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ORIGINAL ARTICLE

The determinants of health-related quality of life among patients with newly diagnosed lung cancer in Taiwan: A cross-sectional study

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Abstract

Background: Although considered one of the most important prognostic factors for lung cancer patients, the health-related quality of life (HRQOL) of the newly diagnosed lung cancer population remains scarcely focused on in the literature. Therefore, we aimed to identify the determinants of HRQOL among newly diagnosed lung cancer patients in Taiwan.

Methods: Two hundred and fifty patients newly diagnosed with lung cancer were recruited from a medical center in northern Taiwan through convenience sampling. Four structured questionnaires, including the Taiwanese version of the MD Anderson symptom inventory (MDASI-T), the Taiwanese version of the Pittsburgh Sleep Quality Index (PSQI-T), the International Physical Activity Questionnaire-Short Form (IPAQ-SF), and the World Health Organization Quality of Life-BREF (WHOQOL-BREF), were used to collect data. Further, a multivariate stepwise linear regression was conducted to determine the independent risk factors for HRQOL. A p value of less than 0.05 was considered statistically significant.

Results: The patients (mean age was 61.04 years, 51.2% male, 94.0% non–small-cell lung cancer, 56.4% stage IIIB–IV) had moderate levels of HRQOL among the physical, psychological, social, and environmental domains, as well as overall QOL. HRQOL was not correlated with married status, religion, and comorbidity. Gender, age, family income, smoking status, cancer stage, ECOG PS scores, PA, symptom burden (severity and interference), and PSQI global scores were correlated with HRQOL. Notably, symptom severity was the dominant negative predictor affecting the psychological and environmental domains of QOL (β = –4.313 and –3.500, respectively), accounting for 23.2% and 14.6% of the variance, respectively. On the other hand, symptom interference was the dominant negative predictor affecting the physical and social domains of QOL, as well as overall QOL (β = –3.592, –1.984, and –0.150, respectively), accounting for 44.4%, 15.0%, and 24.1% of the variance, respectively.

Conclusion: Newly diagnosed lung cancer patients suffered symptom severity and interference that significantly impaired their HRQOL; particularly, symptom interference affected the physical domain of QOL. Healthcare professionals should pay more attention to cancer-related symptom severity, symptom interference, and HRQOL changes when caring for newly diagnosed lung cancer patients.

Keywords: Comorbidity; Prognosis; Quality of life; Sleep quality; Smoking

1. INTRODUCTION

Lung cancer (LC) remains the world's leading cause of cancer-related mortality. According to the Lung Cancer Statistics Report, there were 228 150 new cases of LC and 142 670 LC-related deaths in the United States in 2019.[1] In Taiwan, LC ranks the second highest incidence in all cancers, with 39.8 cases of newly diagnosed LC per 100 000 persons in 2018.[2] In addition to the high incidence rate, LC was also the most common cancer-related deaths in Taiwan, with a mortality rate of 40.8 per 100 000 persons in 2020.[2]

Patients diagnosed with LC experience various discomforting symptoms. Many of these symptoms begin before diagnosis and continue throughout the illness and its treatment, negatively affecting patients' health-related quality of life (HRQOL).[3] HRQOL is generally accepted as a multidimensional concept that assesses how diseases and treatments affect a patient's sense of overall well-being. It includes domains related to physical, mental, emotional, social functioning, and supportive environments.[4,5] In addition, HRQOL has been considered one of the most important prognostic factors for LC survivors.[6–11]

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The HRQOL of newly diagnosed LC patients was reported to be lower than that of other cancer patients.[12] In recent years, some studies indicated that multiple factors were associated with HRQOL among patients with LC.[13] These factors include demographic factors (age, gender, educational level, and smoking status), disease factors (cancer stage, treatment, and performance status),[14–16] symptom burden (SB; symptom severity and interference),[17–20] psychological distress (depression and anxiety),[21,22] physical activity,[23,24] and sleep quality.[25,26] Compared to the quantity of available literature on the HRQOL of patients diagnosed with other major cancers, few studies have explored the HRQOL and its related factors among newly diagnosed LC patients before treatment. Hence, this study aimed to examine the relationships between the SB, physical activity (PA), sleep quality (SQ), and HRQOL among newly diagnosed LC patients.

2. METHODS

2.1. Study participants

This study is a cross-sectional design using convenience sampling. A total of 250 newly diagnosed LC patients were included between June 2015 and May 2017 at a medical center in northern Taiwan. The inclusion criteria were (1) ≥ 20 years of age; (2) diagnosed with LC for the first time (International Classification Diseases, 10th revision code, ICD-10: C34.0); and (3) has alert consciousness, can communicate, and is willing to participate. Patients diagnosed with secondary LC were excluded. All participants provided informed consent before participating in the study and were assessed on their diagnoses before receiving therapy. Further, this study was approved by the Institutional Review Board (IRB) of Taipei Veterans General Hospital (IRB no. 2015-05-005AC).

2.2. Measures

Participants were asked to complete a structured questionnaire comprised of demographics and disease characteristics, SB, PA, SQ, and HRQOL. The demographic and disease data included age, gender, educational level, body mass index (BMI), family income, smoking status, comorbidity, and cancer type, stage, and treatment. The Eastern Cooperative Oncology Group performance status (ECOG PS) scale assessed patients' self-care function with 5 points score (0–4).[16] The data were recorded in the medical chart by the patients' oncologists. ECOG PS was classified as either good (scores of 0–1) or poor (scores of 2–4) performance; a higher score indicates poorer functioning level.[27]

SB was measured using the symptom severity and symptom interference subscales with the Taiwanese version of the MD Anderson symptom inventory (MDASI-T).[28] The symptom severity subscale covers the 13 cancer-related symptom items: pain, fatigue, sleep disturbance, distress, shortness of breath, difficulty remembering, drowsiness, dry mouth, sadness, poor appetite, nausea, vomiting, and numbness. The symptom interference subscale consists of 6 items that address the level of interference from symptoms, including general activity, walking, normal work, mood, relationships with others, and enjoyment of life.[29,30] Each item is rated on an 11-point Likert scale from 0 (not present) to 10 (as bad as you can imagine). MDASI-T was validated among 556 patients with multiple cancer diagnoses in Taiwan, with a Cronbach's α of 0.89 and 0.94 for symptom severity and interference items, respectively.[28] Meanwhile, the Cronbach's α of this study was 0.87 and 0.91 for symptom severity and interference items, respectively. The content validity index (CVI) scores judged by 3 experts were 1.0.

SQ was measured by the Taiwanese version of the Pittsburgh Sleep Quality Index (PSQI-T).[31] The instrument comprises 19 items with 7 component scores. The component scores yield a PSQI global score (0–21); a higher PSQI global score indicates poorer sleep quality, and the global score >5 is used to differentiate poor from good sleepers.[32] The PSQI-T was well validated among 205 patients with various cancer diagnoses in Taiwan, with a Cronbach's α of 0.79.[33] On the other hand, the Cronbach's α for the PSQI-T of this study was 0.80. The CVI scores judged by 3 experts were 1.0.

The PA level was determined by the Taiwan version of the International Physical Activity Questionnaire-Short Form (IPAQ-SF).[34] The tool has been validated as an efficient method for assessing PA among Taiwanese LC patients.[35–37] IPAQ-SF assesses 3 types of activity, including walking, moderate, and vigorous intensity activities, at least 7 d/wk. The 3 types of activity were computed by their energy requirements (walking = 3.3 METs, moderate PA = 4.0 METs, and vigorous PA = 8.0 METs) to yield a total PA score in metabolic equivalent of task-minutes per week (MET-min/wk). Three PA groups proposed to classify participants: low PA (LPA; total PA <600 MET-min/wk), moderate PA (MPA) (total PA ≥600 MET-min/wk), and high PA (HPA) (total PA ≥3000 MET-min/wk).[38]

The HRQOL in this study was measured using the Taiwan version of the World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire. Among the 28 items, the first 2 general facet items evaluated the overall QOL (G1) and general health status (G2) based on a 1–5 scale, with higher scores indicating better G1 and G2. In addition to the 2 general items, the other 26 items were distributed into 4 domains: physical, psychological, social, and environmental. Two scorings (4–20 and 0–100; a higher score indicates better QOL) can be transformed into each domain score; the 0–100 scoring was used in this study. The Cronbach's α ranged from 0.70 to 0.77 for the 4 domains,[39] and the content validity coefficients were between 0.53 and 0.78 for item-domain correlations and 0.51 and 0.64 for inter-domain correlations.[39,40] Lin et al[41] showed that the WHOQOL-BREF has good construct validity, allowing clinicians to evaluate how LC survivors assess their sense of well-being. The analysis of the newly diagnosed LC patients in this study reported that Cronbach's α was 0.87, 0.81, 0.74, and 0.83 in the physical, psychological, social, and environmental domains, respectively.

The validity of IPAQ-SF and WHOQOL-BREF was not assessed in this study because the copyright holders did not allow any change to the instrument. Nevertheless, all questionnaires were approved for use in this study.

2.3. Data analysis

The SPSS v24.0 (IBM Co., Armonk, NY) software was used for the statistical analysis in this study. Categorical and continuous variables were demonstrated by numbers with percentages and means with standard deviation, respectively. A univariate analysis was performed for each QOL domain, with G1 and G2 scores as the dependent variables and demographics, disease characteristics, SB (severity and interference composite score), groups of PA, and the PSQI global score as independent variables. Further, a multivariate stepwise linear regression analysis was used to assess the association among the significant factors in the univariate analysis and each dependent variable under adjustment for potentially confounding variables. The variance inflation factor (VIF) was used to detect multicollinearity in regression analysis, in which a p value of less than 0.05 was considered statistically significant.

3. RESULTS

A total of 250 patients (aged 35–88 years, 51.2% male, 94.0% non–small-cell LC, 56.4% stage IIIB–IV) were included in this

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study. The demographics and disease characteristics are listed in Table 1.

The top three prevalent symptoms among newly diagnosed LC patients were disturbed sleep, fatigue, and dry months; the mean severity scores of the three symptoms ranged from 2.14 to 3.24. In addition, the top three prevalent interferences from symptoms were mood, enjoyment of life, and working; the mean scores of the three interferences ranged from 2.63 to 2.72. The details of the prevalence are presented in Figure 1. The mean symptom severity and interference scores were 1.72 ± 1.47 and 2.26 ± 2.43, respectively. Approximately half of the patients were classified as the LPA group. The mean PSQI global score (7.85 ± 4.67; 62.4%) of the newly diagnosed lung cancer patients showed poorer sleep quality (PSQI global score >5). On average, the newly diagnosed LC patients reported moderate levels of HRQOL. Among the four QOL domains of the newly diagnosed LC patients, the social domain scored the highest, with a mean score of 68.26 ± 15.14, while the psychological domain scored the lowest, with a mean score of 59.14 ± 16.19. The mean G1 and G2 scores were 3.10 ± 0.93 and 2.58 ± 0.98, respectively. The distributions of SB scores, physical activity groups, PSQI global scores, and HRQOL scores are presented in Table 2.

Table 1

Distributions of demographics and disease characteristics of the participants (N = 250)

Variable	n (%)	Mean (SD)
Age (y)		61.04 (10.63)
Gender		
Female	122 (48.8)	
Male	128 (51.2)	
Educational level		
Below high school	49 (19.6)	
Bachelor degree	110 (44.0)	
Above master	91 (63.4)	
Religious beliefs		
No	69 (27.6)	
Yes	181 (72.4)	
Married		
No	56 (22.4)	
Yes	194 (77.6)	
Family income (NTD)		
<20 000	39 (15.6)	
20 000–49 999	78 (31.2)	
50 000–99 999	74 (29.6)	
≥100 000	59 (23.6)	
BMI (kg/m^2)		
<18.5	11 (4.4)	
18.5–23.9	128 (51.2)	
24–26.9	69 (27.6)	
≥27	42 (16.8)	
Smoking status		
Never	132 (52.8)	
Past	62 (24.8)	
Current	56 (22.4)	
Comorbidity		
No	113 (45.2)	
Yes	137 (54.8)	
Lung cancer type		
SCLC	15 (6.0)	
NSCLC	235 (94.0)	
Lung cancer stages		
Stage I–IIIA	109 (43.6)	
Stage IIIB–IV	141 (56.4)	
First-line treatment		
Surgery	96 (38.4)	
Medical	154 (61.6)	
ECOG PS scores		
0–1	214 (85.6)	
2–4	36 (14.4)	

Comorbidity indicated CCI score >1.

BMI = body mass index (<18.5: underweight; 18.5–23.9: normal weight; 24–26.9: overweight; ≥27: obesity); CCI = Charlson Comorbidity Index; ECOG PS = Eastern Cooperative Oncology Group performance status; NSCLC = non–small-cell lung cancer; SCLC = small cell lung cancer; SD = standard deviation.

The detailed univariate analysis is presented in Table 3. Notably, there was a positive correlation between age and the environmental QOL score ($\beta = 0.224$, $p = 0.01$), and women had significantly better QOL than men in the social domain ($p < 0.001$). Significant differences between educational levels ($p < 0.05$) were reported in physical, psychological, and environmental QOL and G1 and G2. The physical QOL of underweight patients (BMI < 18.5 kg/m^2) was worse than others ($p < 0.05$). Low family income and advanced-stage cancer were significantly associated with a lower QOL score in the four domains ($p < 0.05$). Smoking status was significantly associated with physical, social, and environmental QOL and G1 and G2. Higher ECOG PS scores were significantly correlated with lower QOL in the physical, psychological, and environmental domains ($p < 0.01$). However, married status, religion, and comorbidity did not significantly correlate with any QOL domains ($p > 0.05$). The scores of symptom burden (including symptom severity and interference) and global PSQI had significantly negative correlations with the two general facet items (G1 and G2) and the four QOL domains (all $p < 0.001$). The scores of G1, G2, and the four QOL domains in both HPA and MPA groups were significantly higher than in the LPA group ($p < 0.01$).

A multivariate stepwise linear regression was used to determine the predictors of the physical, psychological, social, and environmental domains of QOL, as well as overall QOL. The VIF for all variables was below 5, indicating the absence of a multicollinearity problem. Further, this study found that gender, age, family income, smoking status, cancer stage, ECOG PS scores, PA, symptom severity, symptom interference, and PSQI global scores predicted the HRQOL of newly diagnosed LC patients. Different combinations of the predictors accounted for 57.5%, 26.9%, 21.7%, 22.4%, and 30.7% of the physical, psychological, social, environmental, and overall QOL, respectively. The PSQI global score was a significant predictor in the overall QOL and all QOL domains, except for the environmental domain; however, it explained less variance in any regression model. SB (including symptom severity and interference) was the most robust factor for predicting HRQOL among newly diagnosed LC patients. Symptom severity was the dominant predictor affecting the psychological and environmental QOL, accounting for 23.2% and 14.6% of the variance, respectively. Symptom interference was the dominant predictor affecting the physical, social, and overall QOL, accounting for 44.4%, 15.0%, and 24.1% of the variance, respectively (Table 4).

4. DISCUSSION

Assessments of baseline HRQOL are seldom performed in newly diagnosed LC patients in Taiwan, despite being one of the most important prognostic factors of survival for cancer patients, particularly LC. The clinical significance of this cross-sectional study describes the HRQOL and identifies its related factors in patients with newly diagnosed LC; however, it does not propel cancer treatments in Taiwan.

The participants in this study have moderate levels of QOL in the 4 domains of WHOQOL-BREF (the mean scores ranged from 59.40 to 68.26). This finding is consistent with the findings

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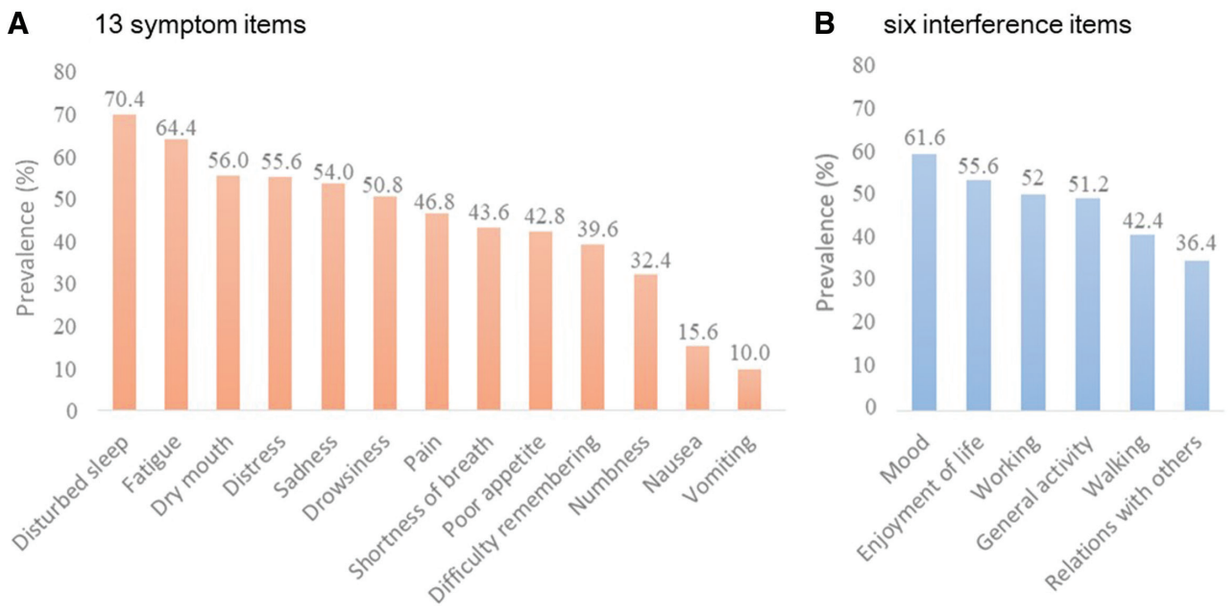

Fig. 1 The prevalence of symptoms and their interference in patients with newly diagnosed lung cancer.

Table 2

Distributions of symptom burden scores, physical activity groups, PSQI global scores, and HRQOL scores (N = 250)

Variable	n (%)	Mean (SD)
Symptom burden scores		
Symptom severity		1.72 (1.47)
Symptom interference		2.26 (2.43)
PA groups		
LPA	121 (48.4)	
MPA	98 (39.2)	
HPA	31 (12.4)	
PSQI global scores		7.85 (4.67)
HRQOL scores		
Physical domain		59.40 (18.92)
Psychological domain		59.14 (16.19)
Social domain		68.26 (15.41)
Environmental domain		62.72 (14.59)
Overall QOL (G1)		3.10 (0.93)
General health status (G2)		2.58 (0.98)

HPA = high physical activity; HRQOL = health-related quality of life; LPA = low physical activity; MPA = moderate physical activity; PA = physical activity; PSQI = Pittsburgh sleep quality index; QOL = quality of life.

of a previous study.[42] However, the result differs from that of Cai et al,[43] which showed that 108 newly diagnosed LC patients had poor QOL in all 4 QOL domains. The possible reason for the finding in the said study might be related to patients' disease characteristics with a higher proportion of stage IIIB–IV (85%), unlike the proportion in this study (56%). In the present study, the worse PS was related to the deterioration of physical and psychological QOL. Similar results had been observed in a previous study,[44] probably because a worse PS likely results in functional difficulties and emotional distress, affecting QOL in advance.

The results of this study showed that newly diagnosed LC patients with moderate or high PA had better HRQOL in any domain compared with those with LPA. The higher PA demonstrated in the previous studies was positively correlated with the HRQOL of LC survivors or patients with advanced-stage LC.[23,45,46] However, another study reported that a moderate-to-vigorous intensity PA was not associated with HRQOL among LC survivors,[24] possibly due to patients' differing LC stages. Therefore, further studies are recommended to explore this issue among patients in terms of disease trajectories. Furthermore, this study revealed that most newly diagnosed LC patients showed poorer sleep quality, which was significantly correlated with HRQOL. The result was similar to a previous study, where many patients were not newly diagnosed with LC.[26] Such a phenomenon may be due to the fact that patients are vulnerable to poor sleep, regardless of their cancer stages—an aspect worth exploring in the future.

In terms of SB, the study revealed that symptom severity and symptom interference were significantly negatively correlated with overall QOL among newly diagnosed LC patients. The findings were consistent with the other studies that employed LC patients and survivors with other stages.[17–19,25,47] In addition, this study used the Taiwan version of WHOQOL-BREF and MDASI to explore the association between HRQOL and SB among newly diagnosed LC patients. The findings may be used as references for accessible clinical care to improve the quality of life of all LC patients. It can also be employed to validate the outcomes for future studies.

To our knowledge, this study is the first survey to focus on and investigate the SB, PA, SQ, and HRQOL of newly diagnosed LC patients. However, some limitations need to be pointed out. First, it is difficult to understand the cause-and-effect relationship and the trajectory change of HRQOL over time in a cross-sectional study. Second, the population in this study was determined through convenience sampling and is limited to a medical center, potentially influencing the representativeness of newly diagnosed LC patients.

In conclusion, this study shows that newly diagnosed LC patients in Taiwan have moderate levels of HRQOL, and its related factors include gender, age, family income, smoking status, cancer stage, ECOG PS scores, PA, SB (symptom severity, symptom interference), and PSQI global scores. Noteworthily,

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Table 3

Univariate analysis of the HRQOL and its related factors (N = 250)

	HRQOL scores					
	Physical	Psychological	Social	Environmental	G1	G2
Variables	β	β	β	β	β	β
Age	–0.014	0.056	0.072	0.224[a]	0.009	0.008
Gender (male/female)	–3.181	–0.711	–6.936[b]	–2.492	–0.077	–0.204
Age	–0.014	0.056	0.072	0.224[a]	0.009	0.008
Educational level						
Bachelor degree/below high school	–6.948[a]	–6.549[a]	–3.566	–7.604[c]	–0.327[a]	–0.350[a]
Above master/below high school	–4.082	–3.484	–0.077	–5.414[a]	–0.003	–0.181
Religious beliefs (yes/no)	–0.954	0.028	0.579	1.200	–0.022	–0.085
Married (yes/no)	2.213	1.441	0.795	2.271	0.014	–0.155
Family income						
20 000–49 999/<20 000	1.359	5.449	3.372	2.359	–0.026	–0.179
50 000–99 999/<20 000	8.653[a]	7.581[a]	4.287	4.960	0.082	–0.009
≥100 000/<20 000	11.953[c]	8.201[a]	8.000[a]	11.654[b]	0.246	0.190
BMI						
18.5–23.9/<18.5	14.342[a]	6.872	5.939	4.690	0.229	0.464
24–26.9/<18.5	3.638[c]	8.700	8.179	4.141	0.399	0.648[a]
≥27/<18.5	1.346[a]	7.781	2.478	6.481	0.325	0.409
Smoking status						
Past/never	–5.986[a]	–0.837	–7.657[c]	–2.124	–0.162	–0.267
Current/never	–8.752[c]	–3.641	–8.489[b]	–7.065[c]	–0.457[a]	–0.413[c]
Comorbidity (yes/no)	–3.767	–1.819	–0.963	–0.391	–0.011	–0.192
Cancer type (NSCLC/SCLC)	8.152	10.428	9.567[a]	9.068[a]	0.319	0.613[a]
Cancer stages (IIIB–IV/I–IIIA)	–13.206[b]	–4.460[a]	–6.062[c]	–6.492[b]	–0.229	–0.443[b]
ECOG PS scores (2–4/0–1)	–20.225[b]	–7.071[c]	–5.139	–9.380[b]	0.636	–0.316
Symptom burden scores						
Symptom severity	–8.162[b]	–5.037[b]	–3.895[b]	–3.795[b]	–0.277[b]	–0.308[b]
Symptom interference	–5.171[b]	–2.859[b]	–2.450[b]	–2.249[b]	–0.188[b]	–0.189[b]
PA groups						
Moderate/low PA	11.761[b]	6.059[c]	6.395[c]	7.727[b]	0.461[b]	0.455[c]
High/low PA	12.802[b]	11.136[c]	7.941[c]	7.271[a]	0.681[b]	0.540[c]
PSQI global scores	–2.047[b]	–1.313[b]	–0.853[b]	–0.956[b]	–0.077[b]	–0.067[b]

β = unstandardized coefficients; BMI = body mass index (<18.5: underweight, 18.5–23.9: normal weight, 24–26.9: overweight, ≥ 27: obesity); ECOG PS = Eastern Cooperative Oncology Group performance status; G1 = overall quality of life; G2 = general health status; HRQOL = health-related quality of life; NSCLC = non–small-cell lung cancer; PA = physical activity; PSQI = Pittsburgh sleep quality index; SCLC = small-cell lung cancer.

[a] $p < 0.05$.

[b] $p < 0.001$.

[c] $p < 0.01$.

the symptom severity is the strongest negative predictor for the psychological and environmental QOL domains, and symptom interference is the strongest negative predictor for the physical and social QOL domains, as well as overall QOL. These findings imply that healthcare professionals should pay more attention to SB to optimize HRQOL when caring for patients diagnosed with LC for the first time. Furthermore, they can be used as a reference in future studies related to the relationships between the earlier assessment of the HRQOL and the related factors among newly diagnosed LC patients and the outcomes of the disease progression.

REFERENCES

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2019. *CA Cancer J Clin* 2019;**69**:7–34.
2. Health Promotion Administration MoHaW. 2021 Annual Report-Ministry of Health and Welfare. Health Promotion Administration, Ministry of Health and Welfare. Available at https://www.hpa.gov.tw/Pages/Detail.aspx?nodeid=4519&pid=14657. Updated October 21, 2021. Accessed April 20, 2022.
3. Mendoza TR, Kehl KL, Bamidele O, Williams LA, Shi Q, Cleeland CS, et al. Assessment of baseline symptom burden in treatment-naïve patients with lung cancer: an observational study. *Support Care Cancer* 2019;**27**:3439–47.
4. Sitlinger A, Zafar SY. Health-related quality of life: the impact on morbidity and mortality. *Surg Oncol Clin N Am* 2018;**27**:675–84.
5. US Department of Health and Human Services (HHS). Guidance for industry: patient-reported outcome measures: use in medical product development to support labeling claims: draft guidance. *Health Qual Life Outcomes* 2006;**4**:79.
6. Trejo MJ, Bell ML, Dhillon HM, Vardy JL. Baseline quality of life is associated with survival among people with advanced lung cancer. *J Psychosoc Oncol* 2020;**38**:635–41.
7. Liu J, Ma Y, Gao R, Liu X, Wang Y, Yu J, et al. Prognostic effects of health-related quality of life at baseline and early change in health-related quality of life on response to treatment and survival in patients with advanced lung cancer: a prospective observational study in China. *BMJ Open* 2022;**12**:e047611.
8. Li TC, Li CI, Tseng CH, Lin KS, Yang SY, Chen CY, et al. Quality of life predicts survival in patients with non-small cell lung cancer. *BMC Public Health* 2012;**12**:790.
9. Bakas T, McLennon SM, Carpenter JS, Buelow JM, Ott JL, Hanna KM, et al. Systematic review of health-related quality of life models. *Health Qual Life Outcomes* 2012;**10**:134.
10. Ediebah DE, Quinten C, Coens C, Ringash J, Dancey J, Zikos E, et al; Canadian Cancer Trials Group and the European Organization

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Table 4

Multivariate analysis of the HRQOL and its related factors (N = 250)

Variables	HRQOL scores									
	Physical		Psychological		Social		Environmental		Overall QOL (G1)	
	$R^2 = 0.575$		$R^2 = 0.269$		$R^2 = 0.217$		$R^2 = 0.224$		$R^2 = 0.307$	
	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2
Age							0.242[a]	0.031		
Gender (male/female)					−7.283[a]	0.046				
Family income (≥100 000/<20 000)	3.963[b]	0.008					8.123[c]	0.047		
Smoking status (current/never)	−3.964[b]	0.008							−0.346[c]	0.025
Cancer stages (IIIB–IV/I–IIIA)	−6.210[a]	0.037								
ECOG PS scores (2–4/0–1)	−5.753[b]	0.013								
Symptom burden scores										
Symptom severity			−4.313[c]	0.232			−3.500[a]	0.146		
Symptom interference	−3.592[a]	0.444			−1.984[a]	0.150			−0.150[a]	0.241
PA group (high/low)			6.688[b]	0.022						
PSQI global scores	−1.122[a]	0.065	−0.519[b]	0.015	−0.533[b]	0.021			−0.045[a]	0.041

β = unstandardized coefficients; ECOG PS = Eastern Cooperative Oncology Group performance status; HRQOL = health-related quality of life; PA = physical activity; PSQI = Pittsburgh sleep quality index; R^2 = coefficient of determination.

[a] $p < 0.001$.

[b] $p < 0.05$.

[c] $p < 0.01$.

for Research and Treatment of Cancer. Quality of life as a prognostic indicator of survival: a pooled analysis of individual patient data from Canadian cancer trials group clinical trials. *Cancer* 2018;**124**:3409–16.

11. Friis RB, Hjøllund NH, Pappot H, Taarnhøj GA, Vestergaard JM, Skuladottir H. Patient-reported outcome measures used in routine care predict for survival at disease progression in patients with advanced lung cancer. *Clin Lung Cancer* 2021;**22**:e169–79.
12. Polanski J, Jankowska-Polanska B, Rosinczuk J, Chabowski M, Szymanska-Chabowska A. Quality of life of patients with lung cancer. *Onco Targets Ther* 2016;**9**:1023–8.
13. Bade BC, Gan G, Li F, Lingeng L, Lynn T, Gerard AS, et al. Randomized trial of physical activity on quality of life and lung cancer biomarkers in patients with advanced stage lung cancer: a pilot study. *BMC Cancer* 2021;**21**:352.
14. Avery KNL, Blazeby JM, Chalmers KA, Batchelor TJP, Casali G, Internullo E, et al. Impact on health-related quality of life of video-assisted thoracoscopic surgery for lung cancer. *Ann Surg Oncol* 2020;**27**:1259–71.
15. Pierzynski JA, Ye Y, Lippman SM, Rodriguez MA, Wu X, Hildebrandt MAT. Socio-demographic, clinical, and genetic determinants of quality of life in lung cancer patients. *Sci Rep* 2018;**8**:10640.
16. Azam F, Latif MF, Farooq A, Tirmazy SH, AlShahrani S, Bashir S, et al. Performance status assessment by using ECOG (eastern cooperative oncology group) score for cancer patients by oncology healthcare professionals. *Case Rep Oncol* 2019;**12**:728–36.
17. Lee MK. Interactions of spiritual well-being, symptoms, and quality of life in patients undergoing treatment for non-small cell lung cancer: a cross-sectional study. *Semin Oncol Nurs* 2021;**37**:151139.
18. Lavdaniti M, Patrikou K, Prapa PM, Vastardi M, Fradelos EC, Papathanasiou LV, et al. A cross-sectional study for assessing perceived symptoms, depression and quality of life in advanced lung cancer patients. *J BUON* 2021;**26**:1824–31.
19. Morrison EJ, Novotny PJ, Sloan JA, Yang P, Patten CA, Ruddy K, et al. Emotional problems, quality of life, and symptom burden in patients with lung cancer. *Clin Lung Cancer* 2017;**18**:497–503.
20. Ostlund U, Wennman-Larsen A, Gustavsson P, Wengström Y. What symptom and functional dimensions can be predictors for global ratings of overall quality of life in lung cancer patients? *Support Care Cancer* 2007;**15**:1199–205.
21. van Montfort E, de Vries J, Arts R, Aerts JG, Kloover JS, Traa MJ. The relation between psychological profiles and quality of life in patients with lung cancer. *Support Care Cancer* 2020;**28**:1359–67.
22. Polanski J, Chabowski M, Chudiak A, Uchmanowicz B, Janczak D, Rosińczuk J, et al. Intensity of anxiety and depression in patients with lung cancer in relation to quality of life. *Adv Exp Med Biol* 2018;**1023**:29–36.
23. Yoo JS, Yang HC, Lee JM, Kim MS, Park EC, Chung SH. The association of physical function and quality of life on physical activity for non-small cell lung cancer survivors. *Support Care Cancer* 2020;**28**:4847–56.
24. D'Silva A, Gardiner PA, Boyle T, Bebb DG, Johnson ST, Vallance JK. Associations of objectively assessed physical activity and sedentary time with health-related quality of life among lung cancer survivors: a quantile regression approach. *Lung Cancer* 2018;**119**:78–84.
25. Martin RE, Loomis DM, Dean GE. Sleep and quality of life in lung cancer patients and survivors. *J Am Assoc Nurse Pract* 2021;**34**:284–91.
26. Nishiura M, Tamura A, Nagai H, Matsushima E. Assessment of sleep disturbance in lung cancer patients: relationship between sleep disturbance and pain, fatigue, quality of life, and psychological distress. *Palliat Support Care* 2015;**13**:575–81.
27. Sehgal K, Gill RR, Widick P, Bindal P, McDonald DC, Shea M, et al. Association of performance status with survival in patients with advanced non-small cell lung cancer treated with pembrolizumab monotherapy. *JAMA Netw Open* 2021;**4**:e2037120.
28. Lin CC, Chang AP, Cleeland CS, Mendoza TR, Wang XS; Taiwanese version of the M. D. Anderson symptom inventory: symptom assessment in cancer patients. *J Pain Symptom Manage* 2007;**33**:180–8.
29. Cleeland CS, Mendoza TR, Wang XS, Chou C, Morrissey M, Engstrom MC, et al. Assessing symptom distress in cancer patients: the M.D. Anderson symptom inventory. *Cancer* 2000;**89**:1634–46.
30. Cleeland CS. The M. D. Anderson Symptom Inventory - User Guide. Available at https://www.mdanderson.org/documents/Departments-and-Divisions/Symptom-Research/MDASI_userguide.pdf. Accessed March 26, 2022.
31. Fu YW. *Psychometric Evaluation of the Pittsburgh Sleep Quality Index in Taiwanese Cancer Patients. Master's theses*. Taipei Medical University; 2007.

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32. Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;**28**:193–213.
33. Tzeng JI, Fu YW, Lin CC. Validity and reliability of the Taiwanese version of the Pittsburgh sleep quality index in cancer patients. *Int J Nurs Stud* 2012;**49**:102–8.
34. Liou YM. *Development and verification of validity and reliability of the international physical activity questionnaire Taiwan version. Doctoral thesis*. National Taiwan University; 2004.
35. Lee PH, Macfarlane DJ, Lam TH, Stewart SM. Validity of the international physical activity questionnaire short form (IPAQ-SF): a systematic review. *Int J Behav Nutr Phys Act* 2011;**8**:115.
36. Liou YM, Jwo CJ, Yao KG, Chiang LC, Huang LH. Selection of appropriate Chinese terms to represent intensity and types of physical activity terms for use in the Taiwan version of IPAQ. *J Nurs Res* 2008;**16**:252–63.
37. Lin YY, Wu YC, Rau KM, Lin CC. Effects of physical activity on the quality of life in taiwanese lung cancer patients receiving active treatment or off treatment. *Cancer Nurs* 2013;**36**:E35–E41.
38. Group TI. Guidelines for data processing and analysis of the International Physical Activity Questionnaire. March 26, 2021. Available at http://www.ipaq.ki.se. Accessed March 26, 2022.
39. Yao G, Chung CW, Yu CF, Wang JD. Development and verification of validity and reliability of the WHOQOL-BREF Taiwan version. *J Formos Med Assoc* 2002;**101**:342–51.
40. Skevington SM, Lotfy M, O'Connell KA; WHOQOL Group. The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL group. *Qual Life Res* 2004;**13**:299–310.
41. Lin CY, Hwang JS, Wang WC, Lai WW, Su WC, Wu TY, et al. Psychometric evaluation of the WHOQOL-BREF, Taiwan version, across five kinds of Taiwanese cancer survivors: rasch analysis and confirmatory factor analysis. *J Formos Med Assoc* 2019;**118**:215–22.
42. Liao YC, Shun SC, Liao WY, Yu CJ, Yang PC, Lai YH. Quality of life and related factors in patients with newly diagnosed advanced lung cancer: a longitudinal study. *Oncol Nurs Forum* 2014;**41**:E44–E55.
43. Cai C, Zhou Z, Yu L, Wan Y. Predictors of the health-related quality of life of patients who are newly diagnosed with lung cancer in China. *Nurs Health Sci* 2011;**13**:262–8.
44. Mohan A, Mohan C, Bhutani M, Pathak AK, Pal H, Das C, et al. Quality of life in newly diagnosed patients with lung cancer in a developing country: is it important? *Eur J Cancer Care* 2006;**15**:293–8.
45. Bade BC, Brooks MC, Nietert SB, Ulmer A, Thomas DD, Nietert PJ, et al. Assessing the correlation between physical activity and quality of life in advanced lung cancer. *Integr Cancer Ther* 2018;**17**:73–9.
46. Jones LW. Physical activity and lung cancer survivorship. *Recent Results Cancer Res* 2011;**186**:255–74.
47. Hung HY, Wu LM, Chen KP. Determinants of quality of life in lung cancer patients. *J Nurs Scholarsh* 2018;**50**:257–64.

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