RESEARCH ARTICLE

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Quality of Life and Factors Associated with Quality of Life among Patients with Lung Cancer in Northeastern Thailand

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Abstract

Background: Lung cancer is a leading cause of global morbidity and mortality, severely affecting patients' quality of life (QoL). Understanding the factors associated with QoL in these patients is crucial for improving treatment and care. This study aimed to assess QoL among lung cancer patients and identify the factors influencing it. **Methods:** This cross-sectional analytic study included 130 patients diagnosed with lung cancer at a tertiary facility in Northeastern Thailand. QoL was evaluated using the FACT-L interview, covering subscales such as physical, social/family, emotional, and functional well-being, as well as a lung cancer subscale, and the FACT-L Trial Outcome Index (TOI) and FACT-G. Descriptive statistics and multiple logistic regression were used for data analysis. **Results:** The majority of subjects had low overall QoL (52.31%; Mean ± SD: 45.24 ± 11.33), low FACT-L TOI (83.08%; 21.05 ± 9.21), and low FACT-G (57.69%; 35.72 ± 8.70). Subscale analysis revealed low levels of physical well-being (85.38%; 6.56 ± 3.54), emotional well-being (85.38%; 6.15 ± 3.67), and functional well-being (96.15%; 4.97 ± 3.82). However, about half of the subjects reported moderate social/family well-being (50.77%; 18.04 ± 4.17) and lung cancer subscale scores (56.15%; 9.51 ± 4.31). Multivariate analysis identified factors significantly associated with higher QoL, including age (AOR = 1.05, 95% CI: 1.01-1.10), absence of comorbidities (AOR = 3.95, 95% CI: 1.60-9.74), and absence of lymph node invasion (AOR = 4.42, 95% CI: 1.26-15.56). Conversely, sleep problems (AOR = 0.26, 95% CI: 0.08-0.81), local metastasis (AOR = 0.25, 95% CI: 0.09-0.72), and undergoing radiotherapy (AOR = 0.25, 95% CI: 0.07-0.98) were associated with lower QoL. **Conclusions:** These findings suggest that lung cancer patients with sleep problems, local metastasis, or undergoing radiotherapy should receive intensive palliative care to improve their QoL during the end of life stage.

Keywords: Quality of life- Subscale of quality of life- FACT-L- Lung cancer- Northeastern Thailand

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Introduction

Lung cancer is a leading cause of global morbidity and mortality, presenting significant public health challenges despite advances in diagnosis and treatment [1]. Non-small cell lung cancer (NSCLC) is the most common form, and while early diagnosis and targeted therapies have improved survival rates, the prognosis remains poor for many [2-4]. Lung cancer's economic burden is substantial, particularly during the end-of-life phase [5, 6].

In 2020, lung cancer was responsible for approximately 1.8 million deaths worldwide, accounting for nearly one in five cancer deaths. Asia bears the brunt of this burden, with over 60% of new cases and deaths occurring in the region [7-8]. In Southeast Asia, lung cancer ranks as the second most common cancer but remains the leading cause of cancer-related deaths [8]. In Thailand, it is the second most diagnosed cancer and accounts for nearly 19% of all cancer deaths [9]. Regional disparities are pronounced, with the northeastern part of the country experiencing the highest incidence and mortality rates [7, 10]. The rising incidence of adenocarcinoma, particularly in regions such as Chiang Mai, Songkhla, and Khon Kaen, further emphasizes the urgency of targeted interventions [11-13].

While much attention is focused on the clinical burden of lung cancer, the impact on patients' quality of life (QoL) is equally significant [14-17]. Lung cancer patients often experience physical symptoms, psychological distress, and social stigma, all of which reduce their overall well-being. QoL is a multidimensional concept that includes physical, mental, and social health [18]. Health-related quality of life (HRQoL) specifically examines how illnesses and treatments affect these aspects of life [19]. Previous studies have investigated QoL among lung cancer patients using

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various assessment tools. Research in Taiwan, Germany, and India, utilizing questionnaires like the WHOQOL-BREF and EORTC QLQ-C30 [20, 21], has highlighted the importance of QoL assessments, especially in newly diagnosed patients. Other studies have explored how socioeconomic factors and access to treatment impact QoL [22], underscoring disparities within patient populations. Additionally, studies focused on post-surgery lung cancer patients have identified factors such as pain management, physical recovery, and psychological support as crucial to improving QoL [23-24].

However, inconsistencies in the tools used to measure QoL have raised concerns about the accuracy of HRQoL outcomes in lung cancer patients. This study aims to investigate the QoL and associated factors among lung cancer patients in Northeastern Thailand using a disease-specific HRQoL assessment tool, providing a more accurate understanding of their well-being over the past seven days. By addressing both the clinical and QoL aspects, this research aims to contribute to better patient care and outcomes.

Materials and Methods

Study Design

This cross-sectional analytic study was conducted from March 1, 2015, to October 31, 2017, at Roi-Et Hospital, a public tertiary care center in Northeastern Thailand. Roi-Et Hospital, with a capacity of 820 beds, serves as a referral center for the surrounding area. The survival analysis component of this research has been previously published [25]. This study focuses on examining the QoL and associated factors among lung cancer patients at the hospital.

Study Subjects

A total of 130 lung cancer patients were recruited for this study. All participants had been newly diagnosed with lung cancer, confirmed using radiological and histological methods, and classified under the International Classification of Diseases, 10th Revision (ICD-10: C34.9) and the International Classification of Diseases for Oncology, 3rd Edition (ICD-O-3) [26]. A sample size calculation was performed for this cross-sectional study, aiming to compare two independent population proportions [27-30]. Based on a significance level (α) of 0.05, with expected proportions of 0.26 and 0.50 for patients with local metastasis in the high QoL (16/62) and low QoL (34/68) groups, respectively, the study achieved a power of 81.2%.

Data Collection

Data were collected through self-administered interviews, covering demographic, clinical, and treatment factors, alongside QoL. Clinical and treatment data were sourced from the cancer registry and medical records, validated by oncology nurses trained in cancer care. QoL, the primary outcome, was measured using the Functional Assessment of Cancer Therapy-Lung (FACT-L, Version 4), a disease-specific HRQoL instrument. Permission to use FACT-L was obtained for this study (Issued: February 14, 2016) [31]. The FACT-L includes 36 items scored on a 5-point Likert scale, assessing five subscales: physical, social/family, emotional, functional well-being, and a lung cancer subscale. Key measures include the FACT-L Trial Outcome Index (TOI), FACT-G total score, and FACT-L total score, with QoL categorized as low, medium, or high based on the mean ± standard deviation.

Statistical Methods

Descriptive statistics were used to analyze demographic, clinical, and treatment factors. The primary outcome was the FACT-L total score, along with subscales such as the FACT-L TOI and FACT-G scores, treated as continuous variables. The Kolmogorov-Smirnov test revealed non-normal distributions for these scores, so binary logistic regression was applied. QoL scores were dichotomized into high and low based on the median: ≥45 for FACT-L total, ≥22 for TOI, and ≥35 for FACT-G. Factors associated with QoL were identified through logistic regression models. Initially, bivariate analyses were performed, and factors with a p-value ≤0.25 were included in a multivariate logistic regression using backward elimination. Three models were constructed for overall QoL and two sub-dimensions, adjusting for gender, age, smoking history, alcohol use, and lung cancer stage.

Model fit was evaluated using -2 Log likelihood, Cox & Snell R^2, Nagelkerke R^2, and the Hosmer and Lemeshow test (p-value >0.05). Results are reported as crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs). Statistical significance was set at $p < 0.05$.

Ethical Consideration

This study was approved by the Ethical Committee for Human Rights Related to Human Experimentation at Roi-Et Hospital (REC No. 014/2016). Permission to access the cancer registry and medical records was granted by the hospital's directors.

Results

Demographic and Quality of Life

The demographic and clinical characteristics among subjects have been published elsewhere [25]. In this study, the overall QoL among lung cancer patients was predominantly low, with 52.31% of subjects reporting a low QoL (Mean ± SD: 45.24 ± 11.33). Most participants also scored low on the FACT-L Trial Outcome Index (TOI) subscale (83.08%; 21.05 ± 9.21), and over half had low FACT-G scores (57.69%; 35.72 ± 8.70).

Among the QoL subscales, a majority of participants reported low physical well-being (85.38%; 6.56 ± 3.54), emotional well-being (85.38%; 6.15 ± 3.67), and functional well-being (96.15%; 4.97 ± 3.82). However, around half of the subjects showed moderate social/family well-being (50.77%; 18.04 ± 4.17) and lung cancer subscale scores (56.15%; 9.51 ± 4.31).

Bivariate Analysis

Bivariate logistic regression analysis identified several factors associated with higher QoL (Table 1). Increased age (OR = 1.03, 95% CI: 1.01-1.07), presence

Table 1. Bivariate Analysis of Factors Associated with Quality of Life among Patients with Lung Cancer in Northeastern Thailand

Factors	FACT-L total score			FACT-L Trial Outcome Index (TOI)			FACT-G total score		
	n (%)	OR (95%CI)	p-value	n (%)	OR (95%CI)	p-value	n (%)	OR (95%CI)	p-value
Gender			0.592			0.939			0.674
Males	42 (46.15)	Ref.		45 (49.45)	Ref.		43 (47.25)	Ref.	
Females	20 (51.28)	1.22 (0.58-2.60)		19 (48.72)	0.97 (0.46-2.06)		20 (51.28)	1.17 (0.55-2.49)	
Age (Year, continuous)		1.03 (1.01-1.07)	0.007		1.04 (1.01-1.07)	0.004		1.04 (1.01-1.07)	0.004
Age (Year)			0.105			0.129			0.309
<60	18 (38.30)	Ref.		19 (40.43)	Ref.		20 (42.55)	Ref.	
≥60	44 (53.01)	1.82 (0.88-3.77)		45 (54.22)	1.74 (0.84-3.60)		43 (51.81)	1.45 (0.71-2.98)	
Marital status			0.074			0.366			0.965
Single, separated, widowed	11 (50.00)	Ref.		13 (59.09)	Ref.		11 (50.00)	Ref.	
Married	47 (48.45)	0.94 (0.37-2.37)		47 (48.45)	0.65 (0.25-1.66)		49 (50.52)	1.20 (0.40-2.58)	
Education			0.074			0.019			0.078
Primary school or lower	43 (55.13)	Ref.		46 (58.97)	Ref.		44 (56.41)	Ref.	
Secondary school	10 (43.48)	0.63 (0.24-1.60)		9 (39.13)	0.44 (0.17-1.16)		9 (39.13)	0.50 (0.19-1.28)	
Vocational certificate Bachelor's degree or higher	9 (31.03)	0.37 (0.15-0.90)		9 (31.03)	0.31 (0.13-0.77)		10 (34.48)	0.41 (0.17-0.98)	
Occupation			0.384			0.294			0.25
Student / Business owner/ Government officer/ Unemployed	8 (34.78)	Ref.		8 (34.78)	Ref.		8 (34.78)	Ref.	
Farmer	36 (50.00)	1.87 (0.71-4.97)		37 (51.39)	1.98 (0.75-5.25)		35 (48.61)	1.77 (0.67-4.70)	
Employee	18 (51.43)	1.98 (0.67-5.87)		19 (54.29)	2.23 (0.75-6.59)		20 (57 .14)	2.50 (0.84-7.42)	
Family income (Baht/month, continuous)		1.00 (0.99-1.01)	0.615		1.00 (0.99-1.01)	0.644		1.00 (0.99-1.01)	0.623
Family income (Baht/month)			0.905			0.576			0.415
<2,000	35 (48.61)	Ref.		38 (52.78)	Ref.		37 (51.39)	Ref.	
2,001-4,999	10 (50.00)	1.05 (0.39-2.85)		8 (40.00)	0.59 (0.23-1.63)		7 (35.00)	0.51 (0.18-1.42)	
≥5,000	17 (44.74)	0.85 (0.39-1.88)		18 (47.37)	0.80 (0.37-1.77)		19 (50.00)	0.94 (0.43-2.08)	
Smoking			0.423			0.614			0.514
No	28 (51.85)	Ref.		28 (51.85)	Ref.		28 (51.85)	Ref.	
Yes	34 (47.69)	0.75 (0.37-1.51)		36 (47.37)	0.83 (0.41-1.68)		35 (46.05)	0.79 (0.39-1.59)	
Alcohol drinking			0.948			0.707			0.894
No	27 (47.37)	Ref.		27 (47.37)	Ref.		28 (49.12)	Ref.	
Yes	35 (47.95)	1.02 (0.51-2.05)		37 (50.68)	1.14 (0.57-2.28)		35 (47.95)	0.95 (0.48-1.91)	
Exercise			0.634			0.712			0.673
No	6 (54.55)	Ref.		6 (54.55)	Ref.		6 (54.55)	Ref.	
Yes	56 (47.06)	0.74 (0.21-2.56)		58 (48.74)	0.79 (0.23-2.74)		57 (47.90)	0.77 (0.22-2.65)	
Sleeping problem			0.023			0.099			0.028
No	17 (68.00)	Ref.		16 (64.00)	Ref.		17 (68.00)	Ref.	
Yes	45 (42.86)	0.35 (0.14-0.89)		48 (45.71)	0.47 (0.19-1.17)		46 (43.81)	0.37 (0.14-0.92)	
Number of family member (Continuous)		1.13 (0.78-1.62)	0.515		1.33 (0.64-2.73)	0.435		1.17 (0.81-1.69)	0.935
Number of family member (Persons)			0.605			0.373			0.388
<4	21 (44.68)	Ref.		21 (44.68)	Ref.		23 (48.94)	Ref.	
≥5	41 (49.40)	1.21 (0.59-2.48)		43 (51.81)	1.18 (0.82-1.69)		40 (48.19)	0.97 (0.47-1.98)	
Comorbidity			0.008			0.022			0.486
No	24 (36.36)	Ref.		26 (39.39)	Ref.		30 (45.45)	Ref.	
Yes	38 (59.38)	2.56 (1.26-5.19)		38 (59.38)	2.24 (1.11-4.54)		33 (51.56)	1.27 (0.64-2.54)	
Site of lung cancer			0.056			0.604			0.164
Upper lobe	35 (56.45)	Ref.		32 (51.61)	Ref.		34 (54.84)	Ref.	
Middle and lower lobe and not otherwise specific	27 (39.71)	0.51 (0.25-1.02)		32 (47.06)	0.83 (0.42-1.66)		29 (42.65)	0.61 (0.31-1.22)	

Table 1. Continued

Factors	FACT-L total score			FACT-L Trial Outcome Index (TOI)			FACT-G total score		
	n (%)	OR (95%CI)	p-value	n (%)	OR (95%CI)	p-value	n (%)	OR (95%CI)	p-value
Lymph node invasion			0.032			0.02			0.075
No	8 (29.63)	Ref.		8 (29.63)	Ref.		9 (33.33)	Ref.	
Yes	54 (52.43)	2.62 (1.05-6.51)		56 (54.37)	2.83 (1.14-7.05)		54 (52.43)	2.20 (0.91-5.36)	
Venous invasion			0.642			0.848			0.692
No	9 (52.94)	Ref.		8 (47.06)	Ref.		9 (52.94)	Ref.	
Yes	53 (46.90)	0.78 (0.28-2.18)		56 (49.56)	1.10 (0.40-3.07)		54 (47.79)	0.81 (0.29-2.26)	
Local metastasis			0.004			0.001			0.024
No	46 (57.50)	Ref.		49 (61.25)	Ref.		45 (56.25)	Ref.	
Yes	16 (32.00)	0.35 (0.16-0.73)		15 (30.00)	0.27 (0.13-0.58)		18 (36.00)	0.44 (0.21-0.91)	
Staging of cancer			0.489			0.219			0.422
Stage IIA, IIB, IIIA, IIIB	5 (35.17)	Ref.		6 (42.86)	Ref.		5 (35.38)	Ref.	
Stage IV	43 (51.19)	1.89 (0.58-6.11)		46 (54.76)	1.61 (0.51-5.06)		44 (52.38)	1.98 (0.61-6.40)	
Unknown stage	14 (43.75)	1.40 (0.38-5.12)		12 (37.50)	0.80 (0.22-2.87)		14 (43.75)	1.40 (0.38-5.12)	
Surgery			0.642			0.833			0.688
No	8 (53.33)	Ref.		7 (46.67)	Ref.		8 (53.33)	Ref.	
Yes	54 (46.96)	0.77 (0.26-2.28)		57 (49.57)	1.12 (0.38-3.30)		55 (47.83)	0.80 (0.27-2.36)	
Chemotherapy			0.266			0.088			0.555
No	19 (55.88)	Ref.		21 (61.76)	Ref.		15 (44.12)	Ref.	
Yes	43 (44.79)	0.64 (0.29-1.41)		43 (44.79)	0.50 (0.22-1.12)		48 (50.00)	1.26 (0.58-2.78)	
Radiotherapy			0.116			0.374			0.882
No	10 (66.67)	Ref.		9 (60.00)	Ref.		7 (46.67)	Ref.	
Yes	52 (45.22)	0.41 (0.13-1.28)		55 (47.83)	0.61 (0.20-1.83)		56 (48.70)	1.08 (0.36-3.19)	

Note: n (%) was present of the high quality of life group; Ref, Reference group; 95%CI, 95 Percent confidence interval; OR, Odds ratios; AOR, Adjusted odds ratios; NA, Data not included in the multivariate analysis.

of comorbidities (OR = 2.56, 95% CI: 1.26-5.19), and lymph node invasion (OR = 2.62, 95% CI: 1.05-6.51) were linked to higher QoL. On the other hand, sleep problems (OR = 0.35, 95% CI: 0.14-0.89), unspecified lung cancer site (OR = 0.24, 95% CI: 0.07-0.81), and local metastasis (OR = 0.35, 95% CI: 0.16-0.73) were associated with lower QoL.

In the analysis of FACT-L TOI, older age (OR = 1.04, 95% CI: 1.01-1.07) and comorbidities (OR = 2.24, 95% CI: 1.11-4.54) correlated with higher scores, while subjects with higher education (OR = 0.31, 95% CI: 0.13-0.77) and local metastasis (OR = 0.27, 95% CI: 0.13-0.58) had lower scores. Similarly, older age (OR = 1.04, 95% CI: 1.01-1.07) was positively associated with higher FACT-G scores, while sleep problems (OR = 0.37, 95% CI: 0.14-0.92) and local metastasis (OR = 0.44, 95% CI: 0.21-0.91) negatively impacted scores.

Multivariate Analysis

After adjusting for confounders, multivariate analysis revealed significant factors associated with overall QoL (Table 2). Increasing age (AOR = 1.05, 95% CI: 1.01-1.10), comorbidities (AOR = 3.95, 95% CI: 1.60-9.74), and lymph node invasion (AOR = 4.42, 95% CI: 1.26-15.56) were linked to higher QoL, whereas sleep problems (AOR = 0.26, 95% CI: 0.08-0.81), local metastasis (AOR = 0.25, 95% CI: 0.09-0.72), and radiotherapy (AOR = 0.25, 95% CI: 0.07-0.98) were associated with lower QoL. Similar associations were found in the FACT-L TOI and FACT-G subscales, where age and comorbidities were linked to higher scores, while local metastasis and sleep problems reduced scores.

Discussion

In summary, our study revealed that more than half of the subjects with lung cancer experienced a low QoL, with notable deficits across various subscales and dimensions of QoL. Factors such as age, comorbidities, lymph node invasion, sleep problems, local metastasis, and radiotherapy were found to significantly influence QoL, after adjusting for potential confounders.

Over half of the participants (52.31%) reported low overall QoL, especially in physical, emotional, and functional well-being, with 85.38%, 85.38%, and 96.15% scoring low in these areas. Advanced disease stages (63.85% stage IV lung cancer) and factors like local invasion, lymph node involvement, and liver metastasis further worsened QoL. However, nearly half showed moderate to high social and family well-being, supported by emotional support, illness acceptance, and communication. Moderate lung cancer subscale scores (56.15%) suggest some success in symptom management. Our findings align with global research showing low QoL in advanced lung cancer patients across several countries. [20, 21, 32]. Similar trends were observed in India, where patients experienced declines in physical and functional well-being at diagnosis, and a U.S. study highlighted significant QoL disruptions, particularly for women with lung cancer [22, 33].

Table 2. Multivariate Analysis of Factors associated with Quality of Life among Patients with Lung Cancer in Northeastern Thailand

Factors	FACT-L total score			FACT-L Trial Outcome Index (TOI)			FACT-G total score		
	OR (95%CI)	AOR (95%CI)	p-value	OR (95%CI)	AOR (95%CI)	p-value	OR (95%CI)	AOR (95%CI)	p-value
Gender			0.785			0.59			0.966
Males	Ref.	Ref.		Ref.	Ref.		Ref.	Ref.	
Females	1.22 (0.58-2.60)	1.22 (0.28-5.27)		0.97 (0.46-2.06)	0.67 (0.15-2.93)		1.17 (0.55-2.49)	0.97 (0.56-3.67)	
Age (Year, continuous)	1.03 (1.01-1.07)	1.05 (1.01-1.10)	0.031	1.04 (1.01-1.07)	1.05 (1.01-1.09)	0.044	1.04 (1.01-1.07)	1.05 (1.01-1.08)	0.007
Education			0.776			0.93			0.966
Primary school or lower	Ref.	Ref.		Ref.	Ref.		Ref.	Ref.	
Secondary school	0.63 (0.24-1.60)	1.12 (0.30-4.14)		0.44 (0.17-1.16)	0.89 (0.26-2.98)		0.50 (0.19-1.28)	1.14 (0.37-3.57)	
Vocational certificate Bachelor's degree or higher	0.37 (0.15-0.90)	1.61 (0.39-6.60)		0.31 (0.13-0.77)	0.78 (0.22-2.82)		0.41 (0.17-0.98)	0.98 (0.31-3.15)	
Smoking			0.309			0.209			0.456
No	Ref.	Ref.		Ref.	Ref.		Ref.	Ref.	
Yes	0.75 (0.37-1.51)	0.44 (0.09-2.12)		0.83 (0.41-1.68)	0.37 (0.08-1.75)		0.79 (0.39-1.59)	0.58 (0.14-2.40)	
Alcohol drinking			0.31			0.394			0.465
No	Ref.	Ref.		Ref.	Ref.		Ref.	Ref.	
Yes	1.02 (0.51-2.05)	2.07 (0.51-8.39)		1.14 (0.57-2.28)	1.83 (0.46-7.36)		0.95 (0.48-1.91)	1.59 (0.46-5.53)	
Sleeping problem			0.02			0.127			0.043
No	Ref.	Ref.		Ref.	Ref.		Ref.	Ref.	
Yes	0.35 (1.14-0.89)	0.26 (0.08-0.81)		0.47 (0.19-1.17)	0.43 (0.14-1.27)		0.37 (0.14-0.92)	0.34 (0.12-0.97)	
Comorbidity			0.003			0.013			
No	Ref.	Ref.		Ref.	Ref.		NA	NA	
Yes	2.56 (1.26-5.19)	3.95 (1.60-9.74)		2.24 (1.11-4.54)	3.02 (1.26-7.23)		NA	NA	
Site of lung cancer			0.051						0.137
Upper lob	Ref.	Ref.		NA	NA		Ref.	Ref.	
Middle and lower lobe and not otherwise specific	0.51 (0.25-1.02)	0.41 (0.17-1.00)		NA	NA		0.61 (0.31-1.22)	0.54 (0.24-1.21)	
Lymph node invasion			0.02			0.024			0.201
No	Ref.	Ref.		Ref.	Ref.		Ref.	Ref.	
Yes	2.62 (1.05-6.51)	4.42 (1.26-15.56)		2.83 (1.14-7.05)	4.10 (1.20-13.97)		2.20 (0.91-5.36)	2.09 (0.67-6.48)	
Local metastasis			0.01			0.008			0.084
No	Ref.	Ref.		Ref.	Ref.		Ref.	Ref.	
Yes	0.35 (0.16-0.73)	0.25 (0.09-0.72)		0.27 (0.13-0.58)	0.26 (0.09-0.70)		0.44 (0.21-0.91)	0.45 (0.18-1.11)	
Staging of cancer			0.241			0.842			0.687
Stage IIA, IIB, IIIA, IIIB	Ref.	Ref.		Ref.	Ref.		Ref.	Ref.	
Stage IV	1.89 (0.58-6.11)	1.49 (0.29-7.47)		1.61 (0.51-5.06)	1.22 (0.26-5.73)		1.98 (0.61-6.40)	1.45 (0.35-6.07)	
Unknown stage	1.40 (0.38-5.12)	3.70 (0.59-23.06)		0.80 (0.22-2.87)	1.59 (0.29-8.67)		1.40 (0.38-5.12)	1.98 (0.41-9.65)	
Chemotherapy						0.014			
No	NA	NA		Ref.	Ref.		NA	NA	
Yes	NA	NA		0.50 (0.22-1.12)	0.29 (0.11-0.79)		NA	NA	
Radiotherapy			0.048						
No	Ref.	Ref.		NA	NA		NA	NA	
Yes	0.41 (0.13-1.28)	0.25 (0.07-0.98)		NA	NA		NA	NA	

A key finding in our study was the association between age and QoL. Interestingly, older age was linked to better QoL, with each additional year correlating with a 5% increase in overall QoL. Although the effect size was modest, this trend was consistent across sub-dimensions such as FACT-L TOI and FACT-G scores. The majority of participants were older adults, with 60.77% aged 60 or older and a mean age of 62.98 years. While age showed no significant effect in bivariate analysis as a categorical variable, its importance emerged in multivariate analysis. Similar findings have been reported, though studies from Egypt and Taiwan have yielded mixed results regarding age and QoL [20, 21 ,23, 32, 34]. Cultural factors in Northeastern Thailand, such as social stigma linking lung cancer to smoking or terminal illness, can cause emotional distress and limit social support. Rural patients face barriers to specialized cancer care due to economic and transportation challenges, exacerbating QoL disparities. Addressing these issues is crucial for improved care. This understanding of cultural factors and systemic barriers provides valuable insights for designing culturally sensitive strategies to improve lung cancer care and enhance QoL among patients in the region.

Sleep disturbances significantly impacted QoL in lung cancer patients, with affected individuals reporting lower overall QoL and sub-dimension scores. These issues, driven by respiratory impairments such as shortness of breath, coughing, and chest tightness, were common, with one-third of participants reporting sleep problems. This highlights the importance of addressing sleep issues in lung cancer management [1, 35]. Previous studies also link better sleep efficiency to higher QoL [16, 36], while sleep disruptions have been associated with poorer outcomes across multiple QoL dimensions [37-40].

Our study also found that comorbidities had a positive association with QoL. Patients with comorbidities were four times more likely to report better QoL and had significantly higher scores on the FACT-L TOI sub-dimension. It is possible that patients with comorbidities have developed adaptive coping mechanisms or benefit from more frequent and comprehensive healthcare monitoring. This paradoxical finding may reflect the patients' familiarity with managing chronic illnesses, which could have enhanced their ability to cope with lung cancer. A substantial portion of our study population was elderly, and many had long-standing comorbid conditions such as diabetes and hypertension, which are common in older adults in Northeastern Thailand [41]. Moreover, the presence of strong social and family support likely played a crucial role in buffering the negative effects of chronic illness on QoL.

Lymph node invasion was another factor associated with higher QoL, with affected patients four times more likely to report better outcomes. In contrast, local metastasis was linked to a significantly lower QoL. This suggests that the disease's progression and spread play a pivotal role in shaping patients' experiences of QoL [35]. Local metastasis typically results in more severe symptoms, such as shortness of breath, coughing, and chest tightness, which can significantly reduce physical and functional well-being [1, 42]. On the other hand, lymph node invasion, though indicative of disease progression, may not cause as severe symptoms, allowing patients to maintain relatively better QoL.

In terms of treatment, radiotherapy and chemotherapy were associated with lower QoL, likely due to their well-known side effects, such as fatigue, nausea, and emotional distress. Both treatments are common in advanced lung cancer cases and can contribute to a heavy symptom burden, reducing overall QoL [43, 44]. In our study, nearly half of the participants reported low or moderate scores on the lung cancer subscale, reflecting the physical and emotional toll of treatment.

This study has several limitations. Its cross-sectional design restricts our ability to establish causality between clinical factors and QoL, as the associations observed may not reflect temporal or causal relationships. Additionally, the sample size of 130 participants, all recruited from a single tertiary care hospital, may not adequately represent the broader lung cancer population in Northeastern Thailand. This is particularly relevant given the socio-demographic and healthcare disparities between urban and rural areas in the region. Patients in rural areas may experience additional barriers, such as limited access to specialized care and delayed diagnoses, which could further affect their QoL and are not fully captured in this study. The self-reported nature of the data may introduce recall bias, particularly regarding subjective measures like QoL. Moreover, the study focuses primarily on patients with advanced-stage lung cancer, potentially underrepresenting the experiences of those with earlier stages of the disease who may have different QoL outcomes. Lastly, the lack of longitudinal data prevents us from assessing how QoL changes over time in relation to disease progression, treatment, and other dynamic factors, such as the long-term effects of sleep problems, metastasis, or radiotherapy. Future research using cohort or longitudinal designs would allow for a clearer understanding of these relationships and how interventions could better address the evolving needs of patients over time.

In conclusion, our findings underscore the multifaceted nature of QoL in lung cancer patients, influenced by clinical factors such as disease stage, comorbidities, sleep problems, and treatment side effects. The positive role of family and social support highlights the importance of comprehensive care that addresses not only the physical but also the psychosocial needs of patients. The study suggested practical approaches, such as implementing sleep management programs, enhancing symptom control strategies during radiotherapy, and integrating psychosocial support tailored to the specific needs of lung cancer patients. These interventions can be incorporated into routine care to improve QoL and provide comprehensive support for patients. Future research should explore the relationship between QoL and survival through longitudinal studies, focusing on interventions to alleviate the burden of sleep disturbances, local metastasis, and treatment-related symptoms. Longitudinal designs will provide a clearer understanding of how these factors evolve over time and how their impact on QoL changes as patients undergo treatment and experience disease

progression. This approach will help identify critical time points for intervention and guide the development of more effective, personalized care strategies that improve long-term patient outcomes.

Author Contribution Statement

B.C., S.W., and N.P. conceptualized and designed the study. B.C., S.W., N.P., P.S., and J.K. contributed to data collection and literature review. Data analysis and interpretation were conducted by B.C. and S.W. The initial manuscript was drafted by B.C. and S.W., with project supervision provided by B.C., S.W., N.P., P.S., and J.K. All authors reviewed and approved the manuscript before submission.

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Availability of data and materials

Permission was obtained from the directors of Roi-Et Hospital to access and utilize the hospital's cancer registry database.

Conflicts of interest

There are no conflicts of interest.

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