Quality of Life and Related Factors in Patients With Newly Diagnosed Advanced Lung Cancer: A Longitudinal Study

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L ung cancer is among the leading causes of cancer death worldwide (World Health Organization, 2014), with the majority of patients diagnosed with advanced non-small cell lung cancer (NSCLC) (National Comprehensive Cancer Network [NCCN], 2014). In Taiwan, about 90% of patients with lung cancer are diagnosed with NSCLC, and about 72% of those patients are at stage III or IV when diagnosed (Taiwan Cancer Registry, 2010). For patients with advanced lung cancer, multimodality treatment is the only way to prolong patient survival (NCCN, 2014). However, the five-year survival rate is still only 14%–17% for patients with lung cancer in the United States (Siegel, Ma, Zou, & Jemal, 2014). Poor prognosis and subsequent treatment-related side effects may cause overwhelming stress, which ultimately threaten quality of life (QOL) during the disease trajectory (Sprangers, Tempelaar, van den Heuvel, & de Haes, 2002).

QOL has been identified as one of the most crucial indicators of cancer prognosis and factors related to the survival duration of patients with lung cancer (Gralla, 2004; Li et al., 2012). Patients with lung cancer have been observed to experience the worst QOL levels compared to patients with other types of cancer (Baker, Denniston, Haffer, & Liberatos, 2009). However, compared to the amount of information on the QOL of patients diagnosed with breast cancer or other major cancers, few studies have examined factors related to QOL changes among patients with advanced-stage lung cancer.

The purposes of the current study were to (a) examine the changes in QOL (global and five functional dimensions: physical, role, emotional, cognitive, and social), symptoms, and self-efficacy for coping with cancer; and (b) identify the factors related to the changes in the six QOL dimensions in patients with advanced lung cancer during the first three months following diagnosis.

Purpose/Objectives: To examine the changes in quality of life (QOL), symptoms, self-efficacy for coping with cancer, and factors related to those changes in patients with newly diagnosed advanced lung cancer.

Design: Longitudinal and correlational.

Setting: Oncology inpatient wards and outpatient departments of a medical center in northern Taiwan.

Sample: 101 patients newly diagnosed with stage IIIB or IV lung cancer.

Methods: Questionnaires were used to assess patients' QOL, symptoms, and self-efficacy before treatment and at one and three months following treatment. Factors related to the changes in global QOL and five functional dimensions were analyzed using six generalized estimating equation models.

Main Research Variables: QOL, symptoms, and self-efficacy for coping with cancer.

Findings: Patients reported moderate levels of global QOL, symptom severity, and self-efficacy for coping with cancer. They also reported high physical and cognitive functions, but relatively low role and social functions. Factors were significantly related to the most functional dimensions, including self-efficacy, fatigue, pain, sleep difficulties, and demographic- and disease-related factors. Self-efficacy was the most robust factor for predicting QOL.

Conclusions: Patients with advanced lung cancer experience a compromised global QOL and relatively low social and role functioning during the first three months following cancer diagnosis. Levels of self-efficacy and symptoms significantly affected changes in QOL and functioning.

Implications for Nursing: Applying a systematic assessment of changes in QOL and developing comprehensive interventions with self-efficacy training and symptom management are strongly recommended for clinical care to improve the QOL of patients with advanced lung cancer.

Key Words: lung cancer; quality of life; self-efficacy; symptoms

Conceptual Framework

The Transactional Model of Stress and Coping Theory (Lazarus & Folkman, 1984) was used as the conceptual

framework to describe the relationship among patients newly diagnosed with lung cancer (stress), self-efficacy (appraisal), and adaptation (QOL and functioning). When faced with a stressor, such as cancer, a person appraises the potential threat and his or her ability to overcome the stressful situation and manage the negative reactions. The theory posits self-efficacy as a central component in the performance of various behaviors necessary in adapting to an illness. Integrated with the modified QOL conceptual model (Ferrans, Zerwic, Wilbur, & Larson, 2005), symptoms and selected demographic and disease-related characteristics were chosen as the important factors simultaneously affecting the QOL of patients with lung cancer in the current study.

Self-efficacy refers to the level of confidence that a person has in overcoming a range of difficulties to perform specific behaviors. It also determines the person's appraisals of what actions can be performed, how much effort can be expended, and how much persistence is necessary to achieve the desired outcome (e.g., medical outcome, psychosocial adjustment). Therefore, self-efficacy affects not only the person's thought processes, but also the stress adaptation process and, in turn, further influences a person's affective and physical states (Bandura, 1986, 1997; Heitzmann et al., 2011).

According to the Transactional Model of Stress and Coping Theory (Lazarus & Folkman, 1984), self-efficacy performs a significant function in supporting people to cope more effectively with stress or threats. The protective effect of self-efficacy has been addressed in treating patients with prostate cancer (Campbell et al., 2004; Northouse et al., 2007) and breast cancer (Boehmer, Luszczynska, & Schwarzer, 2007; Lev et al., 2001; Rottmann, Dalton, Christensen, Frederiksen, & Johansen, 2010), as well as early-stage lung cancer for patients experiencing pain (Porter, Keefe, Garst, McBride, & Baucom, 2008). However, little is known about the self-efficacy level of coping with cancer and its relationship with QOL and functioning in patients with advanced lung cancer.

Literature Review

Quality of Life

QOL refers to patient appraisal and satisfaction with their lives and functioning and is recognized as a subjective, multidimensional, and dynamic experience that reflects satisfaction with the control of disease symptoms and treatment side effects (Cella, 2004). Therefore, measuring QOL is not only a primary end point of clinical trials for new pharmaceuticals (Revicki et al., 2000), but also an essential outcome of cancer nursing care.

Consensus does not exist on what aspects should be included in the QOL concept (Grant et al., 1992). Dimensions that have been included in the QOL concept are global QOL, symptoms, functional status or physi-

cal functioning, emotional state or psychological functioning, interpersonal relationships or social functioning (Cooley, 1998; Grant et al., 1992; Morrow, Lindke, & Black, 1992; Wilson & Cleary, 1995), role functioning, and general health perception (Wilson & Cleary, 1995). Therefore, to adequately detect impairments in patient QOL, a valid QOL instrument tailored to the targeted population is necessary. The current authors adopted the European Organisation for Research and Treatment of Cancer (EORTC) study group model, which conceptualizes that QOL includes symptoms, functioning (e.g., physical, role, emotional, cognitive, social), impact on finances, and global QOL (Aaronson et al., 1993).

Global quality of life: Global QOL refers to a person's subjective assessment of overall health and QOL. The concept is considered a summary measure of QOL (Wilson & Cleary, 1995), and has been recognized as an independent predictor of survival duration in patients with lung cancer (Montazeri, 2009). Although active treatment is a salient approach for increasing the QOL of patients with advanced lung cancer, previous studies have revealed that the global QOL of these patients significantly declined after treatment initiation (Henoch, Bergman, Gustafsson, Gaston-Johansson, & Danielson, 2007; Montazeri, Milroy, Hole, McEwen & Gillis, 2003).

In addition, based on theoretical grounding and empirical evidence, global QOL is significantly affected by various aspects of functioning (Ferrans et al., 2005; Montazeri et al., 2003; Östlud, Wennman-Larsen, Gustavsson, & Wengström, 2007; Wilson & Cleary, 1995). Therefore, improving patient QOL requires simultaneously identifying the factors that influence global QOL and each dimension of functioning. However, no empirical findings concurrently account for the factors that affect all dimensions of QOL.

Functioning: Functioning is the ability of a person to perform particular defined tasks and is affected by symptoms and multiple patient-specific factors (Wilson & Cleary, 1995). In a systematic review, Montazeri (2009) showed that physical functioning was an independent predictor of survival duration in patients with cancer. Several studies have shown that the physical functioning of patients with lung cancer deteriorated during the cancer treatment period (Henoch et al., 2007; Kurtz, Kurtz, Stommel, Given, & Given, 2000; Lövgren, Tishelman, Sprangers, Koyi, & Hamberg, 2008; Montazeri et al., 2003). However, emotional functioning has been found to improve during the treatment (Lövgren et al., 2008; McCorkle & Quint-Benoliel, 1983), although a large majority of patients with lung cancer experienced severe psychological distress across the disease trajectory (Zabora, BrintzenhofeSzoc, Curbow, Hooker, & Piantadosi, 2001). A qualitative study revealed that active treatment offered hope and reduced emotional distress for patients with advanced lung cancer (Berterö, Vanhanen, & Appelin, 2008).

Compared with physical and emotional functioning, minimal information has been reported about the cognitive, role, and social functioning of patients with lung cancer. Langendijk et al. (2001) found that patients with lung cancer reported high levels of cognitive functioning at baseline but it significantly declined after treatment. In addition, both social functioning (Langendijk

et al., 2001; Lövgren et al., 2008) and role functioning (Montazeri et al., 2003) were low before treatment, and continued to decline during the treatment period.

Symptoms: A symptom refers to a subjective experience reflecting changes in the biopsychosocial functioning and sensation of cognition of a person (Dodd et al., 2001). In the current study, the authors focused on the levels of the physical symptoms most commonly reported by patients with cancer. Patients with lung cancer suffer multiple symptoms caused by disease and treatment. Evidence shows that patients with lung cancer experience the highest level of symptoms among patients with different types of cancer (Barbera et al., 2010). Fatigue, dyspnea, appetite loss, pain, and sleep difficulties have been reported as the most severe symptoms in various studies (Brown, Cooley, Chernecky, & Sarna, 2011; Larsson, Ljung, & Johansson, 2012; Liao et al., 2011; Lövgren et al., 2008). Several longitudinal observational studies have indicated that treatment-related symptoms increased over time for patients receiving active treatment (Langendijk et al., 2001; Lövgren et al., 2008; Wang et al., 2006), but disease-related symptoms, such as dyspnea and pain, tended to be palliated after treatment initiation (Wang et al., 2006).

Factors Related to Changes in Quality of Life and Functioning of Patients With Lung Cancer

Relatively few studies have examined factors related to changes in QOL in patients with advanced lung cancer. Previous studies have revealed that patients reporting higher levels of symptoms had lower QOL (Gralla, 2004; Henoch et al., 2007; Hermann & Looney, 2011) and physical functioning (Kurtz et al., 2000). A better baseline QOL score predicted higher QOL after treatment (Bozcuk et al., 2006). Untreated symptoms (Cella, 2004) and poor pretreatment physical functioning (Kurtz et al., 2000) were significantly related to the decline in physical functioning. Increases in levels of fatigue, dyspnea, cough, and pain were associated with impairments in emotional functioning (Brown, McMillan, & Milroy, 2005; Hopwood & Stephens, 2000). In addition, Chen, Yu, and Yang (2008) revealed that more sleep difficulties indicated lower cognitive functioning.

Regarding demographic and disease-related factors, patients who are older adults (Baker et al., 2009; Hermann & Looney, 2011; Sarna et al., 2002), have lower physical performance (Henoch et al., 2007; Hermann & Looney, 2011), comorbidities (Sarna et al., 2010), or who are depressed (Henoch et al., 2007; Hermann & Looney, 2011) have reported reduced levels of global QOL. Male patients have reported higher social functioning and emotional functioning compared with female patients (Lövgren et al., 2008). Consensus is lacking on the effects of education level, marital status, disease stage, or

Table 1. Participant Characteristics (N = 101)		
Characteristic	**X̄**	**SD**
Age (years)	60.4	10.79
Education (years)	9.72	4.92
Karnofsky Performance Status[a]	79.1	12.3
Characteristic	**n**	**%**
Gender		
Male	63	62
Female	38	38
Education		
No formal education	8	8
Elementary school	29	29
High school	36	36
College or higher	28	28
Marital status		
Married	78	77
Single or widowed	23	23
Religion		
Buddhist or Taoist	70	69
Christian or other	9	9
None	22	22
Occupational status		
Employed	31	31
Unemployed	52	52
Unemployed since illness	18	18
Comorbidities		
No	42	42
Yes[b]	59	58
• Cardiovascular disease	46	46
• Diabetes mellitus	15	15
• Liver disease	9	9
• Ulcer	7	7
• Respiratory disease	6	6
• Benign prostatic hyperplasia	4	4
• Hyperthyroidism	4	4
• Renal insufficiency	3	3
• Other disease	11	11
Stage		
IIIB	22	22
IV	79	78
Histology		
Adenocarcinoma	91	90
Squamous cell carcinoma	7	7
Other	3	3
Treatment (Time 2–Time 3)		
Chemotherapy	72	71
Epidermal growth factor receptor-specific tyrosine kinase inhibitor	18	18
Chemotherapy and radiotherapy	11	11

[a] Scores range from 0 (death) to 100 (normal function with no evidence of disease).

[b] More than one may be applicable.

Note. Because of rounding, not all percentages total 100.

Table 2. Changes in Global Quality of Life and Functioning

Dimension	T1 (N = 101)		T2 (N = 101)		T3 (N = 92)		Wald's Chi-Square	Contrast Comparison
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD		
Global quality of life	60.15	20.77	62.71	20.16	60.71	22.37	1.3	ns
Functioning scales								
Physical	80	19.55	75.9	22.11	74.22	20.8	5.73*	T1 > T2, T3
Role	70.79	30.49	70.46	29.23	65.39	32.23	4.82***	T1, T2 > T3
Emotional	75.9	17.19	81.27	16.89	81.34	19.15	11.79**	T2, T3 > T1
Cognitive	88.61	14.71	84.83	17.09	78.98	20.2	24.99***	T1 > T2 > T3
Social	65.01	25.44	69.47	28.48	70.83	25.15	4.35*	T2, T3 > T1
Financial difficulty	20.46	31.96	18.15	28.87	18.47	28.11	1.1	ns

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
ns—nonsignificant; T1—pre-treatment; T2—one month following treatment initiation; T3—three months following treatment

treatment modality on QOL and functioning (Lövgren et al., 2008; Montazeri, Milroy, Hole, McEwen, & Gillis, 2001; Sarna et al., 2002; Sarna & Riedinger, 2004).

Conversely, self-efficacy for coping with cancer, a cognitive appraisal factor that potentially improves patient QOL, has not been concurrently examined in patients with advanced lung cancer. Only one study examined the self-efficacy of patients with early-stage lung cancer and found that a greater level of self-efficacy was related to a lower level of symptoms and psychological distress, as well as higher physical functioning and QOL (Porter et al., 2008).

In addition, although several studies have examined QOL over time, studies by Sarna et al. (2002, 2010) primarily involved patients with early-stage lung cancer and survivors. In populations with advanced lung cancer, QOL typically was used as a treatment outcome indicator to study, for example, the effects of topotecan on symptom palliation and QOL (Gralla, 2004), and the effects of radiation therapy on QOL (Langendijk et al., 2001; Montazeri et al., 2001). Hermann and Looney (2011) examined determinants of QOL in patients with lung cancer at the end of life. However, limited information is available on QOL changes in homogenous patients during the first three months following diagnosis and treatment of advanced-stage lung cancer, despite this period being identified as the most threatening (Sprangers et al., 2002; Weisman & Worden, 1976).

For patients with cancer, particularly those with lung cancer, the first three months after diagnosis make up the period of "existential plight" (Weisman & Worden, 1976, p. 3). To provide timely intervention, the current study aimed to understand the changes of QOL, symptoms, and self-efficacy, as well as identify related factors in each QOL dimension in patients newly diagnosed with lung cancer during this critical period. The authors hypothesized that QOL and functioning correlate positively with the level of self-efficacy and negatively with the levels of symptoms. In addition, the authors hypothesized

that demographic and disease-related characteristics influence patient QOL and functioning.

Methods

Setting and Sample

This longitudinal study was the first phase of a two-phase lung cancer supportive care project. Patients were recruited from National Taiwan University Hospital, a leading medical center in northern Taiwan. Eligible patients were (a) newly diagnosed with stage IIIB or stage IV NSCLC (based on the seventh edition of the International Association for the Study of Lung Cancer's tumor-node-metastasis classification) (Goldstraw, 2009), (b) aware of their cancer diagnosis, and (c) scheduled to receive their anticancer treatments for the first time (including chemotherapy [CT], radiotherapy [RT], CT plus RT [CT+RT], and epidermal growth factor receptor-specific tyrosine kinase inhibitors [EGFR-TKI]). Patients with recurrent lung cancer or other types of cancer diagnoses and those with psychiatric disorders were excluded from the study.

The study was reviewed and approved by the Research Ethics Committee of the National Taiwan University Hospital. Eligible patients were identified and referred by thoracic oncologists. Consecutive patients were recruited from oncology and medical inpatient wards and outpatient departments (OPD). Informed written consent was obtained from all participants prior to data collection. The participants were interviewed face to face by a trained research nurse in OPD or inpatient wards. Patients were assessed at three time points: pre-treatment (before first treatment, T1), and one month (T2) and three months (T3) following initial treatment.

Instruments

The **EORTC QOL Questionnaire Core 30, version 3.0 (EORTC QLQ-C30)** Taiwan Chinese version (Aaronson et al., 1993; Chie, Yang, Hsu, & Yang, 2004) was employed

Table 3. Changes in Levels of Symptoms

Dimension	T1 (N = 101)		T2 (N = 101)		T3 (N = 92)		Wald's Chi-Square	Contrast Comparison
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD		
Symptom scales								
Fatigue	26.29	22.15	33	24.42	35.39	24.7	12.22**	T2, T3 > T1
Nausea and vomiting	3.96	13.57	13.2	21.64	11.59	20.18	19.35***	T2, T3 > T1
Pain	24.75	25.99	18.15	21.23	22.1	24.34	7.41*	T1, T3 > T2
Appetite loss	14.52	21.3	22.77	27.86	23.91	30.59	9.13*	T2, T3 > T1
Individual symptoms								
Dyspnea	26.4	27.62	25.08	23.76	24.64	26.08	0.2	ns
Sleep difficulty	32.01	30.52	25.74	28.62	25.72	30.1	4.17	ns
Constipation	7.59	18.18	13.2	21.12	12.31	20.8	5.81*	T2, T3 > T1
Diarrhea	3.67	10.48	14.19	20.73	10.14	16.19	24.33***	T2 > T3 > T1

* p < 0.05; ** p < 0.01; *** p < 0.001

ns—nonsignificant; T1—pre-treatment; T2—one month following treatment initiation; T3—three months following treatment

to assess patient health-related QOL and symptoms. The EORTC QLQ-C30 is composed of a global QOL scale, five QOL-related functional dimensions or subscales (physical, role, emotional, cognitive, and social), three symptom scales (fatigue, pain, and nausea and vomiting), five symptom items, and one item to measure financial difficulty (Chie et al., 2004; Fayers et al., 2001).

Based on the scoring manual, all scales and items were transformed into a standardized score system ranging from 0–100 (Fayers et al., 2001). Higher scores indicate greater overall QOL/functions and worse symptoms/financial status. The tool has good reliability, with the Cronbach alpha ranging from 0.58–0.85 as demonstrated in Chie et al. (2004); therefore, it has been used frequently in clinical studies (Gralla, 2004; Langendijk et al., 2001). In the current study, the Cronbach alpha for the QOL subscales ranged from 0.56 (cognitive function scale) to 0.9 (role function scale).

The 14-item, seven-dimension brief form **Coping Behavior Inventory (CBI-B)** Chinese version was used to assess patient levels of self-efficacy for coping with cancer and its treatment (Merluzzi, Nairn, Hegde, Martinez Sanchez, & Dunn, 2001; Merluzzi, Nairn, & Martinez Sanchez, 1999; Merluzzi & Martinez Sanchez, 1997). It consists of seven two-item subscales (dimensions), including confidence in maintenance of activity and independence, seeking and understanding medical information, stress management of medical appointments, coping with treatment-related side effects, maintaining a positive attitude, affective regulation, and seeking social support. The CBI-B is scored from 0 (no confidence at all) to 10 (totally confident). A summated score of the CBI-B is used to indicate the overall self-efficacy level. Previous reports have shown the tool has good reliability, with a Cronbach alpha of 0.85 for the overall scale (Merluzzi et al., 2001; Merluzzi & Martinez Sanchez, 1997); in the current study, the Cronbach alpha was 0.93 for the overall scale.

The **Background Information Form (BIF)** includes the demographic information and disease and treatment-related information. Chart reviews were used to collect patient disease-related information (e.g., comorbidity, cancer stages, cancer cell types) and treatment status (e.g., CT, EGFR-TKI, CT+RT). Patient performance status was measured using the Karnofsky Performance Status (KPS) scale. The KPS scores range from 0 (death) to 100 (normal function with no evidence of disease), with higher scores indicating greater level of daily activity (Karnofsky, Abelmann, Craver, & Burchenal, 1948).

Statistical Methods

Descriptive statistical methods were applied to analyze the means and frequencies over three specific times (when available). The Generalized Estimating Equations (GEE) model was used to identify factors related to a linear change (Liang & Zeger, 1986). Contrast comparisons used to examine the differences were significant or not, and Bonferroni correction was used to reduce type I errors. Based on the literature review and the primary purposes of this study, dependent variables were changes in the global QOL score and the five functional domains of QOL scores. Fourteen variables were selected as the independent variables, including the pretreatment score of each QOL functional dimension, age, gender, marital status (single or married), comorbidity (without or with), disease stage (IIIB or IV), treatment (CT only, EGFR-TKI only, or CT+RT), performance status (KPS), overall self-efficacy, and five of the most severe symptoms. To reduce type I errors, only the top five symptoms (fatigue, pain, dyspnea, appetite loss, and sleep difficulty) were selected because no cutoff points exist for EORTC QLQ measures. Fourteen independent variables were entered for each QOL model. In addition, the inverse-probability weighting method (Robins, Rotnitzky, & Zhao, 1995) was employed to manage the nonignorable missing data. Sample size and power were calculated based on

the formula proposed by Liu and Liang (1997). Eighty-three patients were required to achieve a power of 0.8. All analyses were two-tailed and p values less than 0.05 were considered statistically significant.

Results

Patient Characteristics

The consecutive sampling method was used to approach 127 eligible patients; 26 patients refused because of physical distress (n = 8), psychological distress (n = 6), or no interest in the study (n = 12). Among the 101 enrolled patients, all completed T1 and T2 assessments, and 92 completed all three assessments for a 91% completion rate. Some patients declined participating in the study because of being too ill (n = 5), emotional distress (n = 1), or having no interest in the study (n = 1). Two patients had died. An inverse-probability weighting method (Robins et al., 1995) was applied to account for the dropouts.

Among the 101 patients, the mean age was 60.4 years (SD = 10.79), and 62% were men (see Table 1). The majority of the patients had completed high school or higher education (64%), were married (77%), had religious beliefs (78%), and were unemployed (70%). Fifty-eight percent of the patients had comorbidities (having one or more major disease, such as cardiovascular disease and diabetes mellitus). Most were diagnosed as stage IV (78%) with adenocarcinoma (90%), and were receiving chemotherapy (71%) as their first-line treatment.

Global and Functional Dimensions of Quality of Life

On average, the patients reported moderate levels of global QOL, ranging from 60.15 (SD = 20.77) at T1 to 60.71 (SD = 22.37) at T3, but this change was not signifi-cant (p = 0.552) (see Table 2). In the five functional sub-scales, patients reported higher scores in cognitive and physical functions, and relatively lower scores in role and social functions prior to treatment (T1). Regarding the change of functioning, two major patterns with statistically significant change were observed. Physical (p = 0.028), role (p = 0.043), and cognitive (p = 0.014) functions had the highest levels at T1, and decreased gradually. Emotional (p = 0.003) and social (p = 0.014) functions had the lowest levels at T1, although they improved over time (T2 and T3). Finally, these patients reported mild levels of financial difficulty that showed no statistically significant change over time.

Changes in Levels of Symptoms

Table 3 shows that the patients reported mild-to-moderate symptom levels over three months. Before treatment (T1), sleep difficulties represented the dominant symptom, followed by dyspnea, fatigue, and pain. Three months later (T3), fatigue was ranked as the most severe symptom followed by sleep difficulties, dyspnea, and appetite loss. Treatment-related symptoms, including fatigue (p = 0.002), nausea and vomiting (p < 0.001), appetite loss (p = 0.01), constipation (p = 0.048), and diarrhea (p < 0.001), all peaked at T2 and remained high at T3. The pain subscale, however, had its lowest score at T2 (p = 0.025). Levels of dyspnea (p = 0.904) and sleep difficulties (p = 0.12) had decreased slightly after the commencement of treatment, with no statistically significant changes.

Changes in Self-Efficacy for Coping With Cancer

The overall self-efficacy remained at no change between T1 and T2, and slightly declined at T3, but this

Table 4. Changes in Level of Self-Efficacy for Coping With Cancer During Follow-Up

Dimension	T1 (N = 101)		T2 (N = 101)		T3 (N = 92)		Wald's Chi-Square	Contrast Comparison
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD		
Overall self-efficacy	6.88	1.76	6.88	1.83	6.77	1.9	1.53	ns
Maintaining activity and independence	6.96	2.1	6.87	2.34	6.84	2.27	0.83	ns
Positive thinking	6.93	2.4	7	2.35	6.61	2.39	4.1	ns
Searching for and understanding medical information	7.48	2.37	7.68	1.99	7.18	2.26	5.52	ns
Managing stress	7.49	2.1	7.45	2.12	7.36	2.09	1.42	ns
Affective regulation	6.67	2.11	6.47	2.17	6.36	2.25	2.92	ns
Managing side effects	6.58	2.27	6.8	2.23	6.96	2.16	2.43	ns
Searching for support	5.66	3.52	5.35	3.28	5.87	3.29	1.96	ns

ns—nonsignificant; T1—pre-treatment; T2—one month following treatment initiation; T3—three months following treatment

Table 5. Generalized Estimating Equation Analysis for Factors Related to Different Dimensions of QOL

Variable	Global QOL			Physical Function			Role Function		
	B	SE	95% CI	B	SE	95% CI	B	SE	95% CI
Pretreatment	0.08	0.06	[–0.04, 0.2]	0.02*	0.08	[0.04, 0.35]	0.08	0.07	[–0.05, 0.21]
Age	–0.02	0.13	[–0.28, 0.25]	–0.07	0.14	[–0.35, 0.21]	0.37	0.22	[–0.06, 0.8]
Female versus male	0.11	2.46	[–4.71, 4.92]	1.41	1.96	[–2.44, 5.26]	2.34	3.52	[–4.55, 9.24]
Education (years)	–0.15	0.27	[–0.67, 0.38]	0.62*	0.27	[0.1, 1.14]	1.09**	0.43	[0.26, 1.93]
Married versus not	0.8	2.96	[–4.99, 6.6]	3.88	2.28	[–0.59, 8.36]	0.83	5.12	[–0.34, 10.99]
Comorbidity	–0.18	2.33	[–6.41, 2.7]	–1.52	2.54	[–6.5, 3.45]	–6.6*	3.51	[–13.47, –0.28]
Stage IV versus IIIb	2.85	2.64	[–2.39, 8.02]	1.68	2.92	[–4.04, 7.41]	–5.19	3.88	[–12.79, 2.4]
CT+RT versus CT	–0.55	3.4	[–7.22, 6.12]	–0.34	3.8	[–7.78, 7.11]	–8.86	6.24	[–21.11, 3.36]
Target versus CT	–1.41	3.32	[–7.91, 5.09]	–1.22	2.77	[–6.65, 4.21]	–1.1	3.99	[–8.92, 6.73]
KPS	0.15	0.13	[–0.1, 0.41]	0.64***	0.12	[0.4, 0.88]	1.02***	0.19	[0.65, 1.39]
Fatigue	–0.25***	0.07	[–0.4, –0.1]	–0.49***	0.07	[–0.62, –0.37]	–0.3**	0.11	[–0.53, –0.08]
Pain	–0.13*	0.07	[–0.27, –0.01]	–0.08	0.06	[–0.19, –0.04]	–0.14	0.08	[–0.3, 0.19]
Sleep difficulties	–0.02	0.04	[–0.1, 0.06]	–0.03	0.04	[–0.11, 0.05]	–0.07	0.05	[–0.18, 0.03]
Appetite loss	–0.05	0.06	[–0.16, 0.06]	0.07	0.05	[–0.03, 0.17]	–0.1	0.76	[–0.25, 0.04]
Dyspnea	0.06	0.05	[–0.03, 0.15]	0.04	0.06	[–0.07, 0.16]	–0.09	0.06	[–0.21, 0.04]
Self-efficacy	4.58***	0.75	[3.11, 6.05]	0.57	0.59	[–0.59, 1.79]	0.62	0.86	[–1.01, 2.31]
Time	0.04	2.14	[–4.16, 4.23]	–0.8	1.43	[–3.61, –2.01]	–3.68	2.27	[–8.12, 0.77]

Variable	Emotional Function			Cognitive Function			Social Function		
	B	SE	95% CI	B	SE	95% CI	B	SE	95% CI
Pretreatment	0.17*	0.08	[0.01, 0.33]	0.41***	0.08	[0.25, 0.57]	0.38***	0.06	[0.27, 0.5]
Age	0.28*	0.12	[0.05, 0.51]	–0.71	0.13	[–0.33, 0.18]	0.07	0.17	[–0.26, 0.41]
Female versus male	–2.23	2.44	[–7.07, 2.49]	–4.91	2.65	[–10.11, 0.28]	1.4	3.33	[–5.12, 7.92]
Education (years)	0.39	0.23	[–0.07, 0.86]	–0.45	0.31	[–1.06, 0.15]	–0.42	0.36	[–1.12, 0.29]
Married versus no	–4.12	2.69	[–9.45, 1.1]	1.5	2.96	[–4.3, 7.31]	–4.12	3.79	[–11.62, 3.26]
Comorbidity	–4.31*	2.13	[–8.48, –0.14]	0.02	2.47	[–4.81, 4.86]	0.48	3.24	[–5.89, 6.83]
Stage IV versus IIIb	1.66	2.63	[–3.49, 6.81]	2.85	2.6	[–2.25, 7.95]	–4.63	3.57	[–11.64, 2.38]
CT+RT versus CT	7.21*	3.22	[0.9, 13.52]	–2.51	2.6	[–10.83, 5.82]	–15.09***	4.53	[–23.96, –6.2]
Target versus CT	–2.34	3.16	[–8.54, 3.86]	0.78	2.96	[–5.02, 6.59]	5.84	3.36	[–0.74, 12.42]
KPS	0.02	0.15	[–0.28, 3.17]	0.16	0.12	[–0.08, 0.4]	0.2	0.18	[–0.14, 0.55]
Fatigue	–0.11	0.09	[–0.29, 0.06]	–0.24**	0.08	[–0.4, –0.09]	–0.25**	0.1	[–0.44, –0.06]
Pain	–0.15*	0.06	[–0.27, –0.34]	0.04	0.06	[–0.08, 0.16]	–0.04	0.09	[–0.22, 0.13]
Sleep difficulties	–0.08	0.05	[–0.1, 0.11]	–0.07*	0.04	[–0.15, –0.01]	–0.11*	0.05	[–0.22, –0.01]

(Continued on the next page)

*p < 0.05; **p < 0.01; ***p < 0.001

B—beta; CI—confidence interval; CT—chemotherapy; KPS—Karnofsky Performance Status; SE—standard error; QOL—quality of life; RT—radiotherapy

Table 5. Generalized Estimating Equation Analysis for Factors Related to Different Dimensions of QOL (Continued)

Variable	Emotional Function			Cognitive Function			Social Function		
	B	SE	95% CI	B	SE	95% CI	B	SE	95% CI
Appetite loss	0.01	0.05	[–0.1, 0.01]	–0.01	0.05	[–0.02, 0.16]	0.03	0.07	[–0.11, 0.18]
Dyspnea	–0.04	0.04	[–0.12, 0.04]	0.07	0.05	[–0.02, 0.16]	0.07	0.06	[–0.04, 0.18]
Self-efficacy	2.51***	0.59	[1.37, 3.66]	1.39*	0.62	[0.18, 2.59]	3.78***	0.88	[2.06, 5.5]
Time	1.2	1.83	[–2.38, 4.78]	–5.12**	1.91	[–8.94, –1.44]	2.28	2.36	[–2.34, 6.9]

* p < 0.05; ** p < 0.01; *** p < 0.001

B—beta; CI—confidence interval; CT—chemotherapy; KPS—Karnofsky Performance Status; SE—standard error; QOL—quality of life; RT—radiotherapy

change was nonsignificant (p = 0.471) (see Table 4). Regarding seven self-efficacy subscales, the patients had relatively high levels of self-efficacy on searching and understanding medical information (e.g., asking their physician questions) and managing stress (e.g., remaining relaxed when waiting at least one hour for an appointment). However, low levels of self-efficacy were observed for searching for support (e.g., sharing feelings of concern) and affective regulation (e.g., expressing negative feelings about cancer). No statistically significant change was observed for any dimensions of self-efficacy over time.

Factors Related to the Change in Quality of Life

According to the theoretical framework and literature review, 14 independent variables were fitted into each QOL model. Factors significantly related to the changes in global QOL and the five functional dimensions of QOL and the parameters are shown in Table 5. Patients with higher self-efficacy, lower fatigue, and less pain had greater global QOL during treatment. Pretreatment physical functioning, years of education, performance status, and fatigue were critical factors related to the change of physical functioning. The change of role functioning was associated with years of education, comorbidities, performance status (KPS), and fatigue. Patients with higher levels of pretreatment emotional functioning, older age, less pain, and greater self-efficacy reported better emotional functioning. In addition, patients receiving CT+RT had better emotional functioning than those receiving CT alone. By contrast, patients with comorbidities reported lower emotional functioning than their counterparts. Patients reported better cognitive functioning if they had higher pretreatment cognitive functioning scores, lower fatigue, lower sleep difficulties, and greater self-efficacy. Patients also reported lower cognitive functioning at T3 compared to T2. They enjoyed better social functioning if they had higher pretreatment social functioning scores, lower fatigue, lower sleep difficulties, and greater self-efficacy. In addition, patients receiving CT+RT had lower social functioning than those receiving CT.

Discussion

The current study examined the QOL changes and related factors of patients during the most threatening period, the first three months after being diagnosed with advanced lung cancer. The findings supported hypotheses that self-efficacy for coping with cancer, symptom levels, and several demographic- and disease-related factors were significantly related to changes in QOL.

Gradual deteriorations occurred in physical and cognitive functioning, with the lowest scores on the third month, indicating the significantly adverse impact from the cancer treatment to patients. However, the physical and cognitive functions of the patients in the current study were relatively high compared with previous findings (Langendijk et al., 2001; Lövgren et al., 2008). One potential reason may be that the current study only recruited the patients receiving active treatment, whereas patients with poor performance status were recommended to receive supportive care only (NCCN, 2014). In addition, the patients in this study were slightly younger than those in studies by Lövgren et al. (2008) and Langendijk et al. (2001). Furthermore, 18% of the current study's patients were receiving target therapy (TKI) and might have experienced milder side effects compared with those receiving CT or RT (Agero et al., 2006).

The patients reported relatively low emotional functioning at T1; however, emotional functioning increased significantly at T2 and T3, similar to previous studies (Langendijk et al., 2001; Lövgren et al., 2008; McCorkle & Quint-Benoliel, 1983). The lowest score, at T1, suggests shock from receiving a cancer diagnosis, but the increase in knowledge about cancer and its treatment as a result of interactions with clinicians alongside the natural history

Knowledge Translation

The effect of self-efficacy on adaptation is prominent for patients with advanced lung cancer.

A mild level of symptoms is sufficiently severe to reduce patient quality of life.

Personalized supportive care incorporating information provision, self-efficacy training, symptom management, and counseling may assist patients in coping effectively during the most threatening phase of the cancer trajectory.

of the disease trajectory may reduce patient emotional distress (McCorkle & Quint-Benoliel, 1983). In addition, actively receiving treatment may provide hope and may reduce patient emotional distress (Berterö et al., 2008). Nevertheless, emotional distress, particularly depression, has been identified as a persistent problem for patients with lung cancer (Zabora et al., 2001). Therefore, regular psychological assessment is still strongly suggested.

The patients had high scores in physical functioning, but relatively low scores in role and social functioning, similar to previous studies (Langendijk et al., 2001; Lövgren et al., 2008; Montazeri et al., 2003). The findings demonstrate that the overwhelming impacts of diagnosis and treatment on their regular lives and family relationships may cause additionally compromised global QOL (Ferrans et al., 2005; Wilson & Cleary, 1995). Parallel results also were observed in low self-efficacy on searching for social support and affective regulation. Conversely, the highest self-efficacy score was found in searching for and understanding the medical information subscale. The overall findings indicate that patients with newly diagnosed advanced lung cancer experience more psychosocial distress than physical distress. Current treatments for lung cancer may have improved physical aspects of cancer care and the availability of information; however, assessment of psychosocial health and counseling still require development.

In similar previous studies (Liao et al., 2011; Lövgren et al., 2008; Montazeri et al., 2003), the average levels of symptoms have been reported to be mild to moderate, possibly reflecting the effectiveness of clinical symptom management provided to patients. However, selected symptoms including fatigue, pain, and sleep difficulties still significantly affected patient QOL. That supports Tanaka, Akechi, Okuyama, Nishiwaki, and Uchitomi (2002) in that a mild level of symptoms is sufficiently severe to disrupt patient daily activity. Notably, fatigue peaked at T2 and remained high at T3, reflecting the profound effect of treatment on energy levels. In addition, fatigue was ranked as the most severe symptom and a major predictor of QOL, which was consistent with previous research showing that fatigue was one of the

most prominent negative reactions (Bozcuk et al., 2006; Östlund et al., 2007; Sarna et al., 2002). Therefore, fatigue should be carefully identified and treated appropriately during the treatment period.

Similarly, pain predicted a change in global QOL and emotional functioning. Causes of pain in patients with lung cancer are complex. Pain can be caused by the disease itself or as a side effect of treatment (Agero et al., 2006; Mercadante & Vitrano, 2010). To detect adverse effects of disease progression and treatment as early as possible, the current authors recommend that clinicians actively recognize and help patients to manage the distress from these symptoms, even when the symptoms are at mild or moderate levels.

The most salient finding shows that self-efficacy for coping with cancer was the most robust factor associated with global QOL and the most important of functional dimensions for patients with lung cancer. The results support the notion that self-efficacy has a critical influence when patients face a life-threatening event (Lazarus & Folkman, 1984). The finding is particularly prominent for clinical implications because self-efficacy is a task-specific mutable factor that can be facilitated and enacted (Bandura, 1997). Therefore, clinical care that incorporates self-efficacy skill training is necessary to assist patients in coping with advanced lung cancer and managing its impact on role and social functioning.

The pretreatment scores of functional dimension significantly influenced the change of functioning of patients during the first three months following initial treatment, which was consistent with previous findings (Bozcuk et al., 2006). Therefore, careful assessment of the QOL of patients with lung cancer before treatment is highly recommended to identify those at high risk of functional deterioration.

Compared to their counterparts, younger patients or those with lower educational levels reported lower emotional and physical functioning, respectively, which was consistent with previous studies (Lövgren et al., 2008; Montazeri et al., 2001; Sarna et al., 2002; Sarna & Riedinger, 2004). Comorbidity significantly predicted a decline in the patient role and emotional functioning; patients receiving CT+RT had the lowest social function among the treatment subgroups. Those findings indicate that complicated health and treatment status may cause more physical and psychological distress for patients. Performance status, an objective parameter, was a signal of physical and role functioning change. Overall, the findings emphasize that personalized supportive care tailored to diverse subgroups is crucial for improving the QOL of patients with advanced lung cancer.

Limitations

Despite the significant findings in this study, a few limitations should be addressed. First, because of the

inclusion criteria of patients who had received active anticancer treatment, the results cannot be generalized to all patients with advanced-stage lung cancer. Second, because of the three-month data collection, additional studies for changes in QOL longer than three months of cancer diagnosis are required to assist healthcare professionals in understanding QOL and the needs of patients with lung cancer who have survived. Finally, a larger scale of data collection is required to conduct equivalent subgroup comparisons.

Conclusions

The findings of this study contribute to the literature on QOL of patients with newly diagnosed advanced lung cancer. Although the patients reported having relatively good physical and cognitive functioning, they had a compromised global QOL and relatively low social, emotional, and role functioning during the first three months following cancer diagnosis. During the follow-up period, they experienced mild-to-moderate levels of symptoms, but treatment-related symptoms increased over time. In addition, they had relatively low self-efficacy in searching for social support and affective regulation. The results indicate that patients with advanced lung cancer undergo internal crises during the first three months following cancer diagnosis. Self-efficacy for coping with cancer and symptoms are the most robust factors affecting the change of their QOL. In addition, age and some disease-related characteristics influence different aspects of functioning. The importance of the current study entails identifying the key components that are amenable to intervention for patients with advanced lung cancer.

Implications for Nursing

The findings suggest that healthcare professionals should apply a systematic and frequent assessment of changes in QOL, functioning, and symptoms for patients with advanced lung cancer during treatment. Comprehensive interventions, incorporating information provision, self-efficacy skill training (e.g., searching for social support and affective regulation), symptom management (e.g., pharmacologic and non-pharmacologic approaches to reduce interferences from symptoms), and routine counseling are strongly recommended to assist patients in coping effectively during the most threatening phase of the cancer trajectory. Personalized supportive care tailored to various age and treatment subgroups is necessary to meet the unique needs of patients. Additional research is required to examine the effect of interventions that integrate these critical factors to improve the QOL of patients with advanced lung cancer.

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