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Exploring psychological distress among lung cancer patients through the stress system model

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Lung cancer, a leading cause of cancer-related mortality globally, often leads to anxiety, fear and other psychological distress due to its poor prognosis, treatment challenges, and financial burden. Prolonged distress may progress to depression or other mental health disorders, adversely affecting patients' quality of life and treatment outcomes. This study examines the prevalence and determinants of psychological distress in lung cancer patients, offering a theoretical basis for timely clinical interventions. This cross-sectional study applied the stress system model to analyze 435 conveniently sampled lung cancer patients in three Chinese tertiary hospitals from September 2023 to February 2024. Data were collected using the Distress Thermometer (DT), Medical Coping Modes Questionnaire (MCMQ), Brief Illness Perception Questionnaire (BIPQ), Edmonton Symptom Assessment Scale (ESAS), Perceived Social Support Scale (PSSS), and Type D Personality Scale (DS14). Statistical analysis, conducted with SPSS 25.0, utilized univariate, correlation, and binary logistic regression analyses to systematically explore the interrelationships and influence mechanisms of these factors on psychological distress from a holistic stress system model perspective. Among 435 lung cancer patients, 52.87% experienced psychological distress (DT = 4.24 ± 2.356). Significant risk factors ($P < 0.05$) included age, occupational status, family monthly income, payment method, avoidance coping style, symptoms and type D personality. As the detection rate of psychological distress in lung cancer patients is high, clinical staff should dynamically observe the psychological changes of lung cancer patients, do a good job in screening and stratified management of psychological distress, and provide interpersonal psychological guidance to establish a positive mindset, so as to reduce the negative emotions of patients, and to improve the quality of life of patients' health-related issues.

Keywords Lung cancer, Psychological distress, Cancer coping styles, Personality, Influencing factor

Background

Lung cancer (LC) primarily originates from the bronchial mucous epithelium[1] and ranks second globally in terms of new cases, while being the leading cause of cancer deaths worldwide[2]. Diagnosis of lung cancer is often challenging due to the absence of early signs and symptoms, resulting in over three-quarters of patients being diagnosed at an advanced stage[3]. The 5-year survival rate of patients with advanced lung cancer is low, coupled with the difficulty of treatment and poor prognosis, patients will produce negative emotions such as anxiety and fear. Additionally, prolonged treatment duration and high costs impose significant psychological and economic burdens, exacerbating patients' pain and distress[4,5]. Psychological Distress (PD) was proposed by the National Comprehensive Cancer Network (NCCN) to describe the psychosocial problems experienced by cancer patients, and it is defined as an unpleasant emotional experience caused by multiple factors. "These emotional experiences are psychological (cognitive, behavioral, and emotional), social, and spiritual in nature, and can significantly interfere with a patient's ability to cope with cancer, somatic symptoms, and treatment, and negatively affect the outcome of treatment[6]." Nishiura et al.[7] reported that the prevalence of psychological problems in lung cancer patients reaches as high as 60%, which is significantly higher than in patients with other cancer types. Failure to address psychological distress promptly may lead to its chronic, escalating into conditions like depression, anxiety, and other mental illnesses[8]. This significantly impacts patients' quality of life, treatment outcomes, and may even precipitate premature treatment cessation.

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Current studies have demonstrated that lung cancer patients under the age of 60 experience significantly elevated levels of psychological distress, attributed to career disruption, loss of family roles, and the financial toxicity associated with treatment[9]. Severe impairment in pulmonary function (FEV1 < 50%) can directly precipitate anxiety symptoms by disrupting hypothalamic-pituitary-adrenal (HPA) axis function through chronic hypoxia[10]. Among patients undergoing prolonged treatment (> 6months), a notable positive correlation exists between iatrogenic stress and treatment fatigue scores. Additionally, the influence of socio-psychological variables on psychological distress in lung cancer patients cannot be underestimated[11]. Family support levels are significantly correlated with patients' psychological adjustment, with evidence indicating that patients lacking emotional support face a heightened risk of depression[12]. Low-income patients exhibit a higher prevalence of anxiety symptoms due to the financial strain of treatment compared to more economically advantaged groups[13]. Cultural factors, such as stigma, can also contribute to social avoidance behaviors in patients through the mechanism of "family-associated stigma"[14]. Despite the growing body of research on factors influencing psychological distress in lung cancer patients, current studies have notable limitations. Most studies have concentrated on isolated factors, neglecting the systematic exploration of interactive effects among multiple factors. Moreover, research designs often lack a theoretical foundation, leading to fragmented selection and analysis of contributing factors.

This study indicatively applies the Stress System Model, which was proposed by domestic scholar Jiang Qianjin[15] based on Lazarus and Folk man's fractional theory of stress and coping. The model reveals a bidirectional mechanism among dimensions, involving both the collaborative operation of internal resources (such as personality and individual characteristics, cognitive evaluation, coping styles) and external resources (social support), as well as the causal cycle between various resources and stress responses. For this study, when an individual encounters a major stressor like cancer, personality and individual characteristics act as the initial trigger, quickly prompting the individual's cognitive evaluation of the stressor and illness perception, thus influencing the choice of coping styles. At this time, social support, as an important source of external resources, interacts with the individual's coping styles by providing emotional comfort and information support, jointly regulating the degree and direction of stress responses. Psychological distress, as a direct result of psychological stress responses, is also affected by multiple factors including individual characteristics, social support, and coping styles. When a significant imbalance occurs in any part of this dynamic equilibrium, such as overly negative illness perception, insufficient social support, or inappropriate coping styles, it may lead to the aggravation of psychological distress. As the core hub of stress management, nurses dynamically assess patients' disease cognitive bias and social support gaps through standard tools to establish stress profiles; implement cognitive restructuring and positive thinking training and other interventions to regulate physical and mental stress in both directions; and coordinate family and community resources to build a three-dimensional support network of "patient-family-healthcare team" to achieve system imitation.

Despite the progress made in current interventions for psychological distress among cancer patients, such as the demonstrated efficacy of coeducational and supportive therapies in alleviating symptoms of anxiety and depression[16]there are notable gaps in existing interventions regarding their ability to address the unique needs of lung cancer patients as a specific group, accurately align with these needs, and provide personalized support. In light of this, guided by the stress system model as a theoretical framework, the present study comprehensively explores the multi-factorial influences on psychological distress in lung cancer patients, with the aim of providing a foundation for the future development of more precise and efficient risk stratification assessment tools. Such endeavors will enable healthcare professionals to identify high-risk patients at an earlier stage and with greater accuracy, facilitating targeted primary interventions or optimized referral pathways based on stratified risk profiles. This approach is anticipated to substantially enhance the role effectiveness and intervention outcomes of healthcare professionals in the comprehensive management of psychological distress, ultimately contributing to improved overall quality of care for affected patients.

Methods

Study and sample

The convenience sampling method was employed to select 435 lung cancer patients hospitalized in three tertiary hospitals in China from September 2023 to February 2024 for a cross-sectional study. The sample size was determined to be 5 to 10 times the number of variables according to the Kendall sample estimation method[17]. The general information of this study was 14 items, 6 scales involved a total of 14 dimensions and a total of 28 variables. Considering the 20% loss rate, the sample size was 168–336 cases. Inclusion criteria encompassed patients diagnosed with lung cancer meeting the diagnostic criteria of the Primary Lung Cancer Diagnostic and Treatment Guidelines(2022 Edition)[18]aged 18 or older, providing voluntary informed consent, and possessing sufficient cognitive capability. Exclusion criteria included comorbidity serious diseases or other malignancies, a history of psychosis or psychiatric disorders, and current use of antidepressants or antibiotics.

Data collection

This study employed a convenience sampling approach between September 2023 and February 2024. Participants were recruited from thoracic surgery wards at three tertiary hospitals in China. The recruitment procedure followed a standardized protocol: Uniformly trained research staff provided consistent instructions using predetermined scripts; Hospitalized patients were screened against predefined inclusion/exclusion criteria; During enrollment, study objectives were explained while deliberately avoiding the term "cancer" to prevent psychological distress. Written informed consent was obtained; Paper-based questionnaires were distributed with standardized completion guidance; Immediate quality control was implemented during collection, verifying completeness and conducting on-site corrections for missing/erroneous entries. The final cohort comprised 435 participants with 100% valid questionnaire retrieval rate.

Instruments

General demographic and disease information questionnaire

A comprehensive literature review informed the design of a 15-item general information questionnaire for lung cancer patients, further refined through expert consultation and per-surveys. The items cover demographic details such as gender, age, and occupational status, among others.

Distress Thermometer (DT)

Developed by Roth in 1998[19], the DT is a self-assessment tool measuring patients' psychological distress over the past week. Chinese scholar Tang Lili et al.[20] translated into Chinese version, a single item scale with a total of 11 scales ranging from 0 to 10 (0 being no distress, 10 being extreme distress, gradually increasing) was used to judge the actual level of psychological distress of the tested patients by DT score. A DT score ≥ 4 indicates significant psychological distress, following the National Comprehensive Cancer Network (NC-CN) recommendation. Similarly, in most studies, the critical value of DT in the determination of psychological distress level of cancer patients is also 4 points[21,22]. The Cronbach's alpha coefficient for this scale was 0.80[23].

Medical Coping Modes Questionnaire (MCMQ)

Developed by Professor Feifel[24]the MCMQ aims to explore the psychological and behavioral aspects associated with patients' adoption of primary coping strategies during disease treatment. Shen Xiaohong et al.[25] translated the scale into Chinese and formed the Chinese version of the MCMQ. There are 20 items in the scale, and the three dimensions are confronce (1, 2, 5, 10, 12, 15, 16, 19), avoidance (3, 7, 8, 9, 11, 14, 17) and resignation (4, 6, 13, 18, 20). The 4-level scoring method was used, and according to the strength and weakness of each coping event, scores of 1 to 4 were calculated from low to high, with the total score ranging from 20 to 80 points. The scores were standardized and divided into high scores (more than 1 standard deviation) and low scores (less than 1 standard deviation), with higher scores indicating that the response method was adopted. At present, the scale is widely used in medical research with good reliability and validity[26]. The Cronbach's alpha coefficient for each dimension was 0.943, 0.918, 0.940; The KMO value was 0.981, and the approximate chi-square value of Bartlett spherical test was 8471.326 ($P < 0.001$), indicating good reliability and validity.

Brief Illness Perception Questionnaire (BIPQ)

Developed by Broadbent[27]the BIPQ was used to assess the patient's self-perception of the disease. There were 8 items in 3 dimensions, namely cognitive representation (1, 2, 3, 4, 5), emotional representation (6, 8), and disease understanding ability (7). Each item was scored from 0 to 10 points, in which the reverse scoring items were 3, 4 and 7, and the total score was from 0 to 80 points. The higher the score, the more negative perception and the greater the harm to the body. Low burden (0–3 points), medium burden (4–6 points) and high burden (7–10 points) should be considered when analyzing a specific dimension of perceived burden. In 2015, Chinese scholars introduced the Chinese version of BIPQ, which was applied to patients with chronic diseases, showing good reliability and validity[28]. The Cronbach's alpha coefficient of this scale in this study was 0.950; The KMO value was 0.945, and the approximate chi-square value of Bartlett spherical test was 3654.428 ($P < 0.001$), indicating good reliability and validity.

Edmonton Symptom Assessment System (ESAS)

Developed by Bruera[29]the ESAS assesses the physical symptoms of patients with cancer or in hospice care. The scale consisted of 10 items and two dimensions, namely physical symptoms (1, 2, 3, 6, 7, 8, 9, 10) and psychological symptoms (4, 5). The 0–10 points linear module pseudo-scoring method was used to score. Patients selected the closest option according to their subjective feelings, and added the scores of each item to obtain a higher score. Scores were classified as mild (1–3 points), moderate (4–6 points), and severe (7–10 points). Domestic scholars have shown that the scale has good reliability and validity in the application of cancer patients[30]. The Cronbach's alpha coefficient of this scale in this study was 0.917; The KMO value was 0.908, and the approximate chi-square value of Bartlett spherical test was 3248.648 ($P < 0.001$), indicating good reliability and validity.

Perceived Social Support Scale (PSSS)

Developed by Zimet in 1987[31] and the Chinese version was translated and revised by Jiang Qianjin[32]. The scale contains 12 items in three dimensions: family support(3.4.8.11), friend support(6.7.9.12), and other support(1.2.5.10). It is used to assess the level of support from family, friends, and other people. The scale is a 7-point Likert scale that calculates the sum of each item, with a minimum of 12 points and a maximum of 84 points. The scores were divided into low support (12–36 points), medium support (37–60 points), and high support (61–84 points). The scale has shown good reliability and validity in other studies[33]. The Cronbach's alpha coefficient of this scale in this study was 0.971; The KMO value was 0.960, and the approximate chi-square value of Bartlett spherical test was 6209.069 ($P < 0.001$), indicating good reliability and validity.

Type D Personality Scale (DS-14)

The scale was developed by Denollet[34]and the Chinese version was revised in 2006 by Yu Xiaonan from Tilburg University, the Chinese University of Hong Kong and the Institute of Psychology of the Chinese Academy of Sciences[35]. The scale has two dimensions of Negative Affectivity (NA) and Social Inhibition (SI), which have 7 items respectively, and items 1 and 3 are reverse scoring. Likert 5-point scoring method was used (from "not at all" =0 to "completely" =4). NA ≥ 10 and SI ≥ 10 were needed to be determined as type D personality individuals. The Cronbach's alpha coefficient of this scale in this study was 0.913; The KMO value was 0.963, and the approximate chi-square value of Bartlett spherical test was 6517.828 ($P < 0.001$), indicating good reliability and validity.

Data analysis

The questionnaires were collected, and data were double-entered and checked using Excel, then analyzed using SPSS 25.0. General demographic data, clinical characteristics, and DT scale scores were statistically described. The count data were expressed as frequency and percentage. Pearson correlation analysis was used to analyze the correlation between the DT scale scores and the three dimensions of MCMQ, BIPQ, ESAS, PSSS and DS-14 scales. The $\chi 2$ test and Fisher exact probability method were used to clarify the effects of demographic characteristics and various factors of disease information with significant psychological distress. Binary logistic regression analysis was performed with the classification of psychological distress in lung cancer patients as the dependent variable, and variables with statistically significant results from correlation analysis and univariate analysis as independent variables, aiming to correct confounding factors and identify factors associated with psychological distress. The Wald $\chi 2$ value was used to test the significance of each independent variable in the logistic regression model, and the corresponding p value was used to judge the significance. If the p-value is less than a certain significance level, such as 0.05, the independent variable is considered to be significant in the model. Additionally, multidisciplinary of each variable should be checked. It was assessed using the Variance Inflation Factor (VIF), a value greater than 5 or 10, which is generally considered to be severely multidisciplinary[36]. If the VIF value of an independent variable is too high, the variable may need to be removed from the model.

Results

Demographic and clinical characteristics of sample

A total of 435 lung cancer patients were included in this study, providing an overview of their demographic and clinical profiles. The majority were aged above 60 years (50.6%), predominantly male (93.8%), and from rural areas (54.9%). Refer to Table 1 for details.

Psychological distress (DT) score

The DT score of lung cancer patients was 4.24 ± 2.356, ranging from 0 to 10. The incidence of psychological distress in patients with lung cancer ($DT \geq 4$) was 52.87% (230 cases). See Fig. 1.

Univariate analyses of the factors associated with PD

One-way analyses were conducted to assess the differences in DT scores across various demographic and clinical characteristics. Statistically significant differences ($P < 0.05$) in psychological distress were observed across gender, age, occupational status, education level, payment method, monthly household income, disease duration, and number of treatments. For details, see Table 1.

Correlation analysis of PD and MCMQ, BIPQ, ESAS, PSSS, DS-14 in patients with lung cancer

Pearman correlation analysis showed that the total score of DT in lung cancer patients was positively correlated with avoidance and resignation coping style, illness perception and symptom total score, and negatively correlated with confrontation coping style and social support total score. See Table 2 for details.

Binary logistic analysis of the factors associated with PD

The prevalence of clinically significant psychological distress ($DT \geq 4$) was used as the dependent variable. Eight statistically significant variables from the previous univariate analysis were entered into the binary logistic regression analysis along with the variables from the correlation analysis. The variable input method "LR method" was selected, and the performance of the final regression model was evaluated by model fitting index and coefficient interpretation. The final independent variables included age, occupational status, payment method, monthly family income, coping style, symptoms, and type D personality. See Table 3 for details.

Discussion

Psychological distress (PD), also referred to as psychological suffering, encompasses cognitive, behavioral, emotional, social, and spiritual changes, profoundly affecting a patient's ability to cope with cancer, somatic symptoms, and treatment, consequently influencing treatment outcomes[37]. This cross-sectional study pioneers the investigation into the prevalence of psychological distress among lung cancer patients, analyzing relevant influencing factors through the lens of the stress system model.

Initially, the study encompassed 435 lung cancer patients, of whom 52.87% experienced clinically significant psychological distress ($DT \geq 4$) as assessed by the DT scale. Compared to foreign studies reporting a 46% detection rate[38]domestic findings revealed a higher prevalence of psychological distress in Chinese lung cancer patients, reaching 48.3% [95% CI (40.5%, 56.1%)][39]. This disparity is attributed to the enduring concept of "turn pale at the mention of cancer" and the negative psychological impact of the cancer diagnosis and treatment process in China.

The study guided by stress systems theory, concluded that age, occupational status, monthly household income, payment method, type D personality, avoidance coping style, and symptoms were influential factors in the occurrence of psychological distress in lung cancer patients. Previous review studies[40–42] pointed out that gender, marital status, social support, and disease characteristics (e.g., disease duration, disease stage, and comorbidity) are important factors influencing the occurrence of psychological distress in lung cancer chemotherapy patients. Although theoretically significant, they did not play a role in psychological distress in lung cancer patients in this study. Possible reasons for this may not fully reflect the overall characteristics of the lung cancer chemotherapy patient population due to the concentration of sample collection in this study in a specific region. Secondly, the uneven distribution of the sample size resulted in too few samples within

Demographic variables	Categories	*N*	%	PD		Statistical value	*P*-value
				DT ≥ 4	DT<4		
Gender	Male	408	93.8	210	198	5.193[a]	0.023
	Female	27	6.2	20	7		
Ages(years)	18∼<49	25	5.7	11	14	93.387[a]	<0.001
	50∼<59	190	43.7	53	137		
	≥60	220	50.6	166	54		
Occupational status	Incumbency	299	68.7	174	125	107.392[a]	<0.001
	Retired	90	20.7	10	80		
	Not working	46	10.6	46	0		
Marital status	Married	431	99.1	226	205	1.943[b]	0.163
	Single	1	0.2	1	0		
	Widowed	0	0	0	0		
	Divorced	3	0.7	3	0		
Level of education	Below primary school	175	40.2	136	39	93.170[b]	<0.001
	Junior high school	135	31	64	71		
	Senior high school	108	24.8	26	82		
	Bachelor's degree or above	17	4	4	13		
Payment method	Fully self funded	107	24.6	88	19	66.306[a]	<0.001
	Medical insurance in rural area	160	36.8	88	72		
	Medical insurance for worker	168	38.6	54	114		
Monthly household income (CNY)	<2000	158	36.3	122	36	195.962[a]	<0.001
	2001–3999	90	20.7	80	10		
	4000–5999	153	35.2	28	125		
	≥6000	34	7.8	0	34		
Place of residence	Urban area	196	45.1	110	86	3.728[a]	0.155
	Rural area	239	54.9	120	119		
Duration of the disease(year)	<1	400	92	211	189	10.931[b]	0.004
	1<4	29	6.7	19	10		
	≥4	6	1.4	0	6		
Treatment method	Surgical	52	12	18	34	1.771[a]	0.183
	Chemotherapy	383	88	185	198		
Number of treatments	1	144	33.1	51	93	93.330[a]	<0.001
	2	75	17.2	25	50		
	3	77	17.7	35	42		
	4	67	15.4	53	14		
	≥5	72	16.6	66	6		
TNM stage	I	0	0	0	0	1.618[b]	0.445
	II	4	0.9	1	3		
	III	114	26.2	58	56		
	IV	317	72.9	171	146		
Whether metastasis occurs	Yes	254	58.4	133	121	0.064[a]	0.800
	No	181	41.6	97	84		
Number of comorbid diseases	0	284	65.3	141	143	7.520[b]	0.111
	1	72	16.6	48	24		
	2	55	12.6	28	27		
	≥3	24	5.5	13	11		

Table 1. Demographic, disease-related characteristics and univariate analysis of DT ($N = 435$). Note [a]:$\chi 2$Value [b]: Fisher exact probability method. PD, psychological distress; DT, Distress thermometer; CNY, Chinese Yuan; TNM, Tumor Node Metastasis. DT ≥ 4: significant psychological distress.

certain subgroups of characteristics, which will make it difficult to capture the weak or complex effects of these characteristics on mental health outcomes. There may also be other confounding factors that were not considered that influence patients' levels of psychological distress.

Still, the present study reveals that five personality trait variables, age, occupational status, monthly income, mode of payment, significantly influence the occurrence of psychological distress in lung cancer patients.

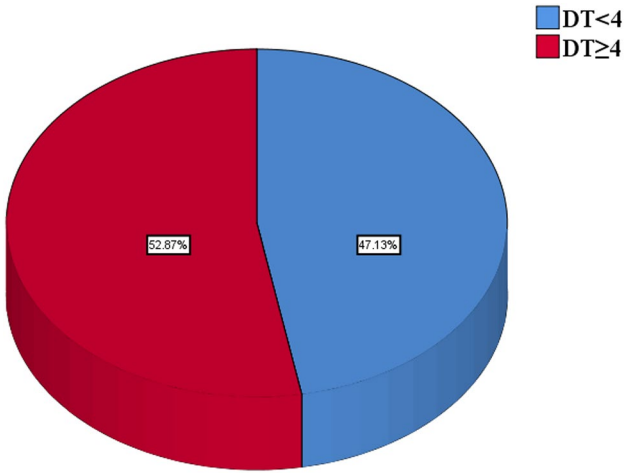

Fig. 1. Distribution map of psychological distress level in lung cancer patients ($N = 435$).

PD			MCMQ			BIPQ	ESAS	PSSS	DS-14
			C	A	*R*				
PD		1							
MCMQ	C	−0.612**	1						
	A	0.632**	−0.792**	1					
	R	0.558**	−0.825**	0.840**	1				
BIPQ		0.532**	−0.548**	0.560**	0.555**	1			
ESAS		0.543**	−0.532**	0.503**	0.483**	0.422**	1		
PSSS		−0.545**	0.512**	−0.544**	−0.507**	−0.410**	−0.490**	1	
DS-14		0.681**	−0.622**	0.659**	0.657**	0.559**	0.546**	−0.541**	1

Table 2. Correlations among MCMQ, BIPQ, ESAS, PSSS， DS-14 and PD in patients with lung cancer ($N = 435$). Abbreviations: C,Confronce; A,Avoidance; R,Resignation; PD, psychological distress; MCMQ, Medical Coping Modes Questionnaire; BIPQ, Brief Illness Perception Questionnaire; ESAS, Edmonton symptom assessment system; PSSS, Perceived social support scale; DS-14,Type D Personality Scale.**$P < 0.05$.

Model		B	VIF	SE	Waldχ2 value	*P*
Constant		−4.778		1.65	8.388	0.004[a]
Ages		1.044	1.235	0.339	9.458	0.002[a]
Occupational status	Retired	−3.081	1.075	0.561	30.213	0.000[b]
Monthly household income (CNY)	Medical insurance for worker	−0.709	2.031	0.256	7.691	0.006[a]
Payment method		−1.584	1.428	0.666	5.65	0.017[a]
MCMQ	Avoidance	0.099	1.731	0.046	4.735	0.030[a]
ESAS		0.064	1.749	0.018	12.013	0.001[b]
DS-14		2.539	2.488	0.456	30.984	0.000[b]

Table 3. Multiple regression analysis of PD and associated factors ($N = 435$). [a]$p < 0.05$. [b]$P \leq 0.01$. Abbreviations: PD, psychological distress; MCMQ, Medical Coping Modes Questionnaire; ESAS, Edmonton symptom assessment system; DS-14,Type D Personality Scale.

Particularly, advancing age correlated positively with psychological distress occurrence, aligning with prior research[43]. 50.6% of lung cancer patients over 60 years of age showed a significant level of psychological distress. The analysis found that the traditional cognition of 'cancer is death' of the elderly lung cancer patients generated strong death anxiety and despair[44]. The concept of family ethics puts elderly patients in a strong psychological conflict of 'not wanting to drag their children down', and the contradiction between family responsibility and sense of self-worth constitutes a unique source of psychological pressure[45]. The influence of long-term living habits, poor adaptability to the unfamiliar environment of the hospital leads to nervousness and anxiety. Thus

suggesting that we need to pay more attention to elderly patients. Clinical caregivers need to implement targeted health education, Sebri et al.[46]found that the psychological empowerment effect can simultaneously improve multiple sources of distress, its visual information presentation to meet the cognitive needs of elderly patients, structured communication can reduce the fear of the unknown, to meet the patient's need for information, and to improve psychological resilience. Special attention was paid to cultural adaptation, and the use of culturally adapted decision aids (DAs) reduced patients' guilt of "dragging their children down" by 37% through the inclusion of a module on negotiating family responsibilities[47].This suggests that future interventions need to deeply integrate decision support with cultural and psychological interventions. Secondly, clinical caregivers need to mobilize family members to give more respect and care to elderly patients, and provide more emotional support and companionship.

Economic level is an important influencing factor of psychological distress, which is consistent with the results of domestic and foreign studies[48,49] Household economic level is usually measured by the monthly household income index, and lower average monthly household income is associated with higher levels of psychological distress. However, patients' occupational status and medical payment methods also reflect the level of financial stress and psychological distress of cancer patients. Especially for farmers and patients who pay at their own expense, due to the lack of stable income sources and medical security, the economic burden of treatment costs is heavier, leading to a significant increase in psychological distress. In contrast, retired patients and patients paid by employee medical insurance have less financial stress and lower levels of psychological distress due to relatively stable pension and medical insurance reimbursement. The situation of being unable to work due to illness further exacerbates the financial stress, especially for farmers and patients who pay out of pocket, the double burden of income interruption and medical expenses makes their psychological distress even more significant. Therefore, it is imperative to advocate for government and social support to reduce medical costs, expand medical insurance coverage (especially for farmers and low-income groups), and relieve the financial pressure of cancer patients' families.

Coping style is an adaptive way of dealing with problems subjectively carried out by individuals[50]. Patients with lung cancer lose confidence in overcoming the disease due to factors such as disease progression, side effects and poor efficacy of treatment. In particular, patients with type D personality with high negative affect and social inhibition tend to adopt avoidance and negative coping styles, leading to continuous accumulation of negative emotions such as anxiety and depression and aggravation of psychological distress[51]. In order to improve the psychological adaptability of such patients, medical staff can guide patients to express emotions through psychological counseling or support groups, combined with cognitive behavioral therapy to reconstruct negative thinking to enhance the sense of disease control. Secondly, social support network was established to alleviate loneliness, and emotion management training such as mindfulness meditation was used to improve self-regulation ability. According to the characteristics of social inhibition in patients with type D personality, medical staff should take the initiative to create a safe environment and help them break through the psychological barrier with progressive communication. Studies have shown that[52]the integration of psychosocial support from diagnosis to terminal stage can not only reduce avoidance coping behaviors, but also significantly improve the quality of life of patients by cultivating adaptive coping mechanisms, which highlights the core value of medical humanistic care in tumor treatment.

Furthermore, symptom burden emerged as risk factors for psychological distress[53]. Most lung cancer patients have obvious somatic symptoms. cancer pain is the highest incidence of self-perceived symptoms in cancer patients, and it is also the symptom that causes the most pain to the patients[54]. Fatigue is more difficult to relieve compared to pain, and is a major influence leading to psychological distress[55]. All of these somatic symptoms can directly affect patients' quality of life and cause or aggravate related psychological problems. Given the profound impact of somatic symptoms on psychological well-being, interdisciplinary collaboration among oncologists, psychiatrists, and allied health professionals is recommended to develop tailored interventions addressing patients' holistic needs, heralding a paradigm shift towards comprehensive oncology care.

Strengths and limitations

The core strength of this study lies in the groundbreaking use of the stress system model as a theoretical support framework. This model is a highly comprehensive and dynamic theoretical framework, which goes beyond the limitations of the traditional single-factor theory and reveals the multi-dimensional and multi-level characteristics of psychological distress. It not only helps to reveal the deep mechanism of psychological distress, but also promotes the understanding of the role of individual differences in the occurrence and development of psychological distress, and provides a scientific basis for formulating more accurate and personalized intervention strategies. In addition, the application of the stress system model also highlights the dynamic and variability of psychological distress, suggesting that psychological distress is not static, but can be modulated and improved by changing certain key factors in the system. This understanding provides a new enlightenment for psychological intervention, that is, treatment should not only focus on the relief of symptoms, but should focus on the adjustment and optimization of the entire stress system, and fundamentally promote the improvement of mental health by enhancing the individual's psychological resilience, improving the social support environment, and optimizing coping strategies.

However, our study is not without limitations. Due to its cross-sectional design, it is not possible to longitudinally follow up the dynamic evolution of psychological distress over time in patients with lung cancer. Future studies should consider a longitudinal approach to fully capture temporal variation. In addition, the distress thermometer scale has good reliability and validity and has been used by many researchers[56,57]. However, it is undeniable that unidimensional measurement tools can only reflect one aspect of information and cannot fully capture shortcomings such as dependent variable complexity and multidimensionality.

This study employed convenience sampling. While this method offers practical advantages in feasibility and implementation, it inevitably resulted in gender imbalance among participants, which may introduce bias in gender representation compared to the target population. Such imbalance risks limiting the generalizability of findings across gender demographics, thereby constraining the study's external validity and broader applicability. Future investigations should prioritize more rigorous sampling methodologies to mitigate demographic skewness. The sample in this study was drawn from a homogeneous cultural background, which limits the generalizability of the findings to populations with diverse cultural backgrounds. Future studies should prioritize cross-cultural comparative research to examine the commonalities and variations in the core pathways of the model across different cultural contexts. The primary objective of this investigation was to examine the occurrence of psychological distress and its associated factors. Consequently, detailed exploration of specific operational protocols for intervention techniques (e.g., cognitive behavioral therapy, emotional support groups) was beyond the scope of this study. Future research should prioritize the development of evidence-based implementation guidelines grounded in the key risk factors identified herein. Such guidelines must delineate operational standards, adaptation frameworks, and outcome measures for delivering these interventions within lung cancer patient populations to facilitate their translation into clinical practice.

Clinical implications

The incidence of psychological distress in patients with lung cancer is high, which is affected by age, occupational status, family monthly income, payment method, coping style, symptoms, type D personality and other factors. In this context, clinical medical staff should maintain a high degree of dynamic vigilance for the psychological fluctuations of patients with lung cancer, not only do a good job in screening and hierarchical management of psychological distress, but also emphasize the key importance of early identification.

For lung cancer patients with psychological distress, clinical medical staff not only need to actively adopt coping strategies, but also encourage patients to actively seek social support to reduce their psychological burden. At the same time, the role of psychologists is particularly important in this process. They have professional psychological assessment and treatment skills, and can provide patients with personalized psychological intervention. Through psychological counseling, they can help patients develop a better understanding of the disease, promote an adaptive perspective, and effectively reduce the uncertainty and anxiety of patients due to the disease. In addition, psychologists can also assist patients to optimize coping strategies, such as teaching relaxation techniques and cognitive reconstruction, in order to face the challenges brought by the disease more actively, help patients better understand and deal with their emotions, and enhance their psychological resilience. In addition to psychological intervention, active pain management and reducing symptom burden related to sleep breathing are also important measures to effectively reduce the psychological distress of lung cancer patients. These measures can not only improve the physiological comfort of patients, but also relieve their psychological pressure to a certain extent, so as to improve the overall quality of life of patients.

In summary, the close cooperation of multidisciplinary teams such as clinical medical staff, psychologists, and symptom management experts is essential for the identification, management, and alleviation of psychological distress in patients with lung cancer. Through comprehensive implementation of policies, the mental health level of lung cancer patients can be improved more effectively and provide strong support for their overall rehabilitation.

Conclusions

This study identified a high prevalence rate of psychological distress (52.87%) among lung cancer patients, with key predictors including age, occupational status, payment method, monthly household income, maladaptive coping styles, Type D personality tendencies, and symptom burden. These findings necessitate close clinical monitoring of high-risk populations (>60 years, low-income, insurance-restricted individuals), systematic screening with stratified management of psychological distress, personalized psychological interventions targeting maladaptive coping or Type D personality traits to cultivate adaptive mindsets, and optimized symptom control, thereby alleviating the high-burden status, reducing negative affect, and enhancing quality of life outcomes.

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Author contributions

YL and LZ completed the study design. YL, WW and XW contributed to data collection and participated in manuscript writing. YL and SL conducted data analysis and interpretated results. The manuscript was drafted by YL and edited and approved by SL, WW. All authors have read and approved the manuscript.

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Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Jinzhou Medical University (JZMULL2023107). Before the beginning of the survey, the purpose and significance of the study were explained to the participants, the principles of voluntary participation and confidentiality were emphasised.

Consent for publication

Not applicable.

Additional information

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