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A cross-sectional study of the quality of life in Chinese inpatients with lung cancer

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Abstract

Objective In China, psychosocial problems of cancer patients are underrecognized and undertreated in medical oncology practice. This study examined the quality of life (QOL) in inpatients with lung cancer treated in large general hospitals and explored the demographic, clinical, and psychosocial factors associated with QOL.

Design Cross-sectional study.

Participants and setting Altogether, 148 inpatients with lung cancer were consecutively recruited from two large general hospitals in Tianjin, China.

Main outcome measured QOL, pain intensity, depressive and anxiety symptoms, and social support were assessed with World Health Organization QOL Scale Brief Version, four-point Verbal Rating Scale, Hospital Anxiety and Depression Scale, and Social Support Rating Scale, respectively.

Results Compared with the normative data for the Chinese general population, patients had significantly lower scores in physical and psychological QOL. Being unmarried, poor economic status, metastasis, poor performance status, depression, anxiety, and low utilization of social support were independently associated with poor physical QOL, while female gender, less education years, currently receiving chemotherapy, small-cell cancer, more intense pain, poor performance status, anxiety, and inadequate subjective social support were independently associated with poor psychological QOL.

Conclusions Inpatients with lung cancer treated in Chinese large general hospitals had poorer QOL in comparison with general population. Appropriate management of

psychosocial problems is potentially effective to improve their QOL.

Strengths and limitations of this study

This is one of the very few studies that investigated associations of quality of life with psychosocial factors in patients with lung cancer in China.

The present study provide empirical evidence for the importance of psychooncology services from the perspective of quality of life, which are seriously neglected in Chinese general hospitals.

The sample size is relatively small and subjects are restricted to lung cancer patients of Chinese general hospitals.

A few factors related to the quality of life of patients with cancer are not investigated in this study.

INTRODUCTION

During the recent decades, health-related quality of life (QOL) has become an important outcome measure in medical oncology research and clinical practice, because it can comprehensively assess the effectiveness of an anticancer regime and the impact of cancer on a patient's physical, functional, social and emotional well-being [1]. In addition, QOL outcome is also an important prognostic indicator, which can be used to predict the survival time of a patient with cancer [2]. Examining the level and predictors of QOL in patients with cancer is therefore essential in developing more effective clinical interventions.

In China, lung cancer is the most prevalent type of cancer and the leading cause of mortality of cancer-related death [3]. Because the survival time of patients with lung cancer is very likely to be short and treatments of lung cancer are expected to be toxic and limited in efficacy, QOL is particularly important for patients with lung cancer [4]. Until now, QOL of patients with lung cancer have been extensively studied in international literature, and most studies were conducted in Western countries [4-10]. These studies have shown that QOL among the lung cancer patients was associated with gender, age, performance status, fatigue, metastasis, cough, pain, social support, depression, and anxiety [4-10].

There is convincing evidence that socio-cultural factors significantly impact QOL [11 12]. Therefore, findings reported in Western countries might not apply to patients with lung cancer living under Chinese socio-cultural settings. To date, there have been a few studies examining the QOL of Chinese patients with lung cancer [13-18]. These

studies reported a variety of factors associated with QOL of Chinese patients with lung cancer, including age, marital status, income, cancer stage, treatment regime, and cell type [13-18]. However, compared to international studies, very few of them focused on the roles of psychosocial factors on QOL.

Because of Chinese oncologists' limited knowledge and the lack of training in clinical psychiatry, psychosocial problems of their patients are not routinely screened, which results in a serious undertreatment for psychosocial problems in clinical oncology practice [19]. More fundamentally, the specific psychosocial services for cancer patients, psychooncology services, are still not available in nearly all of the Chinese general hospitals [20]. Given the important roles of psychosocial factors in cancer incidence and prognosis [21], the associations between psychosocial factors and QOL need to be further examined in Chinese patients with lung cancer, which can increase Chinese oncologists' understanding on the importance of psychosocial interventions.

In China, more than two-thirds cancer patients prefer to seek treatment from oncology departments of large general hospitals (i.e., secondary and tertiary hospitals) [22 23]. Large general hospitals may represent a good setting to examine the QOL of lung cancer patients due to its good sample representativeness. The objective of this study was to investigate the QOL of Chinese inpatients with lung cancer in large general hospitals and explore the demographic, clinical, and psychosocial characteristics associated with QOL.

METHODS

Subjects

This study was part of a large-scale collaborative project investigating the mental health, suicidal behaviors, and QOL of oncology inpatients in two large general hospitals in Tianjin, China [24]. The cross-sectional survey was conducted between February and December 2015, and its details have been published elsewhere [24]. Briefly, we consecutively recruited adult inpatients who were hospitalized in the two hospitals at the time of the survey, diagnosed with cancer (ascertained by histological examination), and had the capacity to provide informed consent, to join in the study. Patients who were too ill, had cognitive disorders (i.e., dementia), or had difficulties in communicating with others, were excluded. Altogether, 735 eligible cancer inpatients were invited and 517 completed the survey. Among the completers, 148 were patients with lung cancer.

Assessments

Demographic and clinical data were collected with a form designed for the present study following a careful review of medical records and an interview with patients and their treating oncologists (when necessary). Demographic variables included gender, age, education, marital status, and self-rated economic status (poor, fair, good). Clinical factors included cancer stage (metastatic vs. not metastatic) [25], cell type (small vs. non-small cell), pain intensity, time since the diagnosis of cancer, functional status, and current treatment regime (chemotherapy, radiotherapy, surgery). A validated four-point Verbal Rating Scale was used to assess the pain

intensity: patients were asked to rate their pain intensity in the last month choosing from the four category responses (1=none, 2=mild, 3=moderate, and 4=severe) [26]. The Eastern Cooperative Oncology Group (ECOG) Performance Status Scale was adopted to assess the impact of cancer on patients' daily living abilities, which is rated on a scale from 0 (fully active) to 5 (dead), with higher score denoting poorer function [27].

Psychosocial factors, including depression, anxiety, and social support, were collected by a self-administered questionnaire. The validated Chinese version of the Hospital Anxiety and Depression Scale (HADS) was used to assess the presence and severity of depressive and anxiety symptoms of patients [28 29]. This 14-item scale consists of two subscales: seven items for depression and the remaining seven for anxiety. Each item is rated on a 0-3 scale, yielding a total score ranging between from 0 to 21 for each subscale. Higher scores denote more severe symptoms of depression or anxiety [28 29]. Social support was assessed with the validated Chinese Social Support Rating Scale (SSRS), which was developed by Xiao et al. [30]. This 10-item scale evaluates three dimensions of social support: objective support (actual received practical support and available social networks), subjective support (emotional and perceived support), and utilization of support (one's use of social network). A higher total score in each subscale indicate a higher level of social support.

QOL was assessed with the validated Chinese World Health Organization QOL Scale Brief Version (WHOQOL-BREF) [31-33]. To reduce the survey burden on patients, only items of the physical and psychological domains of WHOQOL-BREF were used in

the present study. The two subscales used seven and six items to assess the physical and psychological QOL in the past month, respectively. Each item is rated on a 5-point Likert scale ranging between 1 (''very dissatisfied/very poor'') and 5 (''very satisfied/very good''). The two QOL domains are scaled in a positive direction with higher scores indicating a better QOL.

Statistical analysis

Data analyses were conducted with SPSS 16.0. By using the recommended formulas [33], the raw scores of physical and psychological QOL domains were transformed to a 0-100 scale before the analysis. The comparisons of QOL between patients and the normative data of Chinese general population [34] were performed using the independent-samples t-test. Multivariable linear regression analysis that entered all demographic, clinical, and psychosocial factors as independent variables and physical or psychological QOL as the dependent variable, was conducted to examine the independent relationships of QOL with all variables. The statistical significance level was set at $P<0.05$ (two-sided).

RESULTS

The average age of the 148 inpatients with lung cancer was 64.8 years (standard deviation [SD]: 11.5, range: 20-99), and 94 (63.5%) were men. Table 1 displays the demographic, clinical, and psychosocial characteristics of the participants.

Scores of physical and psychological domains of QOL were significantly lower in patients with lung cancer than the normative data of the Chinese general population

(Table 2).

Multiple linear regression analyses (Table 3) revealed that marital status of "unmarried", poor economic status, metastatic cancer, a high Eastern Cooperative Oncology Group (ECOG) performance status score, more depressive symptoms, more anxiety symptoms, and a low score of utilization of social support were independently associated with poor physical QOL, while female gender, less education years, currently receiving chemotherapy, small-cell type of lung cancer, more intense pain, a high ECOG performance status score, more anxiety symptoms, and a low score of subjective social support were independently associated with poor psychological QOL.

DISCUSSION

Although significant advances in cancer treatment have been achieved in recent decades, the survival of patients with lung cancer remains limited. Therefore quality of life should be prioritized over quantity of life in cancer treatment practice. In the present study, patients with lung cancer had significantly poorer QOL in both physical and psychological domains than the Chinese general population, which is in line with findings of prior studies conducted in Western and Chinese contexts [35-38]. Many symptoms of lung cancer such as cough, chest pain, loss of appetite, and shortness of breath could negatively impact the physical health of patients [4]. Psychological distress after cancer diagnosis, fear of death, depression, hopelessness, and even suicidality further worsen the mental health of patients who are experiencing the

physical pain of cancer [24]. In addition, side effects caused by cancer treatment can exacerbate the health of patients [39]. Therefore, we found a markedly impaired physical and psychological QOL in patients with cancer compared to the general population.

This study found a number of demographic and clinical correlates of QOL in lung cancer patients. Female patients with lung cancer had worse psychological QOL, which may be related to gender difference in the prevalence of risk factors associated with poor QOL, for example, females patients with cancer may have more psychological and social issues than males [40 41]. The study by Montazeri, et al. reported significantly association between a low socioeconomic status and poor QOL in lung cancer patients in Iran [42]. Similarly, we found the significant association of poor QOL with less education years and poor economic status in Chinese patients with lung cancer. Consistent with previous findings [13 41], we found that unmarried patients had poorer physical QOL than married patients.

As expected, metastasis was negatively associated with physical QOL. Due to a worse global health status, impaired physical functioning, and more physical symptoms associated with metastatic cancer, patients with metastatic lung cancer reported poorer QOL. Because of the rapid progression of small-cell cancer, most patients with small-cell lung cancer have been at terminal stage when their cancer is diagnosed [13 43], which could explain the significant relationship between small-cell type and poor psychological QOL in our study. Cheng and colleagues found that QOL of lung cancer patients varied across different treatment regimes, with

chemotherapy having the worst QOL and surgery having the best QOL [13]. Our finding on the poor psychological QOL among patients receiving chemotherapy relative to other treatments is in accordance with it, which may be explained by the many unbearable side effects of chemotherapy and deteriorating physical health of patients receiving chemotherapy. In this study, patients who experience more intense pain had poorer psychological QOL; this might be due to the deleterious effects of pain on patients' mental health, employment status, sleep, and personal relationships [44]. Studies have shown that the ability to perform daily activities and self-care are two important determinants of QOL in patients with cancer [45 46]. Owing to functional limitations in hospitalized patients with lung cancer, the significant association between poor performance status and low physical and psychological QOL is expected.

In addition to significant contributions of demographic and clinical factors to QOL of patients with lung cancer, the significant association of QOL with psychosocial factors is also demonstrated in this study, suggesting that psychosocial factors exert an important influence on the QOL of Chinese patients with lung cancer. This finding is in keeping with our expectations. According to the theory of QOL satisfaction model [47], unmet social needs reduce QOL of patients even if they are receiving treatment in hospitals. Empirical evidence shows that social support can act as a buffer against the negative consequences of stress, protects against physical and mental morbidities, and promotes mental adjustment to chronic medical conditions, including cancer [48 49]. For patients with lung cancer, being diagnosed with

cancer and treated for cancer such as surgery are all very stressful, therefore social support is particularly important for the clinical management of hospitalized cancer patients. As a result of this, it is plausible to observe the poor physical QOL in patents with low use of social support and the poor psychological QOL in patients who perceived a low level of social support. At the same time, depression and anxiety were associated with poor QOL in Chinese lung cancer patients. These associations can be ascribed to the negative effects of depression and anxiety on the physical and mental health [7]. Importantly, because depressive disorders in Chinese cancer inpatients are often underrecognized and undertreated [19], untreated depression (and other mental health problems) may have a more profound effect on the health of patients.

There are some limitations in our study. First, this is a cross-sectional survey, so the causality of relationships between QOL and its correlates could not be ascertained. Second, some social factors related to QOL, such as stigma, were not assessed. Third, the WHOQOL-BREF is a generic QOL scale and not a lung cancer-specific instrument on QOL. Although the WHOQOL-BREF could be used for assessing QOL of any populations including cancer patients, it is not sensitive enough to capture cancer-specific domains of QOL. Fourth, due to logistical reasons, no healthy controls were recruited for the study. Comparisons were conducted with the reported normative Chinese data derived by the WHOQOL-BREF.

In summary, inpatients with lung cancer managed in large general hospitals have a poorer QOL than the general population in China. A variety of factors, in particularly

psychosocial factors, are significantly associated with QOL of Chinese patients with lung cancer. Given that psychosocial factors are preventable or modifiable, the significant associations of poor QOL with clinical and psychosocial factors suggest that in addition to conventional anticancer management, oncologists (and other medical professionals) of Chinese large general hospitals should also pay special attention to psychosocial problems of patients with lung cancer, and when necessary, refer patients for psychooncology services and psychiatric consultation.

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CONTRIBUTORS

Wen Gu and Bao-Liang Zhong were responsible for the design of the study, interpretation of data, the manuscript draft, and statistical analysis, Yan-Min Xu for the critical revision of the manuscript. All authors reviewed the data and analysis, revised the manuscript, had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis, and had authority over approval of final manuscript version and the decision to submit for publication.

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COMPETING INTERESTS

None declared.

PATIENT CONSENT

Yes.

ETHICS APPROVAL

The Ethics Committees of Wuhan Mental Health Center approved the study protocol.

The protocol including the methods was performed in accordance with the

Declaration of Helsinki and the relevant ethical guidelines and regulations in China.

Written informed consent was obtained from all participants.

Table 1 Demographic, clinical, and psychosocial characteristics of inpatients with lung cancer

Characteristics	Total sample (n=148)	
	n	%
Gender: male	94	63.5
Marital status: married	140	94.6
Self-rated economic status: poor	54	36.5
Cancer staging: metastatic	38	25.7
Current treatment regimen: chemotherapy	135	91.2
Pathological type: small cell	32	21.6
	Mean	Standard Deviation
Age (years)	64.8	11.5
Education (years)	8.1	3
Score of pain intensity	1.9	1.1
Time since cancer diagnosis (months)	24.9	18.4
ECOG Scale score of performance status	2	1
Depressive symptoms: HADS-D score	8.2	3.2
Anxiety symptoms: HADS-A score	7.8	3.2
SSRS: objective social support	7.7	1.8
SSRS: subjective social support	24.7	4
SSRS: utilization of social support	7.7	1.9

Table 2 Comparison of QOL between inpatients with lung cancer and the general population

QOL	Patients (n=148)		Normative data of the Chinese general population (n=1052) [34]		t	P
	Mean	SD	Mean	SD		
Physical	39.02	10.62	66	12.56	-25.86	<0.001
Psychological	38.85	10.28	60.55	13.96	-18.225	<0.001

Table 3 Multivariable linear regression analyses on correlates of physical and psychological QOL

Variables	Physical QOL		Psychological QOL	
	Coefficient	P	Coefficient	P
Gender: female	-0.700	0.235	-1.494	0.001
Age (years)	-0.018	0.489	-0.024	0.283
Education (years)	-0.135	0.173	-0.209	0.013
Marital status: unmarried*	-2.471	0.032	-0.456	0.652
Self-rated economic status: poor	-1.764	0.004	-0.355	0.474
Cancer staging: metastatic	-1.328	0.032	-0.835	0.106
Current treatment regimen: chemotherapy	-1.068	0.281	-1.536	0.043
Pathological type: small cell	-0.725	0.273	-1.157	0.026
Score of pain intensity	0.17	0.556	-0.535	0.015
Time since cancer diagnosis (months)	0.028	0.083	0.009	0.503
ECOG Scale score of performance status	-0.959	0.003	-0.930	<0.001
Depressive symptoms: HADS-D score	-0.465	<0.001	-0.016	0.881
Anxiety symptoms: HADS-A score	-0.208	0.048	-0.178	0.019
SSRS: objective social support	0.018	0.918	0.191	0.195
SSRS: subjective social support	0.12	0.153	0.137	<0.001
SSRS: utilization of social support	0.344	0.042	0.145	0.267

*"Unmarried" includes never married, separated, cohabitating, divorced, and widowed.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-9
Bias	9	Describe any efforts to address potential sources of bias	*7-9*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9-10
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-10
		(b) Indicate number of participants with missing data for each variable of interest	9-10
Outcome data	15*	Report numbers of outcome events or summary measures	9-10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-10
		(*b*) Report category boundaries when continuous variables were categorized	9-10
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	9-10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	10-13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	22

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Health-related quality of life in Chinese inpatients with lung cancer treated in large general hospitals: a cross-sectional study

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Abstract

Objective In China, psychosocial problems of cancer patients are underrecognized and undertreated in medical oncology practice. This study examined the quality of life (QOL) in inpatients with lung cancer treated in large general hospitals and explored the demographic, clinical, and psychosocial factors associated with QOL.

Design Cross-sectional study.

Participants and setting Altogether, 148 inpatients with lung cancer were consecutively recruited from two large general hospitals in Tianjin, China.

Main outcome measured QOL, pain intensity, depressive and anxiety symptoms, and social support were assessed with World Health Organization QOL Scale Brief Version, four-point Verbal Rating Scale, Hospital Anxiety and Depression Scale, and Social Support Rating Scale, respectively.

Results Compared with the normative data for the Chinese general population, patients had significantly lower scores in physical and psychological QOL. Being unmarried, poor economic status, metastasis, poor performance status, depression, anxiety, and low utilization of social support were independently associated with poor physical QOL, while female gender, less education years, currently receiving chemotherapy, small-cell cancer, more intense pain, poor performance status, anxiety, and inadequate subjective social support were independently associated with poor psychological QOL.

Conclusions Inpatients with lung cancer treated in Chinese large general hospitals had poorer QOL in comparison with general population. Appropriate management of

psychosocial problems is potentially effective to improve their QOL.

Strengths and limitations of this study

This is one of the very few studies that investigated associations of quality of life (QOL) with psychosocial factors in patients with lung cancer in China.

The relatively small sample size of patients and recruiting patients from inpatient departments of large general hospitals only may limit the generalizability of the findings.

The instrument for assessing QOL in this study, the World Health Organization QOL Scale Brief Version, is a generic QOL scale and not a lung cancer-specific instrument on QOL.

INTRODUCTION

During the recent decades, health-related quality of life (QOL) has become an important outcome measure in medical oncology research and clinical practice, because it can comprehensively assess the effectiveness of an anticancer regime and the impact of cancer on a patient's physical, functional, social and emotional well-being [1]. In addition, QOL outcome is also an important prognostic indicator, which can be used to predict the survival time of a patient with cancer [2]. Cancer treatment is challenging, because many physical and psychosocial problems are present at all stages of the disease but conventional treatment for cancer such as chemotherapy focuses on addressing the physical dimensions of cancer (i.e., stopping or slowing the growth of cancer cells) [3,4]. Given that QOL is a comprehensive assessment of clinical outcome, examining the level and predictors of QOL in patients with cancer is therefore essential in developing measures to improve quality of care and treatment outcomes.

In China, lung cancer is the most prevalent type of cancer and the leading cause of mortality of cancer-related death [5]. Because the survival time of patients with lung cancer is very likely to be short and treatments of lung cancer are expected to be toxic and limited in efficacy, QOL is particularly important for patients with lung cancer [6]. Until now, QOL of patients with lung cancer have been extensively studied in international literature, and most studies were conducted in Western countries [6-12]. These studies have shown that QOL among the lung cancer patients was associated with gender, age, performance status, fatigue, metastasis, cough, pain, social support,

depression, and anxiety [6-12].

There is convincing evidence that socio-cultural factors significantly impact QOL [13, 14]. Therefore, findings reported in Western countries might not apply to patients with lung cancer living under Chinese socio-cultural settings. To date, there have been a few studies examining the QOL of Chinese patients with lung cancer [15-20]. These studies reported a variety of factors associated with QOL of Chinese patients with lung cancer, including age, marital status, income, cancer stage, treatment regime, and cell type [15-20]. However, compared to international studies, very few of them focused on the roles of psychosocial factors on QOL: only one reported the significant association between social support and the global QOL in patients with newly diagnosed lung cancer [20].

Because of Chinese oncologists' limited knowledge and the lack of training in clinical psychiatry, psychosocial problems of their patients are not routinely screened, which results in a serious underrecognition/undertreatment for psychosocial problems in clinical oncology practice [21]. More fundamentally, the specific psychosocial services for cancer patients, psychooncology services, are still not available in nearly all of the Chinese general hospitals [22]. Given the important roles of psychosocial factors in cancer incidence and prognosis [23], the associations between psychosocial factors and QOL need to be further examined in Chinese patients with lung cancer, which can increase Chinese oncologists' understanding on the importance of psychosocial interventions.

In China, more than two-thirds cancer patients prefer to seek treatment from

oncology departments of large general hospitals (i.e., secondary and tertiary hospitals) [24, 25]. Large general hospitals may represent a good setting to examine the QOL of lung cancer patients due to its good sample representativeness. The objective of this study was to investigate the QOL of Chinese inpatients with lung cancer in large general hospitals and explore the demographic, clinical, and psychosocial characteristics associated with QOL.

METHODS

Subjects

This study was part of a large-scale collaborative project investigating the mental health, suicidal behaviors, and QOL of oncology inpatients in two large general hospitals in Tianjin, China [26]. The cross-sectional survey was conducted between February and December 2015, and its details have been published elsewhere [26]. Briefly, we consecutively recruited adult inpatients who were hospitalized in the two hospitals at the time of the survey, diagnosed with cancer (ascertained by histological examination), and had the capacity to provide informed consent, to join in the study. Patients who were too ill, had cognitive disorders (i.e., dementia), or had difficulties in communicating with others, were excluded.

Assessments

Demographic and clinical data were collected with a form designed for the present study, followed by a careful review of medical records and an interview with patients and their treating oncologists (when necessary).

Demographic variables included gender, age, education, marital status, and self-rated economic status (poor, fair, good).

Clinical factors included cancer stage (metastatic vs. not metastatic) [27], cell type (small vs. non-small cell), pain intensity, time since the diagnosis of cancer, functional status, and current treatment regime (chemotherapy, radiotherapy, surgery). A validated four-point Verbal Rating Scale was used to assess the pain intensity: patients were asked to rate their pain intensity in the last month choosing from the four category responses (1=none, 2=mild, 3=moderate, and 4=severe) [28]. The Eastern Cooperative Oncology Group (ECOG) Performance Status Scale was adopted to assess the impact of cancer on patients' daily living abilities, which is rated on a scale from 0 (fully active) to 5 (dead), with higher score denoting poorer function [29].

Psychosocial factors, including depression, anxiety, and social support, were collected by a self-administered questionnaire. The validated Chinese version of the Hospital Anxiety and Depression Scale (HADS) was used to assess the presence and severity of depressive and anxiety symptoms of patients [30, 31]. This 14-item scale consists of two subscales: seven items for depression and the remaining seven for anxiety. Each item is rated on a 0-3 scale, yielding a total score ranging between from 0 to 21 for each subscale. Higher scores denote more severe symptoms of depression or anxiety [30, 31]. Social support was assessed with the validated Chinese Social Support Rating Scale (SSRS), which was developed by Xiao et al. [32]. This 10-item scale evaluates three dimensions of social support: objective support (actual received practical support and available social networks), subjective support (emotional and

perceived support), and utilization of support (one's use of social network). A higher total score in each subscale indicate a higher level of social support.

QOL was assessed with the validated Chinese World Health Organization QOL Scale Brief Version (WHOQOL-BREF) [33-35]. To reduce the survey burden on patients, only items of the physical and psychological domains of WHOQOL-BREF were used in the present study. The two subscales used seven and six items to assess the physical and psychological QOL in the past month, respectively. Each item is rated on a 5-point Likert scale ranging between 1 (''very dissatisfied/very poor'') and 5 (''very satisfied/very good''). The two QOL domains are scaled in a positive direction with higher scores indicating a better QOL.

Statistical analysis

Data analyses were conducted with SPSS 16.0. By using the recommended formulas [35], the raw scores of physical and psychological QOL domains were transformed to a 0-100 scale before the analysis. We used the independent-samples t-test to compare QOL between patients and the normative data, which is derived from a representative sample (N=1052) of Chinese general adult population [36]. Multivariable linear regression analysis that entered all demographic, clinical, and psychosocial factors as independent variables and physical or psychological QOL as the dependent variable, was conducted to examine the independent relationships of QOL with all variables. The statistical significance level was set at $P<0.05$ (two-sided).

RESULTS

Altogether, 735 eligible cancer inpatients were invited and 517 completed the survey. For lung cancer, the numbers of patients who were invited and completed the survey were 179 and 148, respectively. The average age of the 148 inpatients with lung cancer was 64.8 years (standard deviation [SD]: 11.5, range: 20-99), and 94 (63.5%) were men. Table 1 displays the demographic, clinical, and psychosocial characteristics of the participants.

Scores of physical and psychological domains of QOL were significantly lower in patients with lung cancer than the normative data of the Chinese general population (Table 2).

Multiple linear regression analyses (Table 3) revealed that marital status of "unmarried", poor economic status, metastatic cancer, a high Eastern Cooperative Oncology Group (ECOG) performance status score, more depressive symptoms, more anxiety symptoms, and a low score of utilization of social support were independently associated with poor physical QOL, while female gender, less education years, currently receiving chemotherapy, small-cell type of lung cancer, more intense pain, a high ECOG performance status score, more anxiety symptoms, and a low score of subjective social support were independently associated with poor psychological QOL.

DISCUSSION

Although significant advances in cancer treatment have been achieved in recent decades, the survival of patients with lung cancer remains limited. Therefore

improving the QOL of patients with limited life expectancy should be a primary concern in lung cancer treatment practice. In the present study, patients with lung cancer had significantly poorer QOL in both physical and psychological domains than the Chinese general population, which is in line with findings of prior studies conducted in Western and Chinese contexts [37-40]. Many symptoms of lung cancer such as cough, chest pain, loss of appetite, and shortness of breath could negatively impact the physical health of patients [6]. Psychological distress after cancer diagnosis, fear of death, depression, hopelessness, and even suicidality further worsen the mental health of patients who are experiencing the physical pain of cancer [26]. In addition, side effects caused by cancer treatment can exacerbate the health of patients [41]. Therefore, we found a markedly impaired physical and psychological QOL in patients with cancer compared to the general population.

This study found a number of demographic and clinical correlates of QOL in lung cancer patients. Female patients with lung cancer had worse psychological QOL, which may be related to gender difference in the prevalence of risk factors associated with poor QOL, for example, females patients with cancer may have more psychological and social issues than males [42, 43]. The study by Montazeri, et al. reported significantly association between a low socioeconomic status and poor QOL in lung cancer patients in Iran [44]. Similarly, we found the significant association of poor QOL with less education years and poor economic status in Chinese patients with lung cancer. Consistent with previous findings [15, 43], we found that unmarried patients had poorer physical QOL than married patients.

As expected, metastasis was negatively associated with physical QOL. Due to a worse global health status, impaired physical functioning, and more physical symptoms associated with metastatic cancer, patients with metastatic lung cancer reported poorer QOL. Because of the rapid progression of small-cell cancer, most patients with small-cell lung cancer have been at terminal stage when their cancer is diagnosed [15, 45], which could explain the significant relationship between small-cell type and poor psychological QOL in our study. Cheng and colleagues found that QOL of lung cancer patients varied across different treatment regimes, with chemotherapy having the worst QOL and surgery having the best QOL [15]. Our finding on the poor psychological QOL among patients receiving chemotherapy relative to other treatments is in accordance with it, which may be explained by the many unbearable side effects of chemotherapy and deteriorating physical health of patients receiving chemotherapy. In this study, patients who experience more intense pain had poorer psychological QOL; this might be due to the deleterious effects of pain on patients' mental health, employment status, sleep, and personal relationships [46]. Studies have shown that the ability to perform daily activities and self-care are two important determinants of QOL in patients with cancer [47, 48]. Owing to functional limitations in hospitalized patients with lung cancer, the significant association between poor performance status and low physical and psychological QOL is expected.

In addition to significant contributions of demographic and clinical factors to QOL of patients with lung cancer, the significant association of QOL with psychosocial

factors is also demonstrated in this study, suggesting that psychosocial factors exert an important influence on the QOL of Chinese patients with lung cancer. This finding is in keeping with our expectations. According to the theory of QOL satisfaction model [49], unmet social needs reduce QOL of patients even if they are receiving treatment in hospitals. Empirical evidence shows that social support can act as a buffer against the negative consequences of stress, protects against physical and mental morbidities, and promotes mental adjustment to chronic medical conditions, including cancer [50, 51]. For patients with lung cancer, being diagnosed with cancer and treated for cancer such as surgery are all very stressful, therefore social support is particularly important for the clinical management of hospitalized cancer patients. As a result of this, it is plausible to observe the poor physical QOL in patents with low use of social support and the poor psychological QOL in patients who perceived a low level of social support. At the same time, depression and anxiety were associated with poor QOL in Chinese lung cancer patients. These associations can be ascribed to the negative effects of depression and anxiety on the physical and mental health [9]. Importantly, because depressive disorders in Chinese cancer inpatients are often underrecognized and undertreated [21], untreated depression (and other mental health problems) may have a more profound effect on the health of patients.

There are some limitations in our study. First, this is a cross-sectional survey, so the causality of relationships between QOL and its correlates could not be ascertained. Second, some social factors related to QOL, such as stigma, were not assessed. Third,

the WHOQOL-BREF is a generic QOL scale and not a lung cancer-specific instrument on QOL. Although the WHOQOL-BREF could be used for assessing QOL of any populations including cancer patients, it is not sensitive enough to capture cancer-specific domains of QOL. Fourth, due to logistical reasons, no healthy controls were recruited for the study. Comparisons were conducted with the reported normative Chinese data derived by the WHOQOL-BREF. Fifth, the sample size of our study (N=148) is relatively small, because we studied a total of 16 candidate predictors of QOL and the required minimum number of subjects should be 160, according to the "10 subjects per predictor" rule of thumb for minimum sample size for multiple linear regression [52]. The lack of statistical power might limit the ability of multiple linear regression model to identify more significant predictors of QOL. Further, due to the small number of patients who were unmarried patients (N=8) and not receiving chemotherapy (N=13), our findings on the relationships between QOL and marital status and treatment regimen might not be reliable. Large-scale studies are warranted to confirm these relationships. Finally, we recruited patients with lung cancer from inpatient departments of large general hospitals only, outpatients of general hospitals and primary care patients were not included, potentially influencing the representativeness of the sample of patients with lung cancer. We need to be cautious in generalizing findings of the present study to all patients with lung cancer.

In summary, inpatients with lung cancer managed in large general hospitals have a poorer QOL than the general population in China. A variety of factors, in particularly

psychosocial factors, are significantly associated with QOL of Chinese patients with lung cancer. Given that psychosocial factors are preventable or modifiable, the significant associations of poor QOL with clinical and psychosocial factors suggest that in addition to conventional anticancer management, oncologists (and other medical professionals) of Chinese large general hospitals should also pay special attention to psychosocial problems of patients with lung cancer, and when necessary, refer patients for psychooncology services and psychiatric consultation.

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CONTRIBUTORS

Wen Gu and Bao-Liang Zhong were responsible for the design of the study, interpretation of data, the manuscript draft, and statistical analysis, Yan-Min Xu for the critical revision of the manuscript. All authors reviewed the data and analysis, revised the manuscript, had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis, and had authority over approval of final manuscript version and the decision to submit for publication.

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COMPETING INTERESTS

None declared.

PATIENT CONSENT

Yes.

ETHICS APPROVAL

The Ethics Committee of Wuhan Mental Health Center approved the study protocol.

The protocol including the methods was performed in accordance with the

Declaration of Helsinki and the relevant ethical guidelines and regulations in China.

Written informed consent was obtained from all participants.

DATA SHARING STATEMENT

The data sets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Table 1 Demographic, clinical, and psychosocial characteristics of inpatients with lung cancer*

Characteristics	Total sample (n=148)	
	n	%
Gender: male	94	63.5
female	54	36.5
Marital status: married	140	94.6
never married	1	0.7
separated/divorced	5	3.4
widowed	2	1.4
Self-rated economic status: poor	54	36.5
fair	81	54.7
good	13	8.8
Cancer staging: metastatic	38	25.7
not metastatic	110	74.3
Current treatment regimen: chemotherapy	135	91.2
radiotherapy	8	5.4
surgery	5	3.4
Pathological type: small cell	32	21.6
non-small cell	116	78.4
	Mean	Standard Deviation
Age (years)	64.8	11.5

Education (years)	8.1	3.0
Score of pain intensity	1.9	1.1
Time since cancer diagnosis (months)	24.9	18.4
ECOG Scale score of performance status	2.0	1.0
Depressive symptoms: HADS-D score	8.2	3.2
Anxiety symptoms: HADS-A score	7.8	3.2
SSRS: objective social support score	7.7	1.8
SSRS: subjective social support score	24.7	4.0
SSRS: utilization of social support score	7.7	1.9

* ECOG, Eastern Cooperative Oncology Group. HADS, Hospital Anxiety and Depression Scale. SSRS, Social Support Rating Scale. Demographic factors included gender, age, education, marital status, and self-rated economic status. Clinical factors included cancer stage, pathological type, pain intensity, time since the diagnosis of cancer, ECOG scale, and current treatment regime. Psychosocial factors included HADS-D, HADS-A, and SSRS. In this study, the ECOG scale score ranged between 0 and 4: 1=Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g., light house work, office work; 2=Ambulatory and capable of all self-care but unable to carry out any work activities; up and about more than 50% of waking hours; 3=Capable of only limited self-care; confined to bed or chair more than 50% of waking hours; 4=Completely disabled; cannot carry on any self-care; totally confined to bed or chair.

Table 2 Comparison of QOL between inpatients with lung cancer and the general population

QOL	Patients (n=148)		Normative data of the Chinese general population (n=1052) [36]		t	P
	Mean	SD	Mean	SD		
Physical	39.02	10.62	66	12.56	-25.86	<0.001
Psychological	38.85	10.28	60.55	13.96	-18.225	<0.001

Table 3 Multivariable linear regression analyses on correlates of physical and psychological QOL

Variables	Physical QOL		Psychological QOL	
	Coefficient	P	Coefficient	P
Gender: female	-0.700	0.235	-1.494	0.001
Age (years)	-0.018	0.489	-0.024	0.283
Education (years)	-0.135	0.173	-0.209	0.013
Marital status: unmarried*	-2.471	0.032	-0.456	0.652
Self-rated economic status: poor	-1.764	0.004	-0.355	0.474
Cancer staging: metastatic	-1.328	0.032	-0.835	0.106
Current treatment regimen: chemotherapy	-1.068	0.281	-1.536	0.043
Pathological type: small cell	-0.725	0.273	-1.157	0.026
Score of pain intensity	0.170	0.556	-0.535	0.015
Time since cancer diagnosis (months)	0.028	0.083	0.009	0.503
ECOG Scale score of performance status	-0.959	0.003	-0.930	<0.001
Depressive symptoms: HADS-D score	-0.465	<0.001	-0.016	0.881
Anxiety symptoms: HADS-A score	-0.208	0.048	-0.178	0.019
SSRS: objective social support	0.018	0.918	0.191	0.195
SSRS: subjective social support	0.120	0.153	0.137	<0.001
SSRS: utilization of social support	0.344	0.042	0.145	0.267

*"Unmarried" included never married, separated/divorced, and widowed.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-9
Bias	9	Describe any efforts to address potential sources of bias	*7-9*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9-10
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-10
		(b) Indicate number of participants with missing data for each variable of interest	9-10
Outcome data	15*	Report numbers of outcome events or summary measures	9-10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-10
		(*b*) Report category boundaries when continuous variables were categorized	9-10
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	9-10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	10-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Health-related quality of life in Chinese inpatients with lung cancer treated in large general hospitals: a cross-sectional study

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Health-related quality of life in Chinese inpatients with lung cancer treated in large general hospitals: a cross-sectional study

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Abstract

Objective In China, psychosocial problems of cancer patients are underrecognized and undertreated in medical oncology practice. This study examined the quality of life (QOL) in inpatients with lung cancer treated in large general hospitals and explored the demographic, clinical, and psychosocial factors associated with QOL.

Design Cross-sectional study.

Participants and setting Altogether, 148 inpatients with lung cancer were consecutively recruited from two large general hospitals in Tianjin, China.

Main outcome measured QOL, pain intensity, depressive and anxiety symptoms, and social support were assessed with World Health Organization QOL Scale Brief Version, four-point Verbal Rating Scale, Hospital Anxiety and Depression Scale, and Social Support Rating Scale, respectively.

Results Compared with the normative data for the Chinese general population, patients had significantly lower scores in physical and psychological QOL. Being unmarried, poor economic status, metastasis, poor performance status, depression, anxiety, and low utilization of social support were independently associated with poor physical QOL, while female gender, less education years, currently receiving chemotherapy, small-cell cancer, more intense pain, poor performance status, anxiety, and inadequate subjective social support were independently associated with poor psychological QOL.

Conclusions Inpatients with lung cancer treated in Chinese large general hospitals had poorer QOL in comparison with general population. Appropriate management of

psychosocial problems is potentially effective to improve their QOL.

Strengths and limitations of this study

This is one of the very few studies that investigated associations of quality of life (QOL) with psychosocial factors in patients with lung cancer in China.

The relatively small sample size of patients and recruiting patients from inpatient departments of large general hospitals only may limit the generalizability of the findings.

The instrument for assessing QOL in this study, the World Health Organization QOL Scale Brief Version, is a generic QOL scale and not a lung cancer-specific instrument on QOL.

INTRODUCTION

During the recent decades, health-related quality of life (QOL) has become an important outcome measure in medical oncology research and clinical practice, because it can comprehensively assess the effectiveness of an anticancer regime and the impact of cancer on a patient's physical, functional, social and emotional well-being [1]. In addition, QOL outcome is also an important prognostic indicator, which can be used to predict the survival time of a patient with cancer [2]. Cancer treatment is challenging, because many physical and psychosocial problems are present at all stages of the disease but conventional treatment for cancer such as chemotherapy focuses on addressing the physical dimensions of cancer (i.e., stopping or slowing the growth of cancer cells) [3, 4]. Given that QOL is a comprehensive assessment of clinical outcome, examining the level and predictors of QOL in patients with cancer is therefore essential in developing measures to improve quality of care and treatment outcomes.

In China, lung cancer is the most prevalent type of cancer and the leading cause of mortality of cancer-related death [5]. In 2013, population-based cancer registration data estimated that the crude incidence and mortality rates of lung cancer in China were as high as 70.1 and 36.8 per 100000 respectively, and the two rates have been stable in recent years [6, 7]. Meanwhile, due to the poor quality of care and limited medical treatment for lung cancer, the overall five-year survival rate of lung cancer remains low in China (16.1%), particularly in rural regions (11.2%) [7, 8]. Because the survival time of patients with lung cancer is very likely to be short and treatments of

lung cancer are expected to be toxic and limited in efficacy, QOL is particularly important for patients with lung cancer [9]. Until now, QOL of patients with lung cancer have been extensively studied in international literature, and most studies were conducted in Western countries [9-15]. These studies have shown that QOL among the lung cancer patients was associated with gender, age, performance status, fatigue, metastasis, cough, pain, social support, depression, and anxiety [9-15].

There is convincing evidence that socio-cultural factors significantly impact QOL [16, 17]. Therefore, findings reported in Western countries might not apply to patients with lung cancer living under Chinese socio-cultural settings. To date, there have been a few studies examining the QOL of Chinese patients with lung cancer [18-23]. These studies reported a variety of factors associated with QOL of Chinese patients with lung cancer, including age, marital status, income, cancer stage, treatment regime, and cell type [18-23]. However, compared to international studies, very few of them focused on the roles of psychosocial factors on QOL: only one reported the significant association between social support and the global QOL in patients with newly diagnosed lung cancer [23].

Because of Chinese oncologists' limited knowledge and the lack of training in clinical psychiatry, psychosocial problems of their patients are not routinely screened, which results in a serious underrecognition/undertreatment for psychosocial problems in clinical oncology practice [24]. More fundamentally, the specific psychosocial services for cancer patients, psychooncology services, are still not available in nearly all of the Chinese general hospitals [25]. Given the important roles of

psychosocial factors in cancer incidence and prognosis [26], the associations between psychosocial factors and QOL need to be further examined in Chinese patients with lung cancer, which can increase Chinese oncologists' understanding on the importance of psychosocial interventions.

In China, more than two-thirds cancer patients prefer to seek treatment from oncology departments of large general hospitals (i.e., secondary and tertiary hospitals) [27, 28]. Large general hospitals may represent a good setting to examine the QOL of lung cancer patients due to its good sample representativeness. The objective of this study was to investigate the QOL of Chinese inpatients with lung cancer in large general hospitals and explore the demographic, clinical, and psychosocial characteristics associated with QOL.

METHODS

Subjects

This study was part of a large-scale collaborative project investigating the mental health, suicidal behaviors, and QOL of oncology inpatients in two large general hospitals in Tianjin, China [29]. The cross-sectional survey was conducted between February and December 2015, and its details have been published elsewhere [29]. Briefly, adult patients who were diagnosed with lung cancer and hospitalized in the two hospitals at the time of the survey were consecutively invited to participate in the study. Eligible subjects were those who were aware of the diagnosis of lung cancer (ascertained by histological examination), aged 18 years and above, and had

the capacity to provide informed consent. We excluded patients who were too ill, had cognitive disorders (i.e., dementia), or had difficulties in communicating with others.

Assessments

Demographic and clinical data were collected with a form designed for the present study, followed by a careful review of medical records and an interview with patients and their treating oncologists (when necessary).

Demographic variables included gender, age, education, marital status, and self-rated economic status (poor, fair, good).

Clinical factors included cancer stage (metastatic vs. not metastatic) [30], cell type (small vs. non-small cell), pain intensity, time since the diagnosis of cancer, functional status, and current treatment regime (chemotherapy, radiotherapy, surgery). A validated four-point Verbal Rating Scale was used to assess the pain intensity: patients were asked to rate their pain intensity in the last month choosing from the four category responses (1=none, 2=mild, 3=moderate, and 4=severe) [31]. The Eastern Cooperative Oncology Group (ECOG) Performance Status Scale was adopted to assess the impact of cancer on patients' daily living abilities, which is rated on a scale from 0 (fully active) to 5 (dead), with higher score denoting poorer function [32].

Psychosocial factors, including depression, anxiety, and social support, were collected by a self-administered questionnaire. The validated Chinese version of the Hospital Anxiety and Depression Scale (HADS) was used to assess the presence and severity of depressive and anxiety symptoms of patients [33, 34]. This 14-item scale

consists of two subscales: seven items for depression and the remaining seven for anxiety. Each item is rated on a 0-3 scale, yielding a total score ranging between from 0 to 21 for each subscale. Higher scores denote more severe symptoms of depression or anxiety [33, 34]. Social support was assessed with the validated Chinese Social Support Rating Scale (SSRS), which was developed by Xiao et al. [35]. This 10-item scale evaluates three dimensions of social support: objective support (actual received practical support and available social networks), subjective support (emotional and perceived support), and utilization of support (one's use of social network). A higher total score in each subscale indicate a higher level of social support.

QOL was assessed with the validated Chinese World Health Organization QOL Scale Brief Version (WHOQOL-BREF) [36-38]. To reduce the survey burden on patients, only items of the physical and psychological domains of WHOQOL-BREF were used in the present study. The two subscales used seven and six items to assess the physical and psychological QOL in the past month, respectively. Each item is rated on a 5-point Likert scale ranging between 1 (''very dissatisfied/very poor'') and 5 (''very satisfied/very good''). The two QOL domains are scaled in a positive direction with higher scores indicating a better QOL.

Data were collected in places of the hospitals that were deemed convenient and could provide reasonable privacy for respondents (oncologists' office, sickroom, etc.). All patients independently and anonymously completed the questionnaires on demographic characteristics, HADS, SSRS, and WHOQOL-BREF. Trained investigators interviewed patients and their treating oncologists and reviewed medical records to

collect data on clinical factors.

Patient and public involvement

The role of patients in this study was participants. They were not involved in the development of the research question and outcome measures, the recruitment of subjects, and the undertaking of the study. After the completion of the study, we had sent each participant a letter describing resulting of the present study in detail.

Statistical analysis

Data analyses were conducted with SPSS 16.0. By using the recommended formulas [38], the raw scores of physical and psychological QOL domains were transformed to a 0-100 scale before the analysis. We used the independent-samples t-test to compare QOL between patients and the normative data, which is derived from a representative sample (N=1052) of Chinese general adult population [39].

Multivariable linear regression analysis that entered all demographic, clinical, and psychosocial factors as independent variables and physical or psychological QOL as the outcome variable, was conducted to examine the independent relationships of QOL with all variables. The assumptions of linearity, normality, homoscedasticity, and absence of multicollinearity for multiple linear regression analysis were tested prior to the formal analysis. Because there were no curvilinear relationships in scatterplots of outcome variables versus continuous independent variables, and no clear distribution patterns in scatterplots of residuals (errors between observed and predicted outcome values) versus predicted outcome values, our data met the assumptions of linearity and homoscedasticity. We also found a normal distribution

of residuals for physical QOL (K-S statistic=0.064, P=0.20) and psychological QOL (K-S statistic=0.068, P=0.10) in the Kolmogorov-Smirnov test. Variance Inflation Factor (VIF) values of all independent variables ranged from 1.13 to 5.77, markedly below the critical threshold of 10, indicating a very low degree of multicollinearity among the variables. The statistical significance level was set at P<0.05 (two-sided).

RESULTS

Altogether, 735 eligible cancer inpatients were invited and 517 completed the survey. For lung cancer, the numbers of patients who were invited and completed the survey were 179 and 148, respectively. The average age of the 148 inpatients with lung cancer was 64.8 years (standard deviation [SD]: 11.5, range: 20-99), and 94 (63.5%) were men. Table 1 displays the demographic, clinical, and psychosocial characteristics of the participants.

Scores of physical and psychological domains of QOL were significantly lower in patients with lung cancer than the normative data of the Chinese general population (Table 2).

Multiple linear regression analyses (Table 3) revealed that marital status of "unmarried", poor economic status, metastatic cancer, a high Eastern Cooperative Oncology Group (ECOG) performance status score, more depressive symptoms, more anxiety symptoms, and a low score of utilization of social support were independently associated with poor physical QOL, while female gender, less education years, currently receiving chemotherapy, small-cell type of lung cancer,

more intense pain, a high ECOG performance status score, more anxiety symptoms, and a low score of subjective social support were independently associated with poor psychological QOL.

DISCUSSION

Although significant advances in cancer treatment have been achieved in recent decades, the survival of patients with lung cancer remains limited. Therefore improving the QOL of patients with limited life expectancy should be a primary concern in lung cancer treatment practice. In the present study, patients with lung cancer had significantly poorer QOL in both physical and psychological domains than the Chinese general population, which is in line with findings of prior studies conducted in Western and Chinese contexts [40-43]. Many symptoms of lung cancer such as cough, chest pain, loss of appetite, and shortness of breath could negatively impact the physical health of patients [9]. Psychological distress after cancer diagnosis, fear of death, depression, hopelessness, and even suicidality further worsen the mental health of patients who are experiencing the physical pain of cancer [29]. In addition, side effects caused by cancer treatment can exacerbate the health of patients [44]. Therefore, we found a markedly impaired physical and psychological QOL in patients with cancer compared to the general population.

This study found a number of demographic and clinical correlates of QOL in lung cancer patients. Female patients with lung cancer had worse psychological QOL, which may be related to gender difference in the prevalence of risk factors

associated with poor QOL, for example, females patients with cancer may have more psychological and social issues than males [45, 46]. The study by Montazeri, et al. reported significantly association between a low socioeconomic status and poor QOL in lung cancer patients in Iran [47]. Similarly, we found the significant association of poor QOL with less education years and poor economic status in Chinese patients with lung cancer. Consistent with previous findings [18, 46], we found that unmarried patients had poorer physical QOL than married patients.

As expected, metastasis was negatively associated with physical QOL. Due to a worse global health status, impaired physical functioning, and more physical symptoms associated with metastatic cancer, patients with metastatic lung cancer reported poorer QOL. Because of the rapid progression of small-cell cancer, most patients with small-cell lung cancer have been at terminal stage when their cancer is diagnosed [18, 48], which could explain the significant relationship between small-cell type and poor psychological QOL in our study. Cheng and colleagues found that QOL of lung cancer patients varied across different treatment regimes, with chemotherapy having the worst QOL and surgery having the best QOL [18]. Our finding on the poor psychological QOL among patients receiving chemotherapy relative to other treatments is in accordance with it, which may be explained by the many unbearable side effects of chemotherapy and deteriorating physical health of patients receiving chemotherapy. In this study, patients who experience more intense pain had poorer psychological QOL; this might be due to the deleterious effects of pain on patients' mental health, employment status, sleep, and personal

relationships [49]. Studies have shown that the ability to perform daily activities and self-care are two important determinants of QOL in patients with cancer [50, 51]. Owing to functional limitations in hospitalized patients with lung cancer, the significant association between poor performance status and low physical and psychological QOL is expected.

In addition to significant contributions of demographic and clinical factors to QOL of patients with lung cancer, the significant association of QOL with psychosocial factors is also demonstrated in this study, suggesting that psychosocial factors exert an important influence on the QOL of Chinese patients with lung cancer. This finding is in keeping with our expectations. According to the theory of QOL satisfaction model [52], unmet social needs reduce QOL of patients even if they are receiving treatment in hospitals. Empirical evidence shows that social support can act as a buffer against the negative consequences of stress, protects against physical and mental morbidities, and promotes mental adjustment to chronic medical conditions, including cancer [53, 54]. For patients with lung cancer, being diagnosed with cancer and treated for cancer such as surgery are all very stressful, therefore social support is particularly important for the clinical management of hospitalized cancer patients. As a result of this, it is plausible to observe the poor physical QOL in patents with low use of social support and the poor psychological QOL in patients who perceived a low level of social support. At the same time, depression and anxiety were associated with poor QOL in Chinese lung cancer patients. These associations can be ascribed to the negative effects of depression and anxiety on the physical and

mental health [12]. Importantly, because depressive disorders in Chinese cancer inpatients are often underrecognized and undertreated [24], untreated depression (and other mental health problems) may have a more profound effect on the health of patients.

There are some limitations in our study. First, this is a cross-sectional survey, so the causality of relationships between QOL and its correlates could not be ascertained. Second, some social factors related to QOL, such as stigma, were not assessed. Third, the WHOQOL-BREF is a generic QOL scale and not a lung cancer-specific instrument on QOL. Although the WHOQOL-BREF could be used for assessing QOL of any populations including cancer patients, it is not sensitive enough to capture cancer-specific domains of QOL. Fourth, due to logistical reasons, no healthy controls were recruited for the study. Comparisons were conducted with the reported normative Chinese data derived by the WHOQOL-BREF. Fifth, the sample size of our study (N=148) is relatively small, because we studied a total of 16 candidate predictors of QOL and the required minimum number of subjects should be 160, according to the "10 subjects per predictor" rule of thumb for minimum sample size for multiple linear regression [55]. The lack of statistical power might limit the ability of multiple linear regression model to identify more significant predictors of QOL. Further, due to the small number of patients who were unmarried patients (N=8) and not receiving chemotherapy (N=13), our findings on the relationships between QOL and marital status and treatment regimen might not be reliable. Large-scale studies are warranted to confirm these relationships. Finally, we recruited patients with lung

cancer from inpatient departments of large general hospitals only, outpatients of general hospitals and primary care patients were not included, potentially influencing the representativeness of the sample of patients with lung cancer. We need to be cautious in generalizing findings of the present study to all patients with lung cancer.

In summary, inpatients with lung cancer managed in large general hospitals have a poorer QOL than the general population in China. A variety of factors, in particularly psychosocial factors, are significantly associated with QOL of Chinese patients with lung cancer. Given that psychosocial factors are preventable or modifiable, the significant associations of poor QOL with clinical and psychosocial factors suggest that in addition to conventional anticancer management, oncologists (and other medical professionals) of Chinese large general hospitals should also pay special attention to psychosocial problems of patients with lung cancer, and when necessary, refer patients for psychooncology services and psychiatric consultation.

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CONTRIBUTORS

Wen Gu and Bao-Liang Zhong were responsible for the design of the study, interpretation of data, the manuscript draft, and statistical analysis, Yan-Min Xu for the critical revision of the manuscript. All authors reviewed the data and analysis, revised the manuscript, had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis, and had authority over approval of final manuscript version and the decision to submit for publication.

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COMPETING INTERESTS

None declared.

PATIENT CONSENT

Yes.

ETHICS APPROVAL

The Ethics Committee of Wuhan Mental Health Center approved the study protocol.

The protocol including the methods was performed in accordance with the

Declaration of Helsinki and the relevant ethical guidelines and regulations in China.

Written informed consent was obtained from all participants.

DATA SHARING STATEMENT

The data sets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Table 1 Demographic, clinical, and psychosocial characteristics of inpatients with lung cancer*

Characteristics	Total sample (n=148)	
	n	%
Gender: male	94	63.5
female	54	36.5
Marital status: married	140	94.6
never married	1	0.7
separated/divorced	5	3.4
widowed	2	1.4
Self-rated economic status: poor	54	36.5
fair	81	54.7
good	13	8.8
Cancer staging: metastatic	38	25.7
not metastatic	110	74.3
Current treatment regimen: chemotherapy	135	91.2
radiotherapy	8	5.4
surgery	5	3.4
Pathological type: small cell	32	21.6
non-small cell	116	78.4
	Mean	Standard Deviation
Age (years)	64.8	11.5

Education (years)	8.1	3.0
Score of pain intensity	1.9	1.1
Time since cancer diagnosis (months)	24.9	18.4
ECOG Scale score of performance status	2.0	1.0
Depressive symptoms: HADS-D score	8.2	3.2
Anxiety symptoms: HADS-A score	7.8	3.2
SSRS: objective social support score	7.7	1.8
SSRS: subjective social support score	24.7	4.0
SSRS: utilization of social support score	7.7	1.9

* ECOG, Eastern Cooperative Oncology Group. HADS, Hospital Anxiety and Depression Scale. SSRS, Social Support Rating Scale. Demographic factors included gender, age, education, marital status, and self-rated economic status. Clinical factors included cancer stage, pathological type, pain intensity, time since the diagnosis of cancer, ECOG scale, and current treatment regime. Psychosocial factors included HADS-D, HADS-A, and SSRS. In this study, the ECOG scale score ranged between 0 and 4: 1=Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g., light house work, office work; 2=Ambulatory and capable of all self-care but unable to carry out any work activities; up and about more than 50% of waking hours; 3=Capable of only limited self-care; confined to bed or chair more than 50% of waking hours; 4=Completely disabled; cannot carry on any self-care; totally confined to bed or chair.

Table 2 Comparison of QOL between inpatients with lung cancer and the general population

QOL	Patients (n=148)		Normative data of the Chinese general population (n=1052) [39]		t	P
	Mean	SD	Mean	SD		
Physical	39.02	10.62	66	12.56	-25.86	<0.001
Psychological	38.85	10.28	60.55	13.96	-18.225	<0.001

Table 3 Multivariable linear regression analyses on correlates of physical and psychological QOL

Variables	Physical QOL			Psychological QOL		
	Unstandardized coefficient	P	95% Confidence interval for unstandardized coefficient	Unstandardized coefficient	P	95% Confidence interval for unstandardized coefficient
Gender: female	-0.700	0.235	-1.010, 2.500	-1.494	0.001	0.649, 2.339
Age (years)	-0.018	0.489	-1.238, 1.202	-0.024	0.283	-0.106, 0.058
Education (years)	-0.135	0.173	-0.357, 0.087	-0.209	0.013	-0.294, -0.123
Marital status: unmarried*	-2.471	0.032	-4.908, -0.034	-0.456	0.652	-2.644, 1.732
Self-rated economic status: poor	-1.764	0.004	-2.964, -0.564	-0.355	0.474	-10.920, 10.210
Cancer staging: metastatic	-1.328	0.032	-2.632, -0.024	-0.835	0.106	-2.047, 0.377
Current treatment regimen: chemotherapy	-1.068	0.281	-4.577, 2.441	-1.536	0.043	-3.051, -0.021

Pathological type: small cell	-0.725	0.273	-2.979, 1.529	-1.157	0.026	-2.223, -0.091
Score of pain intensity	0.170	0.556	-2.097, 2.437	-0.535	0.015	-0.919, -0.151
Time since cancer diagnosis (months)	0.028	0.083	-0.030, 0.086	0.009	0.503	-2.238, 2.256
ECOG Scale score of performance status	-0.959	0.003	-1.542, -0.376	-0.930	<0.001	-1.383, -0.477
Depressive symptoms: HADS-D score	-0.465	<0.001	-0.631, -0.299	-0.016	0.881	-0.087, 0.055
Anxiety symptoms: HADS-A score	-0.208	0.048	-0.354, -0.062	-0.178	0.019	-0.248, -0.108
SSRS: objective social support	0.018	0.918	-0.055, 0.091	0.191	0.195	-0.146, 0.528
SSRS: subjective social support	0.120	0.153	-0.012, 0.252	0.137	<0.001	0.121, 0.153
SSRS: utilization of social support	0.344	0.042	0.111, 0.577	0.145	0.267	-0.214, 0.504

*"Unmarried" included never married, separated/divorced, and widowed.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-9
Bias	9	Describe any efforts to address potential sources of bias	*7-9*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9-10
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-10
		(b) Indicate number of participants with missing data for each variable of interest	9-10
Outcome data	15*	Report numbers of outcome events or summary measures	9-10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-10
		(*b*) Report category boundaries when continuous variables were categorized	9-10
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	9-10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	10-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Health-related quality of life in Chinese inpatients with lung cancer treated in large general hospitals: a cross-sectional study

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Health-related quality of life in Chinese inpatients with lung cancer treated in large general hospitals: a cross-sectional study

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Abstract

Objective In China, psychosocial problems of cancer patients are underrecognized and undertreated in medical oncology practice. This study examined the health-related quality of life (QOL) in inpatients with lung cancer treated in large general hospitals and explored the demographic, clinical, and psychosocial factors associated with QOL.

Design Cross-sectional study.

Participants and setting Altogether, 148 inpatients with lung cancer were consecutively recruited from two large general hospitals in Tianjin, China.

Main outcome measured QOL, pain intensity, depressive and anxiety symptoms, and social support were assessed with World Health Organization QOL Scale Brief Version, four-point Verbal Rating Scale, Hospital Anxiety and Depression Scale, and Social Support Rating Scale, respectively.

Results Compared with the normative data for the Chinese general population, patients had significantly lower scores in physical (t=-25.860, P<0.001) and psychological (t=-18.225, P<0.001) QOL. Being unmarried (β=-2.471, 95%CI: -4.908, -0.034), poor economic status (β=-1.764, 95%CI: -2.964, -0.564), cancer metastasis (β=-1.328, 95%CI: -2.632, -0.024), poor performance status (β=-0.959, 95%CI: -1.542, -0.376), depression (β=-0.465, 95%CI: -0.631, -0.299), anxiety (β=-0.208, 95%CI: -0.354, -0.062), and low utilization of social support (β=-0.344, 95%CI: -0.577, -0.111) were independently associated with poor physical QOL, while female gender (β=-1.494, 95%CI: -0.649, -2.339), less education years (β=-0.209, 95%CI: -0.294,

-0.123), currently receiving chemotherapy (β=-1.536, 95%CI: -3.051, -0.021), small-cell cancer (β=-1.157, 95%CI: -2.223, -0.091), more intense pain (β=-0.535, 95%CI: -0.919, -0.151), poor performance status (β=-0.930, 95%CI: -1.383, -0.477), anxiety (β=-0.178, 95%CI: -0.248, -0.108), and inadequate subjective social support (β=-0.137, 95%CI: -0.153,-0.121) were independently associated with poor psychological QOL.

Conclusions Inpatients with lung cancer treated in Chinese large general hospitals have poorer QOL than the general population. Effective prevention and management of psychosocial problems are potentially effective to improve their QOL.

Strengths and limitations of this study

- This study assessed psychosocial factors that were potentially associated with quality of life (QOL) of patients with lung cancer in China.

- The relatively small sample size of patients and recruiting patients from inpatient departments of large general hospitals only may limit the generalizability of the findings.

- The direction of causality between psychosocial factors and QOL could not be ascertained due to the cross-sectional design of this study.

- This study assessed QOL of lung cancer patients with a generic QOL scale, not a lung cancer-specific measure.

- Age- and sex-matched healthy controls were not included for comparison.

INTRODUCTION

During the recent decades, health-related quality of life (QOL) has become an important outcome measure in medical oncology research and clinical practice, because it can comprehensively assess the effectiveness of an anticancer regime and the impact of cancer on a patient's physical, functional, social and emotional well-being [1]. In addition, the QOL outcome is also an important prognostic indicator, which can be used to predict the survival time of a patient with cancer [2]. Cancer treatment is challenging, because many physical and psychosocial problems are present at all stages of the disease but conventional treatment for cancer such as chemotherapy focuses on addressing the physical dimensions of cancer (i.e., stopping or slowing the growth of cancer cells) [3, 4]. Given that QOL is a comprehensive assessment of clinical outcome, examining the level and predictors of QOL in patients with cancer is essential in developing measures to improve quality of care and treatment outcomes.

In China, lung cancer is the most prevalent type of cancer and the leading cause of mortality of cancer-related death [5]. In 2013, population-based cancer registration data estimated that the crude incidence and mortality rates of lung cancer in China were as high as 70.1 and 36.8 per 100000 respectively, and the two rates have been stable in recent years [6, 7]. Meanwhile, due to the poor quality of care and limited medical treatment for lung cancer, the overall five-year survival rate of lung cancer remains low in China (16.1%), particularly in rural regions (11.2%) [7, 8]. Because the survival time of patients with lung cancer is very likely to be short and treatments of

lung cancer are expected to be toxic and limited in efficacy, QOL is particularly important for patients with lung cancer [9]. Until now, QOL of patients with lung cancer have been extensively studied in international literature, and most studies were conducted in Western countries [9-15]. These studies have shown that QOL among the lung cancer patients was associated with gender, age, performance status, fatigue, metastasis, cough, pain, social support, depression, and anxiety [9-15].

There is convincing evidence that socio-cultural factors significantly impact QOL [16, 17]. Therefore, findings reported in Western countries might not apply to patients with lung cancer living under Chinese socio-cultural settings. To date, there have been a few studies examining the QOL of Chinese patients with lung cancer [18-23]. These studies reported a variety of factors associated with QOL of Chinese patients with lung cancer, including age, marital status, income, cancer stage, treatment regime, and cell type [18-23]. However, compared to international studies, very few of them focused on the roles of psychosocial factors on QOL: only one reported the significant association between social support and the global QOL in patients with newly diagnosed lung cancer [23].

Because of Chinese oncologists' limited knowledge and the lack of training in clinical psychiatry, patients' psychosocial problems are not routinely screened for by oncology providers, resulting in a serious underrecognition/undertreatment for psychosocial problems in clinical oncology practice [24]. More fundamentally, the specific psychosocial services for cancer patients, psychooncology services, are still not available in nearly all of the Chinese general hospitals [25]. Given the important

roles of psychosocial factors in cancer incidence and prognosis [26], the associations between psychosocial factors and QOL need to be further examined in Chinese patients with lung cancer, which can increase Chinese oncologists' understanding on the importance of psychosocial interventions.

In China, more than two-thirds cancer patients prefer to seek treatment from oncology departments of large general hospitals (i.e., secondary and tertiary hospitals) [27, 28]. Large general hospitals may provide a good setting to examine the QOL of lung cancer patients due to their representative samples. The objective of this study was to investigate the QOL of Chinese inpatients with lung cancer in large general hospitals and explore the demographic, clinical, and psychosocial characteristics associated with QOL.

METHODS

Subjects

This study was part of a large-scale collaborative project investigating the mental health, suicidal behaviors, and QOL of oncology inpatients in two large general hospitals in Tianjin, China [29]. The cross-sectional survey was conducted between February and December 2015, and its details have been published elsewhere [29]. Briefly, adult patients who were diagnosed with lung cancer and hospitalized in the two hospitals at the time of the survey were consecutively invited to participate in the study. Eligible subjects were those who were aware of the diagnosis of lung cancer (ascertained by histological examination), aged 18 years and above, and had

the capacity to provide informed consent. We excluded patients who were too ill, had cognitive disorders (i.e., dementia), or had difficulties in communicating with others.

Assessments

Demographic and clinical data were collected with a form designed for the present study, followed by a careful review of medical records and an interview with patients and their treating oncologists (when necessary).

Demographic variables included gender, age, education, marital status, and self-rated economic status (poor, fair, good).

Clinical factors included cancer stage (metastatic vs. not metastatic) [30], cell type (small vs. non-small cell), pain intensity, time since the diagnosis of cancer, functional status, and current treatment regime (chemotherapy, radiotherapy, surgery). A validated four-point Verbal Rating Scale was used to assess the pain intensity: patients were asked to rate their pain intensity in the last month choosing from the four category responses (1=none, 2=mild, 3=moderate, and 4=severe) [31]. The Eastern Cooperative Oncology Group (ECOG) Performance Status Scale was adopted to assess the impact of cancer on patients' daily living abilities, which is rated on a scale from 0 (fully active) to 5 (dead), with higher score denoting poorer function [32].

Psychosocial factors, including depression, anxiety, and social support, were collected by a self-administered questionnaire. The validated Chinese version of the Hospital Anxiety and Depression Scale (HADS) was used to assess the presence and severity of depressive and anxiety symptoms of patients [33, 34]. This 14-item scale

consists of two subscales: seven items for depression and the remaining seven for anxiety. Each item is rated on a 0-3 scale, yielding a total score ranging between from 0 to 21 for each subscale. Higher scores denote more severe symptoms of depression or anxiety [33, 34]. Social support was assessed with the validated Chinese Social Support Rating Scale (SSRS), which was developed by Xiao, et al. [35]. This 10-item scale evaluates three dimensions of social support: objective support (actual received practical support and available social networks), subjective support (emotional and perceived support), and utilization of support (one's use of social network). A higher total score in each subscale indicate a higher level of social support.

QOL was assessed with the validated Chinese World Health Organization QOL Scale Brief Version (WHOQOL-BREF) [36-38]. To reduce the survey burden on patients, only items of the physical and psychological domains of WHOQOL-BREF were used in the present study. The two subscales use seven and six items to assess the physical and psychological QOL in the past month, respectively. Each item is rated on a 5-point Likert scale ranging between 1 (''very dissatisfied/very poor'') and 5 (''very satisfied/very good''). The two QOL domains are scaled in a positive direction with higher scores indicating a better QOL.

Data were collected in places of the hospitals that were deemed convenient and could provide reasonable privacy for respondents (oncologists' office, sickroom, etc.). All patients independently and anonymously completed the questionnaires on demographic characteristics, HADS, SSRS, and WHOQOL-BREF. Trained investigators interviewed patients and their treating oncologists and reviewed medical records to

collect data on clinical factors.

Patient and public involvement

The role of patients in this study was participants. They were not involved in the development of the research question and outcome measures, the recruitment of subjects, and the undertaking of the study. After the completion of the study, we had sent each participant a letter describing resulting of the present study in detail.

Statistical analysis

Data analyses were conducted with SPSS 16.0. By using the recommended formulas [38], the raw scores of physical and psychological QOL domains were transformed to a 0-100 scale before the analysis. We used the independent-samples t-test to compare QOL between patients and the normative data, which is derived from a representative sample (N=1052) of Chinese general adult population [39].

Multivariable linear regression analysis that entered all demographic, clinical, and psychosocial factors as independent variables and physical or psychological QOL as the outcome variable, was conducted to examine the independent relationships of QOL with all variables. The assumptions of linearity, normality, homoscedasticity, and absence of multicollinearity for multiple linear regression analysis were tested prior to the formal analysis. Because there were no curvilinear relationships in scatterplots of outcome variables versus continuous independent variables, and no clear distribution patterns in scatterplots of residuals (errors between observed and predicted outcome values) versus predicted outcome values, our data met the assumptions of linearity and homoscedasticity. We found a normal distribution of

residuals for physical (K-S statistic=0.064, P=0.20) and psychological QOL (K-S statistic=0.068, P=0.10) in the Kolmogorov-Smirnov test. We also found a very low degree of multicollinearity among independent variables, because Variance Inflation Factor (VIF) values of all independent variables ranged from 1.13 to 5.77, markedly below the critical threshold of 10. The statistical significance level was set at P<0.05 (two-sided).

RESULTS

Altogether, 735 eligible cancer inpatients were invited and 517 completed the survey. For lung cancer, the numbers of patients who were invited and completed the survey were 179 and 148, respectively. The average age of the 148 inpatients with lung cancer was 64.8 years (standard deviation [SD]: 11.5, range: 20-99), and 94 (63.5%) were men. Table 1 displays the demographic, clinical, and psychosocial characteristics of the participants.

Scores of physical (t=-25.860, P<0.001) and psychological (t=-18.225, P<0.001) domains of QOL were significantly lower in patients with lung cancer than the normative data of the Chinese general population (Table 2).

Multiple linear regression analyses (Table 3) revealed that marital status of "unmarried" (Unstandardized coefficient [β]=-2.471, 95%CI: -4.908, -0.034), poor economic status (β=-1.764, 95%CI: -2.964, -0.564), metastatic cancer (β=-1.328, 95%CI: -2.632, -0.024), a high Eastern Cooperative Oncology Group (ECOG) performance status score (β=-0.959, 95%CI: -1.542, -0.376), more depressive

symptoms (β=-0.465, 95%CI: -0.631, -0.299), more anxiety symptoms (β=-0.208, 95%CI: -0.354, -0.062), and a low score of utilization of social support (β=-0.344, 95%CI: -0.577, -0.111) were independently associated with poor physical QOL, while female gender (β=-1.494, 95%CI: -0.649, -2.339), less education years (β=-0.209, 95%CI: -0.294, -0.123), currently receiving chemotherapy (β=-1.536, 95%CI: -3.051, -0.021), small-cell type of lung cancer (β=-1.157, 95%CI: -2.223, -0.091), more intense pain (β=-0.535, 95%CI: -0.919, -0.151), a high ECOG performance status score (β=-0.930, 95%CI: -1.383, -0.477), more anxiety symptoms (β=-0.178, 95%CI: -0.248, -0.108), and a low score of subjective social support (β=-0.137, 95%CI: -0.153,-0.121) were independently associated with poor psychological QOL.

DISCUSSION

Although significant advances in cancer treatment have been achieved in recent decades, the survival of patients with lung cancer remains limited. Therefore improving the QOL of patients with limited life expectancy should be a primary priority in lung cancer treatment practice. In the present study, patients with lung cancer had significantly poorer QOL in both physical and psychological domains than the Chinese general population, which is in line with findings of prior studies conducted in Western and Chinese contexts [40-43]. Many symptoms of lung cancer such as cough, chest pain, loss of appetite, and shortness of breath could negatively impact the physical health of patients [9]. Psychological distress after cancer diagnosis, fear of death, depression, hopelessness, and even suicidality further worsen the

mental health of patients who are experiencing the physical pain of cancer [29]. In addition, side effects caused by cancer treatment can exacerbate the health of patients [44]. Therefore, we found a markedly impaired physical and psychological QOL in patients with cancer compared to the general population.

This study found a number of demographic and clinical correlates of QOL in lung cancer patients. Female patients with lung cancer had worse psychological QOL, which may be related to gender difference in the prevalence of risk factors associated with poor QOL, for example, females patients with cancer may have more psychological and social issues than males [45, 46]. The study by Montazeri, et al. reported significantly association between a low socioeconomic status and poor QOL in lung cancer patients in Iran [47]. Similarly, we found the significant association of poor QOL with less education years and poor economic status in Chinese patients with lung cancer. Consistent with previous findings [18, 46], we found that unmarried patients had poorer physical QOL than married patients.

As expected, metastasis was negatively associated with physical QOL. Due to a worse global health status, impaired physical functioning, and more physical symptoms associated with metastatic cancer, patients with metastatic lung cancer reported poorer QOL. Because of the rapid progression of small-cell cancer, most patients with small-cell lung cancer have been at terminal stage when their cancer is diagnosed [18, 48], which could explain the significant relationship between small-cell type and poor psychological QOL in our study. Cheng and colleagues found that QOL of lung cancer patients varied across different treatment regimes, with

chemotherapy having the worst QOL and surgery having the best QOL [18]. Our finding on the poor psychological QOL among patients receiving chemotherapy relative to other treatments is in accordance with it, which may be explained by the many unbearable side effects of chemotherapy and deteriorating physical health of patients receiving chemotherapy. In this study, patients who experience more intense pain had poorer psychological QOL; this might be due to the deleterious effects of pain on patients' mental health, employment status, sleep, and personal relationships [49]. Studies have shown that the ability to perform daily activities and self-care are two important determinants of QOL in patients with cancer [50, 51]. Owing to functional limitations in hospitalized patients with lung cancer, the significant association between poor performance status and low physical and psychological QOL is expected.

In addition to significant contributions of demographic and clinical factors to QOL of patients with lung cancer, the significant association of QOL with psychosocial factors is also demonstrated in this study, suggesting that psychosocial factors exert an important influence on the QOL of Chinese patients with lung cancer. This finding is in keeping with our expectations. According to the theory of QOL satisfaction model [52], unmet social needs reduce QOL of patients even if they are receiving treatment in hospitals. Empirical evidence shows that social support can act as a buffer against the negative consequences of stress, protects against physical and mental morbidities, and promotes mental adjustment to chronic medical conditions, including cancer [53, 54]. For patients with lung cancer, being diagnosed with

cancer and treated for cancer such as surgery are all very stressful, therefore social support is particularly important for the clinical management of hospitalized cancer patients. As a result of this, it is plausible to observe the poor physical QOL in patients with low use of social support and the poor psychological QOL in patients who perceived a low level of social support. At the same time, depression and anxiety were associated with poor QOL in Chinese lung cancer patients. These associations can be ascribed to the negative effects of depression and anxiety on the physical and mental health [12]. Importantly, because depressive disorders in Chinese cancer inpatients are often underrecognized and undertreated [24], untreated depression (and other mental health problems) may have a more profound effect on the health of patients.

There are some limitations in our study. First, this is a cross-sectional survey, so the causality of relationships between QOL and its correlates could not be ascertained. Second, some social factors related to QOL, such as stigma, were not assessed. Third, the WHOQOL-BREF is a generic QOL scale and not a lung cancer-specific instrument on QOL. Although the WHOQOL-BREF could be used for assessing QOL of any populations including cancer patients, it is not sensitive enough to capture cancer-specific domains of QOL. Fourth, due to logistical reasons, no age- and gender-matched healthy controls were recruited for the study. Comparisons were conducted with the reported normative Chinese data derived by the WHOQOL-BREF. Fifth, the sample size of our study (N=148) is relatively small, because we studied a total of 16 candidate predictors of QOL and the required minimum number of

subjects should be 160, according to the "10 subjects per predictor" rule of thumb for minimum sample size for multiple linear regression [55]. The lack of statistical power might limit the ability of multiple linear regression model to identify more significant predictors of QOL. Further, due to the small number of patients who were unmarried patients (N=8) and not receiving chemotherapy (N=13), our findings on the relationships between QOL and marital status and treatment regimen might not be reliable. Large-scale studies are warranted to confirm these relationships. Finally, we recruited patients with lung cancer from inpatient departments of large general hospitals only, outpatients of general hospitals and primary care patients were not included, potentially influencing the representativeness of the sample of patients with lung cancer. We need to be cautious in generalizing findings of the present study to all patients with lung cancer.

In summary, inpatients with lung cancer managed in large general hospitals have a poorer QOL than the general population in China. A variety of factors, in particularly psychosocial factors, are significantly associated with QOL of Chinese patients with lung cancer. Given that psychosocial factors are preventable or modifiable, the significant associations of poor QOL with clinical and psychosocial factors suggest that in addition to conventional anticancer management, oncologists (and other medical professionals) of Chinese large general hospitals should also pay special attention to psychosocial problems of patients with lung cancer, and when necessary, refer patients for psychooncology services and psychiatric consultation.

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CONTRIBUTORS

Wen Gu and Bao-Liang Zhong were responsible for the design of the study, interpretation of data, the manuscript draft, and statistical analysis, Yan-Min Xu for the critical revision of the manuscript. All authors reviewed the data and analysis, revised the manuscript, had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis, and had authority over approval of final manuscript version and the decision to submit for publication.

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COMPETING INTERESTS

None declared.

PATIENT CONSENT

Yes.

ETHICS APPROVAL

The Ethics Committee of Wuhan Mental Health Center approved the study protocol.

The protocol including the methods was performed in accordance with the

Declaration of Helsinki and the relevant ethical guidelines and regulations in China.

Written informed consent was obtained from all participants.

DATA SHARING STATEMENT

The data sets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Table 1 Demographic, clinical, and psychosocial characteristics of inpatients with lung cancer*

Characteristics	Total sample (n=148)	
	n	%
Gender: male	94	63.5
female	54	36.5
Marital status: married	140	94.6
never married	1	0.7
separated/divorced	5	3.4
widowed	2	1.4
Self-rated economic status: poor	54	36.5
fair	81	54.7
good	13	8.8
Cancer staging: metastatic	38	25.7
not metastatic	110	74.3
Current treatment regimen: chemotherapy	135	91.2
radiotherapy	8	5.4
surgery	5	3.4
Pathological type: small cell	32	21.6
non-small cell	116	78.4
	Mean	Standard Deviation
Age (years)	64.8	11.5

Education (years)	8.1	3.0
Score of pain intensity	1.9	1.1
Time since cancer diagnosis (months)	24.9	18.4
ECOG Scale score of performance status	2.0	1.0
Depressive symptoms: HADS-D score	8.2	3.2
Anxiety symptoms: HADS-A score	7.8	3.2
SSRS: objective social support score	7.7	1.8
SSRS: subjective social support score	24.7	4.0
SSRS: utilization of social support score	7.7	1.9

* ECOG, Eastern Cooperative Oncology Group. HADS, Hospital Anxiety and Depression Scale. SSRS, Social Support Rating Scale. Demographic factors included gender, age, education, marital status, and self-rated economic status. Clinical factors included cancer stage, pathological type, pain intensity, time since the diagnosis of cancer, ECOG scale, and current treatment regime. Psychosocial factors included HADS-D, HADS-A, and SSRS. In this study, the ECOG scale score ranged between 0 and 4: 1=Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g., light house work, office work; 2=Ambulatory and capable of all self-care but unable to carry out any work activities; up and about more than 50% of waking hours; 3=Capable of only limited self-care; confined to bed or chair more than 50% of waking hours; 4=Completely disabled; cannot carry on any self-care; totally confined to bed or chair.

Table 2 Comparison of QOL between inpatients with lung cancer and the general population

QOL	Patients (n=148)		Normative data of the Chinese general population (n=1052) [39]		t	P
	Mean	SD	Mean	SD		
Physical	39.02	10.62	66.00	12.56	-25.860	<0.001
Psychological	38.85	10.28	60.55	13.96	-18.225	<0.001

Table 3 Multivariable linear regression analyses on correlates of physical and psychological QOL

Variables	Physical QOL			Psychological QOL		
	Unstandardized coefficient	P	95% Confidence interval for unstandardized coefficient	Unstandardized coefficient	P	95% Confidence interval for unstandardized coefficient
Gender: female	-0.700	0.235	-1.010, 2.500	-1.494	0.001	-0.649, -2.339
Age (years)	-0.018	0.489	-1.238, 1.202	-0.024	0.283	-0.106, 0.058
Education (years)	-0.135	0.173	-0.357, 0.087	-0.209	0.013	-0.294, -0.123
Marital status: unmarried*	-2.471	0.032	-4.908, -0.034	-0.456	0.652	-2.644, 1.732
Self-rated economic status: poor	-1.764	0.004	-2.964, -0.564	-0.355	0.474	-10.920, 10.210
Cancer staging: metastatic	-1.328	0.032	-2.632, -0.024	-0.835	0.106	-2.047, 0.377
Current treatment regimen: chemotherapy	-1.068	0.281	-4.577, 2.441	-1.536	0.043	-3.051, -0.021

Pathological type: small cell	-0.725	0.273	-2.979, 1.529	-1.157	0.026	-2.223, -0.091
Score of pain intensity	0.170	0.556	-2.097, 2.437	-0.535	0.015	-0.919, -0.151
Time since cancer diagnosis (months)	0.028	0.083	-0.030, 0.086	0.009	0.503	-2.238, 2.256
ECOG Scale score of performance status	-0.959	0.003	-1.542, -0.376	-0.930	<0.001	-1.383, -0.477
Depressive symptoms: HADS-D score	-0.465	<0.001	-0.631, -0.299	-0.016	0.881	-0.087, 0.055
Anxiety symptoms: HADS-A score	-0.208	0.048	-0.354, -0.062	-0.178	0.019	-0.248, -0.108
SSRS: objective social support	0.018	0.918	-0.055, 0.091	0.191	0.195	-0.146, 0.528
SSRS: subjective social support	0.120	0.153	-0.012, 0.252	0.137	<0.001	0.121, 0.153
SSRS: utilization of social support	0.344	0.042	0.111, 0.577	0.145	0.267	-0.214, 0.504

*"Unmarried" included never married, separated/divorced, and widowed.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-9
Bias	9	Describe any efforts to address potential sources of bias	*7-9*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9-10
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-10
		(b) Indicate number of participants with missing data for each variable of interest	9-10
Outcome data	15*	Report numbers of outcome events or summary measures	9-10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-10
		(*b*) Report category boundaries when continuous variables were categorized	9-10
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	9-10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	10-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.