International Journal of Studies in Nursing; Vol. 7, No. 2; 2022
ISSN 2424-9653 E-ISSN 2529-7317
Published by July Press

The Impact of Symptoms and Psychological Distress on Quality of Life in Early-Stage Lung Cancer Survivors

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Received: March 30, 2022 Accepted: April 25, 2022 Online Published: May 11, 2022

doi:10.20849/ijsn.v7i2.1080 URL: https://doi.org/10.20849/ijsn.v7i2.1080

Abstract

Background: The number of cancer survivors continues to increase worldwide. Health-related quality of life (HRQoL) is important as a health-related outcome for cancer patients and cancer survivors. Patients with early-stage non-small cell lung cancer may face the stress of symptoms and treatment side effects. However, for survivors of this type of cancer, the impact of cancer or treatment-related stress perception, symptoms, and psychological distress on HRQoL remains to be explored.

Purpose: To examine the impact of stress appraisal, symptoms distress, and psychological distress (anxiety and depression) on quality of life in early-stage lung cancer survivors.

Method: A cross-sectional study design using convenience sampling. Early-stage non-small cell lung cancer patients who had completed treatment of lung cancer for at least one month were recruited after obtaining informed consent. Self-administered questionnaires were used to collect demographics and information on clinical characteristics, perceived stress, symptoms distress, psychological distress (anxiety and depression), and HRQoL. Multiple regression analysis was used to identify factors affecting HRQoL.

Results: The study recruited 85 (30 male and 55 female) lung cancer survivors with mean age of 63.20 years old (*SD*= 9.01), 85.8 % of which were diagnosed with stage I non-small cell lung cancer. Mean time since diagnosis was 3.33 years (*SD* = 2.05). All participants underwent surgery. We found that 52.6% of the variance ($F_{(4, 80)}$ =24.28, p<.001) in HRQoL was explained by the variables of anxiety (β= -.34, t= -3.36, p=.001), depression (β= -.28, t= -3.21, p=.002), perceived stress (β= -.21, t= -2.30, p=.024), and symptom distress (β= -.13, t= -1.53, p=.13).

Conclusion: Our results suggest that health professionals should pay more attention to the assessment of perceived stress, psychological distress, and symptom distress for promoting HRQoL and healthy functioning of non-small cell lung cancer survivors.

Keywords: lung cancer survivor, perceived stress, symptoms distress, anxiety, depression, HRQoL

1. Introduction

Cancer is a serious and life-threatening disease (Bray et al., 2021). The incidence of lung cancer, which can threaten patients' lives, healthy functioning, and HRQoL, continues to rise (Islami et al., 2021; Sung et al., 2021). In recent years, the application of low-dose computed tomography (LDCT) in screening high-risk populations for lung cancer has assisted in detecting and diagnosing early-stage lung cancer. The number of early-stage non-small-cell lung cancer (NSCLC) patients undergoing surgery has increased, which has a significant impact on cure rates and overall survival rates (Sugimura & Yang, 2006; Wang et al., 2013; Flores et al., 2014; Shewale et al., 2020; Sung et al., 2021). A study explored the time trends of survival in surgically resected early−stage NSCLC patients from 1998 and 2016 and found a significant upward time trend in 3−year and 5−year overall survival rates in patients who underwent lung resection (Shewale et al., 2020). In Taiwan, the five-year overall survival rate of lung cancer patients has increased from 15.9% (2002–2008) to 25% (2010–2016) (Wang et al., 2013; Chang et al., 2021).

Although the survival rate of lung cancer patients has significantly improved, cancer survivors may still face the threat of cancer recurrence, health functions decline, symptoms distress, and psychological stress such as

perceived stress, depression, and anxiety, which can affect cancer survivor's HRQoL and daily functioning (Jung *et al.*, 2017; Yip *et al.*, 2018). A review of previous studies found that approximately about one-third to one-half of cancer patients experience significant level of distress during their cancer diagnosis and disease trajectory. Among them, lung cancer patients experienced the highest levels of distress (Degner, & Sloan, 1995; Zabora J.R. *et al.*, 1997; Carlson *et al.*, 2004). The most frequently experienced problem was fatigue, pain, dyspnea, cough, managing emotions/stress, depression, and anxiety (Carlson *et al.*, 2004; Kenny *et al.*, 2008; Ostroff et al., 2011; Poghosyan *et al.*, 2013). Lowery *et al.* (2014) found that most lung cancer survivors (79.8%) had some degree of symptom burden. Physical symptoms sometimes persisted for six months to two years (Kenny *et al.*, 2008; Poghosyan *et al.*, 2013; Février *et al.*, 2020). A greater amount of physical symptoms will be able to negatively impact overall HRQoL (Carlson *et al.*, 2004; Lowery *et al.*, 2014).

Being diagnosed with lung cancer, undergoing cancer treatment, or experiencing a survival period is often extremely stressful for the patient (Redd, 1995; Monti *et al.*, 2006). Perceived stress may trigger physiological response effects, which in turn may lead to tumor growth, prolonged disease course, or disease progression, and even tumor metastasis (Antoni & Lutgendorf, 2007; Ben-Eliyahu *et al.*, 2007; Lutgendorf *et al.*, 2010; Flores *et al.*, 2017; Straub & Cutolo, 2018; Antoni & Dhabhar, 2019). The above issues are becoming a greater concern for lung cancer survivors (Hansen & Sawatzky, 2008).

A meta-analysis to explore the relationship between stress and cancer showed that stress and inappropriate stress coping strategies were significantly associated with higher cancer incidence, poorer cancer survival, and higher cancer mortality in lung cancer patients. Overall, there was a negative relationship between stressful life experiences and cancer (Chida *et al.*, 2008).

The common symptoms of psychological and emotional distress are depression and anxiety. A study surveyed 561 lung cancer survivors and found psychological distress to be a very common problem and that about a quarter of patients were affected by anxiety or depression, especially if in poor physical function and pain (Eichler *et al.*, 2018).

Factors affecting the health-related quality of life of non-small cell lung cancer (NSCLC) survivors have not been well studied in Taiwan. Furthermore, there are few studies to examine the stress perception in early-stage lung cancer patients who coexist with the disease after treatment. Therefore, this study aimed to investigate the influence of perceived stress, symptoms, depression, and anxiety on the health-related quality of life in early-stage lung cancer survivors, as well as to determine the predictors of HRQoL in early-stage NSCLC survivors.

2. Methods

We employed a cross-sectional study design using convenience sampling to recruit post-treatment non-small cell lung cancer survivors from the outpatient department of a medical center in Northern Taiwan between January and September 2020. A total of 85 cases were recruited after explaining the research purpose and acquiring signed informed consent. A survey using self-report structured questionnaires was employed to assess research variables including demographic and clinical characteristics, stress perception, symptoms, level of anxiety and depression, and HRQoL.

2.1 Research Participants

The Inclusion criteria were as follows: (1) lung cancer survivor with diagnosed stage I to III NSCLC undergone lung surgery; (2) more than one month elapsed after the end of cancer treatment; (3) aged over 20 years old; (4) able to speak, read, and communicate in Mandarin or Taiwanese. The exclusion criteria were as follows: (1) Stage 4 NSCLC; (2) Currently receiving anti-cancer treatment or palliative care; (3) unable to work or perform physical activity; (4) patients with cognitive disorders.

2.2 Ethical Considerations

This study was approved by the Ethics Committee for Biomedical Research of a Northern Taiwan medical center (No. 19MMHIS251e). The purpose of research was fully explained to the eligible participants, and the respondents were assured that all their information would be treated as strictly confidential. Written informed consent was obtained from all participants.

2.3 Measures

2.3.1 Demographic and Clinic Characteristics

Demographic characteristics included gender, age, education, marital status, and employment status. Clinical characteristics included date of being diagnosed with lung cancer, stage of lung cancer, types of treatment

received, comorbidity, and the time since the end of treatment.

2.3.2 Functional Assessment of Cancer Therapy -General (FACT-G)

The Functional Assessment of Cancer Therapy-General Scale (FACT-G) was developed by Cella *et al.* (1987) and constitutes a widely used QoL scale for patients with cancer (Cella et al., 1993; Victorson *et al.*, 2008). FACT-G is an indicator to measure QoL of lung cancer patients. FACT-G has been translated into many different languages including Chinese (FACT-G[Ch]), which has acceptable reliability (Cronbach alpha 0.85). The convergent validity of FACT-G (Ch) with a generic QoL measure (WHO-QOL-BREF[HK]) was 0.72 ($P < 0.001$) (Yu *et al.*, 2000). This scale has a total of 27 items scored on a 5-point scale, ranging from none (0) to very many (4). FACT-G assesses cancer patients' QoL across four domains: physical well-being (PWB; 7 items), social and family well-being (SWB; 7 items), emotional well-being (EWB; 6 items), and functional well-being (FWB; 7 items). A questionnaire is regarded as valid if a patient answers more 50% of questions. All subscale scores are added together for a total FACT-G score, ranging from 0 to 108. A higher score indicates greater QoL. In the current study, Cronbach's α of FACT-G was 0.92.

2.3.3 Perceived Stress Scale (PSS)

The Perceived Stress Scale (PSS) is a 14-item self-report measure tool designed to assess the degree to which situations in one's life are experienced as stressful (Cohen et al., 1983). Each item is rated on a 5-Likert scale, where 0 = never, 1 = almost, 2 = sometimes, 3 = fairly often, 4 = very often. Total score ranges from 0 to 56, with higher scores indicating a higher level of perceived stress (Cohen et al., 1983). The Chinese translation of the scale has proved to have good reliability and validity (Wu, 1998; Chu & Kao, 2005; Yeh *et al.*, 2012). In the current study, the PSS Cronbach's α was 0.83. Research suggests that the median of the score (28) can be used as a breakpoint between 'stressed' and 'non-stressed' (Dehghan *et al.*, 2020). Individuals scoring 28 and above were thus classified as 'stressed'.

2.3.4 Symptom Distress Scale (SDS)

The Symptom Distress Scale (SDS) was developed by McCorkle and Yaung in 1978 to assess the degree of distress and discomfort in patients with physical symptoms. Distress is not differentiated into disease- or treatment-related. This instrument comprises 13 items reflecting the common symptoms experienced by cancer patients: intensity and frequency of pain, intensity and frequency of nausea, mood, appetite, insomnia, concentration, fatigue, bowel pattern, appearance, coughing, and respiration. Each symptom is rated by the patient on a 5-point Likert scale ranging from 1 (no distress) to 5 (extreme distress). Total symptom distress scores range from 13 to 65. Higher scores indicate greater symptom distress. Reported Cronbach's α of the SDS ranged from .72 to .89 for cancer patients, and evidence of construct validity has been supported by studies. A total score higher than 25 indicates that the patient has moderate symptoms and needs to be further evaluated for symptom relief. A total score greater than 33 indicates a state of severe symptom distress and requires timely intervention (McCorkle *et al.*, 1998). The Chinese translation of the scale has proved to have good reliability and validity (Tang, 2006). In the current study, Cronbach's α of SDS was 0.75 for lung cancer survivors.

2.3.5 Hospital Anxiety and Depression Scale (HADS)

The 14-item HADS is a self-report measure designed by Zigmond and Snaith in 1983 and is widely used to assess the anxiety and depression symptoms in patients. It is divided into two subscales, one for anxiety (HADS_A), and one for depression (HADS_D). Items are scored on a 4-point scale (0–3) with a total score ranging from 0–21 for each subscale. A higher total score indicates a higher level of anxiety or depression. A subscale score of 8–10 indicates a suspected case; scores greater than or equal to 11 on either scale are suggestive of a clinical diagnosis (Zigmond & Snaith, 1983; Chen *et al.*, 2000). In previous research the Cronbach's α was 0.84 for HADS_A and 0.74 for HADS_D (Chen *et al.*, 2000). In the current study, the Cronbach's α was 0.78 for HADS_A and 0.70 for HADS_D.

2.4 Statistical Analysis

An *a priori* power analysis was performed with G*Power 3.1.2 software. We used an F test of R^2 deviation from zero in a multiple regression model with four predictors, an effect size of 0.15, a significance level (α) of 0.05, and a target statistical power of 0.80, which yielded a required sample size of 85.

All data were entered and analyzed with SPSS version 25 for Windows (IBM, Armonk, NY). Descriptive statistics were carried out to provide information regarding demographic and clinic characteristics. We used mean, standard deviation, frequency, and percentages to describe the sample. Univariate and multivariate statistical analyses such as t-tests were employed. We used correlation coefficients to identify the relationship between dependent and independent variables. Multiple regression was applied to examine the predictors of

HRQoL and determine the amount of variance contributed by variables to HRQoL.

3. Results

3.1 Participant Characteristics

A total of 85 lung cancer survivors participated in this study. The majority of participants were women (64.7%). Mean participant age was 63.20 years (*SD*=9.01, range 37–78 years). The majority of participants were married (82.4 %), and 73% had a completed high school education or above. Most participants reported that they followed a religion (80%); 74.1% were nonsmokers: 76.5% had one or more chronic diseases. Common chronic diseases were high blood pressure, diabetes, or heart disease. 85.8% of survivors were diagnosed with stage I NSCLC, with a mean time since diagnosis of 3.33 years (*SD*=2.05). All participants had received surgery, 20 (23.5%) had also received adjuvant chemotherapy, and two (2.4%) had also received radiotherapy. Eleven (12.9%) participants had survived more than 5 years after being diagnosed with lung cancer (see in Table 1).

Table 1. Demographic and clinical characteristics of the study participants (*N =85*)

Demographics characteristics	n (%)	range	Mean (SD)
Age (years)		37–78	63.20 (±9.01)
Gender			
female	55 (64.7%)		
male	30 (35.2%)		
Marital status			
Married	70 (82.4%)		
Single/divorced/widowed	15 (17.5%)		
Level of education			
Elementary and junior high school	23 (27.1%)		
High school	31 (36.5%)		
University, college and above	31 (36.5%)		
Religious belief			
Yes	68 (80.0%)		
No	17 (20%)		
Smoking history			
Nonsmoker	63 (74.1%)		
Former smoker	21 (24.7%)		
Current smoker	1 (1.2%)		
Clinical characteristics			
Time since diagnosis(year)			
< 2 years	31 (36.5%)		
2–5 years	43 (50.6%)		
> 5 years	11 (12.9%)		
Stage of NSCLC			
I	73 (85.8%)		
II	10 (11.8%)		
III	2 (2.4%)		
Comorbidities			
Yes	65 (76.5%)		
COPD	2 (2.4%)		

Diabetes Mellitus	12 (14.1%)
Hypertension	31 (36.5%)
Heart disease	10 (11.8%)
Other	27 (31.8%)
No	20 (23.5%)
Types of treatment	
Surgery only	85 (100%)
Surgery + chemotherapy	20 (23.5%)
Surgery + chemotherapy + radiotherapy	2 (2.4%)

3.2 Perceived Stress, Psychological Distress, Symptoms Distress, and HRQoL in Lung Cancer Survivors

The results of stress perception and psychological distress were derived from the scores of the Perceived Stress Scale (PSS), HADS_A (Anxiety) subscales, and HADS_D (Depression) subscales. In this study, the mean PSS score was 17.95 (*SD*= 7.94), and 92.9% of subjects reported normal responses in perceived stress. Psychological distress was measure by HADS_A and HADS_D. The mean HADS_D score was 4.79 (*SD*=3.53) and the mean HADS_A score was 4.36 (*SD*=3.41). In this study, 24.7% and 15.3% of participants reported scores that would be interpreted as suspected or definite for clinical depression, or for clinical anxiety, respectively. These responses did not differ by marital status, stage of diagnosis, or time since onset.

The mean SDS score was 20.47 (*SD*=5.07). Insomnia (*M*=2.22, *SD*=1.25) ranked as the most distressing symptom and fatigue (*M*=1.99, *SD*=0.68) as the second most distressing symptom. Pain frequency (*M*=1.78, *SD*=1.15), cough (*M*=1.78, *SD*=0.84), and outlook (*M*=1.78, *SD*=0.85) were equally ranked as the third most distressing symptoms, and nausea, appetite, bowel pattern, concentration, appearance, and breathing were the lowest item scores. 21.2% of participants showed total scores of ≥ 25, the threshold for diagnosing moderate symptom distress.

Patient's HRQoL was measured by FACT-G (Ch). Mean overall HRQoL was 86.15 (*SD*=15.13); nearly 70% of subjects experienced good to excellent HRQoL. However, 16.5% of subjects had mean FACT-G scores lower than 68. The means of the physical [7-item], social/family [7-item], emotional [6-item], and functional well-being scales [7-item] were 24.71 (*SD*=3.25), 20.38 (*SD*=6.44), 19.66 (*SD*=3.58) and 21.07 (*SD*=5.45), respectively (see Table 2). Social and family well-being had a slightly lower average score than the other dimensions of HRQoL; more than 30% of the subjects showed dissatisfaction with social and family well-being, especially dissatisfaction with interaction with and emotional support from friends or family, and sexual life dissatisfaction. In addition, more than 40% of subjects said they were not satisfied with their sleep quality.

Table 2. Perceived stress, symptoms distress, anxiety, depression, and HRQoL scores of participants (*N*= 85)

Variable (range)	Mean (SD)	N (%)	Min.	Max.
PSS (0–56)	17.95 (7.94)		3	41
SDS (13–65)	20.47 (5.07)		13	36
< 25		67 (78.8)		
25–32		16 (18.8)		
≥ 33		2 (2.4)		
HADS_A (0–21)	4.36 (3.41)		0	16
0–7		72 (84.7)		
8–10		8 (9.4)		
≥ 11		5 (5.9)		
HADS_D (0–21)	4.79 (3.53)		0	12

0–7		64 (75.3)		
8–10		14 (16.5)		
≥ 11		7 (8.2)		
FACT–G (0–108)	86.15 (15.13)		44	107
PWB (0–28)	24.71 (3.25)		16	28
SWB (0–28)	20.38 (6.44)		0	28
EWB (0–24)	19.66 (3.53)		5	24
FWB (0–28)	21.07 (5.45)		6	28

Abbreviations: SD, standard deviation; PSS, Perceived Stress Scale; SDS, Symptom Distress Scale; HADS, Hospital Anxiety and Depression Scale; HADS_A, HADS-Anxiety subscale; HADS_D, HADS-Depression subscale; FACT-G, Functional Assessment of Cancer Treatment-General; PWB, physical well-being; SWB, social/ family well-being; EWB, emotional well-being; FWB, functional well-being.

3.3 Identifying Factors Associated With HRQoL in Early-Stage NSCLC Survivors

Pearson's product-difference correlation analysis was used to investigate variables associated with HRQoL (FACT-G) in early-stage NSCLC survivors, including demographics and clinic characteristics, perceived stress, symptom distress, HADS_A, and HADS_D. No statistically significant correlation between demographics and clinical characteristics with QoL were found. Our results indicate a significant moderate correlation between QoL and perceived stress (r= -.55, p<.001), symptoms distress (r= -.46, p<.001), anxiety (r= -.64, p<.001), and depression (r= -.56, p<.001). This indicates that more stressful events and symptoms were significantly negatively correlated with QoL (Table 3).

Table 3. Pearson correlations between perceived stress, SDS, HADS_A, HADS_D, and HRQoL (N=85)

Variable	1	2	3	4	5
1.FACT-G	1				
2.PSS	-.55**	1			
3.SDS	-.46**	.38**	1		
4.HADS_A	-.64**	.54**	.46**	1	
5.HADS_D	-.56**	.40**	.32**	.46**	1

Note: **p< .001, *p< .01

Abbreviations: FACT-G, Functional Assessment of Cancer Therapy-General; PSS, Perceived Stress Scale; SDS, Symptom Distress Scale; HADS_A, HADS-Anxiety subscale; HADS_D, HADS-Depression subscale.

3.4 Predictors of HRQoL in Early-Stage NSCLC Survivors

Simultaneous multiple regression was performed to analyze the predictors affecting HRQoL. Selected predictors consisted of perceived stress, symptom distress, anxiety, and depression, based on previous Pearson correlation coefficient results (see Table 3). A complete model with all variables was constructed, and absence of problematic multicollinearity was verified based on tolerance and variance inflation factors (Schroeder, 1990) (Table 4). The results showed that a total 52.6% of the variance ($F_{(4, 80)}$ =24.28, p<.001) in QoL was explained by anxiety (β=-.34, t=-3.36 , p=.001), depression (β=-.28, t=-3.21, p=.002), perceived stress (β=-.21, t=-2.30, p=.024), and symptom distress (β=-.13, t=-1.53, p=.13). When comparing the standardized coefficients, anxiety was the most significant predictor of QoL in this model, while symptom distress was not a significant predictor (Table 4).

Table 4. Multiple regression results for predictors of HRQoL

	Nonstandardized coefficients		Standardized coefficients					Collinearity statistics	
Model	B	Std. Error	Beta	T	R2	R2 adj	F	Tolerance	Variance inflation factor (VIF)
Constant	113.69	4.97		22.88***	.548	.526	24.28***		
PSS	-.40	.18	-.21	-2.30*				.665	1.504
SDS	-.39	.26	-.13	-1.53				.757	1.321
HADS_A	-1.50	.43	-.34	-3.46**				.591	1.691
HADS_D	-1.19	.37	-.28	-3.21**				.751	1.332

Note: Dependent variable: QoL, measure by FACT-G scale. *p < 0.05; **p < 0 .01; ***p < 0 .001.

4. Discussion

With advances in lung cancer screening tools and treatments, the rate of early-stage lung cancer diagnosis and the number of survivors continues to increase. Past studies have shown lung cancer to be a cancer with high incidence (Islami *et al.*, 2021; Sung *et al.*, 2021) and high symptom burden (Lowery *et al.*, 2014). However, there are limited studies on the HRQoL of early-stage lung cancer survivors. It is well known that HRQoL is a major indicator of treatment and care outcomes, and an important predictor of survival for lung cancer patients (Dharma-Wardene *et al.*, 2004; Anant *et al.*, 2005; Braun *et al.*, 2011; Polanski *et al.*, 2016). In other words, improving the QoL of early-stage lung cancer survivors can not only improve the patient's health function and well-being, but also decrease the risk of death (Chang, *et al.*, 2019). During the course of cancer treatment, cancer patients will experience many instances of life stress, disease symptoms distress, and psychological distress, which will affect their health function and life quality. This study focused on the stress in early-stage lung cancer survivors and its impact on HRQoL.

We found a mean FACT-G score of 86.15 for HRQoL of survivors of early-stage NSCLC after the treatment period, indicating that survivors experienced good to excellent HRQoL (So *et al.*, 2013). Chang *et al.* (2019) suggested that an increase in the FACT-G score indicates a decrease in the risk of death, and the study suggested that an optimal sensitivity and specificity the cutoff points to estimate the risk ratio of death for lung cancer patients was a score of 68. In the present study, 16.5% of participants had a mean FACT-G score lower than 68, suggesting that a decrease in any one-point score for these participants might increase the risk of death. The results of this study and others highlight that HRQoL in patients with NSCLC is an important predictor of health function and chance of survival, which also provides important information for professionals caregivers of cancer patients (Braun *et al.*, 2011; So *et al.*, 2013; Chang *et al.*, 2019). These results suggest that health professionals need to pay more attention to the HRQoL of lung cancer survivors.

We found that anxiety was the most important predictor of HRQoL in early-stage lung cancer survivors, followed by depression and perceived stress. However, symptom distress did not significantly predict HRQoL. Lung cancer survivors, like most cancer patients, will experience psychological distress (Hung *et al.*, 2011; Ostroff *et al.*, 2011; So et al., 2013; Jung *et al.*, 2017). Additional burdens from cancer, during treatment, and psychological distress may persist and lead to more difficulty in disease management and symptom control or decreased treatment adherence (Whisenant *et al.*, 2020). In addition, the presence of depression or anxiety in cancer patients affects cancer survival (Pirl *et al.*, 2012; Sullivan *et al.*, 2016). Our results also indicate that perceived stress, depression, and anxiety were important predictors of HRQoL, which conforms to previous findings that psychological distress is also an important predictor of HRQoL. In the present study, 24.7% of participants reported scores indicative of suspected or definite cases of clinical depression; 15.3% of participants reported suspected or definite cases of clinical anxiety; however, only 7.1% of participants reported perceived stress. These results are similar to other cancer patient studies and emphasize that the negative emotion of depression and anxiety were more important psychological problems than stress (Hung *et al.*, 2011; Ostroff *et al.*, 2011; Lowery *et al.*, 2014; Jung *et al.*, 2018).

Studies on the influence of HRQOL in early-stage lung cancer survivors have also shown that depression and

dyspnea are predictors of physiological QoL, and depression and anxiety are predictors of psychological HRQoL (Ostroff *et al.*, 2011). Depression, anxiety, and stress were important predictors of overall HRQoL in the present study, while symptom distress showed a non-significant relation to QoL.

Studies have noted that adults with lung cancer experience more symptom distress than patients with other types of cancer (Cooley, 2000; Carlson *et al.*, 2004; Morrison *et al.*, 2017). The most common symptoms in newly diagnosed patients are fatigue, pain, loss of appetite, dyspnea, nausea, and insomnia; these findings were invariant to different countries and different points in time (Cooley, 2000; Reinke *et al.*, 2016). The present study also showed that symptom distress focused on insomnia, fatigue, pain frequency, cough, and outlook. Most patients with lung cancer experience multiple symptoms, and symptoms may differ at various points in the illness trajectory, and among various treatments (Cooley, 2000; Polanski *et al.*, 2016). Symptoms of distress are highly correlated with the level of emotional distress (Osroff *et al.*, 2011).

5. Conclusions

We elucidated the factors that influence HRQoL of early-stage lung cancer survivors and determined predictors that explain variance in HRQoL — principally psychological distress (anxiety and depression) and perceived stress. These factors do not just affect cancer patients undergoing treatment, but also strongly influence HRQoL of early-stage lung cancer survivors (Ostroff *et al.*, 2011; Jung *et al.*, 2017; Eichler *et al.*, 2018). It is recommended that the assessment of anxiety, depression and perceived stress should be incorporated into routine care and to understand the patient's coping situation. Moreover, symptoms distress in patients with lung cancer is an important focus for clinical intervention and understanding symptom-related research in this area is important (Lowery *et al.*, 2014). Health care providers play a key role in providing adequate symptom management and promoting HRQoL during chronic illness, and symptom management in lung cancer patients is particularly important. Recent research also highlights the need to address the complex issues of lung cancer survivors, such as stigma, financial problems, sexual dysfunction, and fear of recurrence (Rajapakse, 2021). These problems can affect the poor physical and psychosocial distress of patients and their families (Vijayvergia *et al.*, 2015). Our study recommends that future study efforts should further elucidate the complex issues affecting the overall well-being of lung cancer survivors and develop appropriate interventions in this survivor population.

6. Limitations

Several limitations to the study should be noted. First, the present findings apply only to survivors of early-stage NSCLC with no current evidence of disease. Second, the cross-sectional research design prevented examination of the causal direction of associations between selected correlates and HRQoL. In addition, the study sample was limited to participants in the outpatient department of the regional medical center, notably during the time of recruiting the subjects amid the global coronavirus (COVID-19) pandemic, which may have prevented patients from participating in the study. The participants enrolled in this study may also have experienced carry-on effects from the epidemic, which may affect the external validity and inferentiality of this study's results due to participants feeling anxious and worried.

Acknowledgements

The authors would like to express sincere gratitude to all patients who volunteered to participate in this study. This research would not have been possible without their willingness to share their experiences.

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