression-free survival

cancer had an increased likelihood of progressing to a curative state following initial treatment. In contrast, those with advanced-stage disease exhibited a greater propensity for disease progression or distant recurrence. These probabilities indicate the likelihood of moving between various health stages; they are presented in Tables 4 and 5. Moreover, Table 6 described the transitional probabilities using parametric survival analysis with Weibull distribution for patients with early and advanced endometrial cancer to recurrent and death.

Discussion

Our research investigated the long-term survival outcomes of patients with endometrial cancer, aiming to deepen our comprehension of the disease trajectory postdiagnosis through the classification of patients into five distinct states. The transitions between these states were found to be contingent upon specific clinical events, including achieving a cure, experiencing locoregional or distant recurrence, and disease progression during treatment. The probabilities associated with these event-

driven transitions were elucidated through a Markov state transition model, which offered vital insights for subsequent economic evaluations of patients with endometrial cancer.

Our findings indicate a 5-year overall survival rate of 89.5% for patients with early-stage endometrial cancer, aligning with the 80%–90% survival rates documented in various randomized trials [14-16]. For advanced-stage disease, the 5-year overall survival rate was 50.42%, consistent with the findings reported by Shaeffer and Randall [17] and Chambers et al [18].

Univariate analysis identified several factors influencing overall survival, while multivariate analysis highlighted high-grade histology and the presence of cervical stromal invasion as the most significant prognostic factors for overall survival. This finding is in concordance with previous studies indicating that nonendometrioid subtypes have a significant impact on overall survival [19, 10]. Patients diagnosed with endometrial cancer are at heightened risk for disease progression or distant recurrence, particularly in advanced stages, when the prognosis worsens markedly. Currently, there is no established screening method for detecting early-stage disease. However, the downregulation of PTEN expression holds promise as a potential screening tool in the future [20]. The imperative for innovative interventions, such as immunotherapy, to improve survival rates and treatment outcomes in patients with advanced or recurrent endometrial cancer is well recognized. Recent findings from the NRG-GY018 trial conducted by Eskander et al [21] demonstrated that incorporating pembrolizumab into standard chemotherapy regimens significantly extends progression-free survival, with a hazard ratio for progression or death of 0.30. This outcome mirrors the benefits observed with the addition of durvalumab in the DUO-E trial [22] and dostarlimab in the RUBY study [23], underscoring the potential of immunotherapeutic agents in enhancing clinical results for this patient population.

Recent studies have increasingly employed Markov models and transition probabilities to refine cost-effectiveness analyses across various medical interventions, including colorectal [24] and cervical cancer screenings [25], as well as novel pharmacological treatments for endometrial cancer [26]. To the best of our knowledge, this study is the first to delineate specific states and events and subsequently construct a state transition model for long-term observation of Thai endometrial cancer patients after primary treatment. The elucidation of transition probabilities significantly advances our understanding of the long-term consequences and outcomes associated with these states and events, laying the groundwork for more nuanced cost-effectiveness and economic evaluations in forthcoming research endeavors.

This study is subject to several limitations. First, its retrospective design introduces the possibility of missing data and unaccounted confounding variables. Second, the protocol for lymphadenectomy at our institution was historically predicated on the assessed risk of extrauterine spread. However, contemporary practices, such as sentinel lymph node mapping, now offer a safer alternative to traditional lymphadenectomy for staging endometrial cancer, providing enhanced insights into lymphatic metastasis. Last, it is crucial to acknowledge the evolution in the understanding of prognostic factors and risk stratification in endometrial cancer, particularly the integration of biological markers and molecular profiling, which have gained acceptance globally. Regrettably, these recent advancements were not incorporated into our analysis.

In conclusion, this study offers vital insights into the overall survival rates and transitional probabilities of patients with endometrial cancer, underscoring the imperative for curative strategies that play a pivotal role in enhancing treatment outcomes and minimizing recurrence. Moreover, our findings provide clinicians with a valuable tool for customizing patient counseling and treatment regimens. Additionally, these data could play a crucial role in conducting economic analyses within the realm of endometrial cancer management, thereby facilitating informed decision-making and efficient resource distribution in healthcare settings.

Author Contribution Statement

All authors contributed to the conception and design of the study, material preparation, data collection, data analysis, and discussion. Chinnaphat Chaiwattanateerakorn and Vitcha Poonyakanok wrote the first draft of the manuscript, and then it was reviewed and edited by Pattara Leelahavarong, Natthakan Chitpim and Atthapol Jaishuen. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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If it was approved by any scientific Body/ if it is part of an approved student thesis

This study was not approved by any scientific body and was not a part of an approved student thesis.

Any conflict of interest

The authors have no relevant financial or non-financial interests to disclose.

How the ethical issue was handled (name the ethical committee that approved the research)

The study protocol was approved by Siriraj Institutional Review Board (COA number Si-331/2023).

Availability of data (if apply to your research)

The data of this study are available from the corresponding author upon reasonable request.

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