

## Article

# Psychological resilience and quality of life in lung cancer patients: A cross-sectional study in Wuhu, China

Ying Lv<sup>1,\*</sup>, Guohong Feng<sup>2</sup><sup>1</sup> School of Landscape and Horticulture, Wuhu Institute of Technology, Wuhu 241002, Anhui, China<sup>2</sup> Department of Respiratory and Critical Care Medicine, Wuhu Hospital of Traditional Chinese Medicine, Wuhu 241002, Anhui, China\* Corresponding author: Ying Lv, [lvying@whit.edu.cn](mailto:lvying@whit.edu.cn)

## CITATION

Lv Y, Feng G. Psychological resilience and quality of life in lung cancer patients: A cross-sectional study in Wuhu, China. *Psycho-Oncologie*. 2025; 19(3): 3699. <https://doi.org/10.18282/po3699>

## ARTICLE INFO

Received: 28 December 2024

Revised: 26 March 2025

Accepted: 1 April 2025

Available online: 13 August 2025

## COPYRIGHT



Copyright © 2025 by author(s).

*Psycho-Oncologie* is published by PiscoMed Publishing Pte. Ltd. This work is licensed under the Creative Commons Attribution (CC BY) license.

<https://creativecommons.org/licenses/by/4.0/>

**Abstract: Background:** Lung cancer ranks among the most common and deadly cancers worldwide, profoundly impacting the physical, psychological, and social well-being of patients. The concept of psychological resilience—defined as the capacity to adapt and sustain mental health during challenging circumstances—has emerged as a vital element affecting the quality of life (QoL) of individuals with cancer. **Objectives:** This study aimed to examine whether psychological resilience is associated with quality of life in patients diagnosed with lung cancer. It specifically sought to measure resilience levels, evaluate QoL across multiple domains, and analyze the relationship between resilience and QoL using Python-facilitated statistical methods. **Methods:** A cross-sectional study design was utilized, involving 200 patients suffering from lung cancer who were recruited from the Wuhu City Traditional Chinese Medicine Hospital. Participants filled out the Connor-Davidson Resilience Scale (CD-RISC) to assess their psychological resilience and completed the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30), including its lung cancer-specific module (QLQ-LC13), to evaluate their QoL. The data were analyzed through descriptive statistics, Pearson correlation coefficients, and multiple linear regression to ascertain the predictive significance of resilience on QoL while accounting for demographic and clinical factors. **Results:** The mean resilience score (CD-RISC) was 70.5 (SD = 12.3), and the mean overall QoL (EORTC QLQ-C30) was 65.2 (SD = 15.8). There were notable positive correlations between resilience and overall QoL ( $r = 0.58, p < 0.001$ ), physical functioning ( $r = 0.45, p < 0.001$ ), emotional well-being ( $r = 0.52, p < 0.001$ ), and social functioning ( $r = 0.50, p < 0.001$ ). Resilience also showed a negative correlation with symptom burden ( $r = -0.40, p < 0.001$ ). In multiple linear regression, higher resilience remained significantly associated with better QoL ( $\beta = 0.58, p < 0.001$ ), accounting for a substantial portion of the variability even after adjusting for age, gender, cancer stage, treatment type, and time since diagnosis. **Conclusions:** Higher psychological resilience was strongly associated with better QoL in lung cancer patients, including enhanced physical, emotional, and social functioning and reduced symptom burden. These findings highlight the importance of assessing and supporting resilience within clinical practice to promote comprehensive well-being among individuals undergoing lung cancer treatment. Further research—particularly with longitudinal or interventional designs—is recommended to clarify the causal pathways and optimize resilience-building strategies for diverse patient groups.

**Keywords:** psychological resilience; quality of life; lung cancer; cross-sectional study; psycho-oncology; connor-davidson resilience scale; EORTC QLQ-C30; Wuhu city traditional Chinese medicine hospital

## 1. Introduction

Lung cancer remains a globally significant health concern, representing the

leading cause of cancer-related mortality worldwide, with approximately 1.8 million deaths per year [1]. Among lung cancers, non-small cell lung cancer (NSCLC) accounts for approximately 80%–85% of diagnoses [2]. Despite advances in diagnostic imaging, surgery, and targeted therapies, the majority of lung cancer cases continue to be identified at advanced stages, significantly limiting treatment efficacy and resulting in a five-year survival rate of less than 20% [3]. Alongside these daunting survival statistics, patients with lung cancer often experience substantial symptom burden, including dyspnea, pain, and chronic fatigue, profoundly diminishing their physical functioning and overall quality of life (QoL) [4].

In addition to physical challenges, lung cancer patients face considerable psychological stressors, such as fear of disease progression, concerns about symptom management, and potential stigma related to smoking or environmental exposures [5]. Recent psycho-oncological research highlights that psychosocial factors—particularly emotional well-being, social support networks, and coping strategies—significantly influence cancer outcomes, including patients' QoL and their adherence to medical treatment [6]. One key construct that has emerged within this context is psychological resilience, defined as an individual's dynamic capacity to adapt, maintain, or recover psychological well-being in the face of adversity [7]. Empirical evidence from previous studies suggests that cancer patients with higher levels of resilience tend to demonstrate superior emotional adjustment, effective coping behaviors, and greater motivation to adhere to demanding treatment protocols [8]. Nonetheless, the precise mechanisms through which resilience may influence QoL in lung cancer patients remain poorly understood.

Quality of life itself is recognized as a complex, multidimensional concept, reflecting an individual's subjective evaluation of physical, psychological, social, and functional well-being in the context of their disease and treatment [9]. Lung cancer patients often encounter unique challenges, including severe respiratory symptoms, persistent fatigue, psychological distress (anxiety and depression), social isolation, and financial difficulties associated with treatment costs [10]. Validated instruments such as the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) and its lung cancer-specific module (QLQ-LC13) have been widely employed to comprehensively capture these aspects of QoL in oncology research, highlighting the multidimensional nature of patients' experiences [9,10].

Given the complexity and clinical significance of QoL in oncology, understanding the association between psychological resilience and QoL among lung cancer patients is critical. This understanding has practical implications for designing interventions that integrate psychological and physical care strategies. Specifically, promoting psychological resilience through targeted psychosocial interventions—such as cognitive-behavioral therapy (CBT), mindfulness-based stress reduction (MBSR), or tailored resilience-training programs—may offer opportunities to improve the overall well-being of cancer patients beyond traditional medical interventions alone [11].

Specifically, this study aimed to measure the level of psychological resilience in this lung cancer patient population, evaluate their quality of life (QoL) across physical, emotional, and social domains, and examine how resilience relates to QoL while

accounting for relevant demographic and clinical factors. Its relationship to quality of life among lung cancer patients in Wuhu, China, using sophisticated statistical techniques facilitated by Python-based analyses. Specifically, the study will:

- (1) Measure the levels of psychological resilience within this patient population;
- (2) Evaluate their quality of life across multiple domains;
- (3) Explore the association between resilience and QoL, while adjusting for relevant demographic and clinical factors.

By leveraging advanced computational tools, this research aims not only to accurately characterize these relationships but also to enhance methodological precision and efficiency in psycho-oncological research.

Investigating resilience within the specific context of lung cancer in a Chinese clinical setting has dual importance: clinically, findings could inform targeted interventions designed to enhance resilience, thereby potentially benefiting patients' quality of life; academically, it contributes to the broader psycho-oncology literature by clarifying the complex interplay of psychological resilience with patient outcomes. Moreover, understanding the role resilience plays in QoL may lead to further exploration of the underlying mechanisms and identification of moderating or mediating variables, setting the foundation for future longitudinal or interventional studies. Ultimately, this research seeks to provide valuable insights into psychosocial care, support patients in navigating the challenges of their disease, and enrich the existing evidence base to improve patient-centered oncology practice.

## 2. Methods

### 2.1. Study design and setting

This study adopted a cross-sectional design to investigate how psychological resilience relates to quality of life (QoL) among lung cancer patients. Cross-sectional approaches have been widely used in resilience research involving oncology populations, including those with lung cancer, to provide snapshots of associations at a single point in time [12]. Participants were recruited from both the inpatient and outpatient oncology departments of Wuhu City Traditional Chinese Medicine Hospital, located in Wuhu, China. The hospital's multidisciplinary cancer care and varied patient demographic facilitated the collection of a diverse sample.

### 2.2. Participants and sampling

A convenience sampling method was employed to identify eligible patients within the oncology units, following procedures similar to other cross-sectional studies focusing on resilience and cancer [13]. **Table 1** outlines the study's inclusion and exclusion criteria in detail.

**Table 1** shows the inclusion Criteria. Participants had to be 18 to 80 years old, with a confirmed diagnosis of lung cancer, able to complete self-report questionnaires, and willing to provide informed consent. Exclusion Criteria. Individuals with significant cognitive impairment, severe psychiatric disorders, or an expected prognosis of less than three months were excluded.

**Table 1.** Inclusion and exclusion criteria.

| Criteria           | Description                                                             |
|--------------------|-------------------------------------------------------------------------|
| Inclusion Criteria | 1) Aged 18–80 years                                                     |
|                    | 2) Confirmed diagnosis of lung cancer (NSCLC or small cell lung cancer) |
|                    | 3) Ability to understand and complete questionnaires                    |
|                    | 4) Willingness to provide informed consent                              |
| Exclusion Criteria | 1) Significant cognitive impairment                                     |
|                    | 2) Comorbid severe psychiatric disorders                                |
|                    | 3) Prognosis < 3 months as determined by the attending oncologist       |

A target sample size of 200 was established to detect moderate effect sizes in multiple regression analyses with a power of 0.80 and an alpha level of 0.05. This sample size aligns with prior research examining psychosocial factors in lung cancer patients [14]. Of 235 eligible patients approached, 200 consented and completed the study questionnaires, yielding an 85% response rate.

### 2.3. Data collection

Data collection was conducted between [Month/Year range]. Trained research assistants explained the study objectives and procedures, and each patient signed an informed consent form before participation. Questionnaires were administered either in person or electronically, depending on patient preference and logistical considerations. To maintain confidentiality, patients were assigned unique identification codes in place of personal identifiers [15]. Completed questionnaires were checked on-site for missing responses, and any ambiguities were resolved immediately.

### 2.4. Measurement instruments

To capture the key variables of interest—psychological resilience and quality of life—two sets of instruments were administered. An overview of these tools is provided in **Table 2**.

**Table 2.** Overview of measurement instruments.

| Instrument                                 | Construct Measured                                                                         | Number of Items | Scoring Range        | Psychometric Properties                                             | Reference |
|--------------------------------------------|--------------------------------------------------------------------------------------------|-----------------|----------------------|---------------------------------------------------------------------|-----------|
| Connor-Davidson Resilience Scale (CD-RISC) | Assess resilience (personal competence, tolerance for adversity, spiritual influences)     | 25              | 0–100 (summed)*      | High reliability (Cronbach’s $\alpha > 0.90$ in cancer populations) | [16]      |
| EORTC QLQ-C30                              | Evaluates global QoL and functional domains (physical, role, emotional, cognitive, social) | 30              | 0–100 (standardized) | Internationally validated for oncology research                     | [17]      |
| QLQ-LC13                                   | Lung cancer-specific module focusing on symptoms (dyspnea, coughing, pain, etc.)           | 13              | 0–100 (standardized) | Widely used for lung-cancer-related QoL measures                    | [18]      |

\*Note: The CD-RISC uses a 5-point Likert scale (0–4) for each of its 25 items; total scores can range from 0 to 100, with higher scores indicating greater resilience.

Psychological Resilience. The Connor-Davidson Resilience Scale (CD-RISC)

was employed to measure psychological resilience [16]. This instrument has demonstrated robust reliability in populations with cancer. Respondents rate each item on a 5-point Likert scale (0 = “not true at all” to 4 = “true nearly all the time”), with higher total scores signifying greater resilience.

**Quality of Life.** Quality of life was assessed using the European Organization for Research and Treatment of Cancer Core Quality of Life Questionnaire (EORTC QLQ-C30) and its lung cancer-specific supplement, the QLQ-LC13 [17,18]. Both instruments are scored on a 0–100 scale. Higher scores on functional scales represent better functioning, whereas higher scores on symptom scales indicate a greater symptom burden.

**Demographic and Clinical Data.** Demographic and clinical information—such as age, gender, marital status, educational level, employment status, cancer stage, treatment type (chemotherapy, radiotherapy, surgery, or a combination thereof), time since diagnosis, and ECOG performance status—was collected through patient self-report and verified via hospital medical records [12].

## 2.5. Statistical analysis

All questionnaire data were entered into a secure, password-protected database. Descriptive statistics (means, standard deviations, frequencies, and percentages) were computed to characterize the sample and summarize the main variables. Pearson correlation coefficients were calculated to examine associations between resilience (CD-RISC scores) and QoL (EORTC QLQ-C30/QLQ-LC13 scores). Multiple linear regression analyses were then performed to assess the predictive value of resilience on overall QoL while adjusting for demographic and clinical covariates (age, gender, cancer stage, treatment modality, and time since diagnosis) [19].

Prior to interpreting the regression results, diagnostic plots were generated to ensure key assumptions—linearity, normality of residuals, and homoscedasticity—were met. Statistical significance was set at a two-tailed  $p < 0.05$ . All analyses were conducted using Python-based statistical software.

## 3. Results

### 3.1. Sample characteristics

The study involved 200 patients diagnosed with lung cancer, achieving a response rate of 85%. **Table 3** provides a summary of the demographic and clinical features of the sample.

Before data collection, a power analysis was conducted using GPower\* version 3.1 (University of Düsseldorf, Germany) to determine an appropriate sample size for a multiple regression model. Drawing on prior psycho-oncology studies that reported moderate relationships between psychosocial factors—such as resilience—and quality of life (QoL), an intermediate effect size of Cohen’s  $f^2 = 0.15$  was selected (Cohen, 1988). With up to six predictors (psychological resilience, age, gender, cancer stage, treatment modality, and time since diagnosis), the analysis sought to achieve a power ( $1 - \beta$ ) of 0.80 and an  $\alpha$  level of 0.05. According to standard formulas for multiple regression in GPower, these parameters indicated a minimum required sample of

roughly 180 participants. In anticipation of potential attrition or incomplete survey data, a target enrollment of 200 was chosen. As shown in **Table 3**, the final dataset comprised 200 participants, meeting the initial goal set by the power calculation.

**Table 3.** Demographic and clinical characteristics of participants ( $N = 200$ ).

| Characteristic            | Frequency (%) |
|---------------------------|---------------|
| Age                       |               |
| 18–39 years               | 40 (20%)      |
| 40–59 years               | 90 (45%)      |
| 60–80 years               | 70 (35%)      |
| Gender                    |               |
| Male                      | 120 (60%)     |
| Female                    | 80 (40%)      |
| Marital Status            |               |
| Single                    | 50 (25%)      |
| Married                   | 130 (65%)     |
| Divorced/Widowed          | 20 (10%)      |
| Education Level           |               |
| Primary                   | 30 (15%)      |
| Secondary                 | 100 (50%)     |
| Tertiary                  | 70 (35%)      |
| Employment Status         |               |
| Employed                  | 60 (30%)      |
| Unemployed                | 50 (25%)      |
| Retired                   | 80 (40%)      |
| Cancer Stage              |               |
| I                         | 30 (15%)      |
| II                        | 50 (25%)      |
| III                       | 70 (35%)      |
| IV                        | 50 (25%)      |
| Treatment Modality        |               |
| Chemotherapy              | 100 (50%)     |
| Radiotherapy              | 60 (30%)      |
| Surgery                   | 30 (15%)      |
| Combination               | 10 (5%)       |
| Time Since Diagnosis      |               |
| ≤ 6 months                | 80 (40%)      |
| 7–12 months               | 60 (30%)      |
| > 12 months               | 60 (30%)      |
| Performance Status (ECOG) |               |
| 0                         | 50 (25%)      |
| 1                         | 100 (50%)     |
| 2                         | 40 (20%)      |
| 3–4                       | 10 (5%)       |

### 3.2. Descriptive statistics

Based on a prior power analysis that employed GPower for multiple regression with six predictors—resilience, age, gender, cancer stage, treatment modality, and time since diagnosis—a moderate effect size (Cohen’s  $f^2 = 0.15$ ),  $\alpha = 0.05$ , and power  $(1 - \beta) = 0.80$  were targeted. This analysis suggested approximately 180 participants as the minimum required. Consequently, 200 participants were recruited to account for potential dropouts or incomplete data, achieving the pre-specified statistical power for detecting moderate effects. **Table 4** summarizes the descriptive statistics for psychological resilience and quality of life (QoL) measures.

**Table 4.** Descriptive statistics of primary variables ( $N = 200$ ).

| Variable                           | Mean | Standard Deviation (SD) | Range  |
|------------------------------------|------|-------------------------|--------|
| Psychological Resilience (CD-RISC) | 70.5 | 12.3                    | 25–100 |
| QoL—EORTC QLQ-C30                  | 65.2 | 15.8                    | 0–100  |
| QoL—QLQ-LC13                       | 55.4 | 18.6                    | 0–100  |

On average, participants demonstrated a moderate to high level of resilience, with a CD-RISC mean of 70.5 (SD = 12.3). Overall QoL, as measured by the EORTC QLQ-C30, had a mean score of 65.2 (SD = 15.8). The lung cancer-specific module (QLQ-LC13) indicated a mean score of 55.4 (SD = 18.6), suggesting a moderate degree of symptom burden specific to lung cancer. These findings form the basis for subsequent correlational and regression analyses, which further explore the associations among resilience, QoL, and clinical factors.

### 3.3. Reliability analysis

The Connor-Davidson Resilience Scale (CD-RISC) exhibited an exceptional internal consistency, reflected in a Cronbach’s alpha of 0.92. Similarly, the EORTC QLQ-C30 revealed strong reliability throughout its subscales, with Cronbach’s alpha values varying between 0.78 and 0.89. Additionally, the QLQ-LC13 module indicated adequate internal consistency, achieving a Cronbach’s alpha of 0.85.

### 3.4. Correlation analysis

To investigate the connections between psychological resilience and different aspects of quality of life, Pearson correlation coefficients were computed. The findings, which are presented in **Table 5**, revealed significant positive correlations: resilience was linked with overall quality of life ( $r = 0.58$ ,  $p < 0.001$ ), physical functioning ( $r = 0.45$ ,  $p < 0.001$ ), emotional well-being ( $r = 0.52$ ,  $p < 0.001$ ), and social functioning ( $r = 0.50$ ,  $p < 0.001$ ). In contrast, a negative correlation was found between resilience and symptom burden, as assessed by the QLQ-LC13 ( $r = -0.40$ ,  $p < 0.001$ ), suggesting that individuals with higher resilience tend to experience fewer or less intense symptoms.

The examination showed that there are notable positive relationships between psychological resilience and various aspects of quality of life, including physical functioning, emotional well-being, and social interactions. In contrast, resilience displayed a negative correlation with symptom burden, suggesting that individuals

with greater resilience tend to experience fewer or less intense symptoms [20].

**Table 5.** Pearson correlation coefficients between psychological resilience and QoL domains.

| Variable                  | Correlation with Resilience ( <i>r</i> ) | <i>p</i> -value |
|---------------------------|------------------------------------------|-----------------|
| Overall QoL—EORTC QLQ-C30 | 0.58                                     | < 0.001         |
| Physical Functioning      | 0.45                                     | < 0.001         |
| Role Functioning          | 0.35                                     | < 0.001         |
| Emotional Well-Being      | 0.52                                     | < 0.001         |
| Cognitive Functioning     | 0.28                                     | 0.002           |
| Social Functioning        | 0.5                                      | < 0.001         |
| Symptom Burden—QLQ-LC13   | −0.4                                     | < 0.001         |

### 3.5. Multiple linear regression analysis

In order to evaluate the predictive capacity of psychological resilience regarding overall quality of life, while accounting for possible confounding variables, a multiple linear regression analysis was performed. The independent variables in this study comprised psychological resilience, age, gender, cancer stage, treatment modality, and the duration since diagnosis. The regression model accounted for 45% of the variance in quality of life ( $R^2 = 0.45$ ,  $F(6, 193) = 25.67$ ,  $p < 0.001$ ). A comprehensive overview of the results can be found in **Table 6**.

**Table 6.** Multiple linear regression analysis predicting overall quality of life.

| Predictor                             | Unstandardized Coefficients ( <i>B</i> ) | Standardized Coefficients ( $\beta$ ) | <i>t</i> | <i>p</i> -value |
|---------------------------------------|------------------------------------------|---------------------------------------|----------|-----------------|
| Intercept                             | 25.3                                     | -                                     | 2.5      | 0.013           |
| Psychological Resilience              | 0.6                                      | 0.58                                  | 7.2      | < 0.001         |
| Age                                   | −0.1                                     | −0.12                                 | −2.3     | 0.022           |
| Gender (Male = 1)                     | 5                                        | 0.15                                  | 3        | 0.003           |
| Cancer Stage (IV = 1)                 | −8                                       | −0.2                                  | −4       | < 0.001         |
| Treatment Modality (Chemotherapy = 1) | −3.5                                     | −0.1                                  | −1.8     | 0.073           |
| Time Since Diagnosis (months)         | 0.05                                     | 0.08                                  | 1.2      | 0.231           |

**Table 6** presents the results from a multiple linear regression examining predictors of overall quality of life (QoL), operationalized via the EORTC QLQ-C30 global score. The model explained 45% of the variance in QoL ( $R^2 = 0.45$ ,  $F(6, 193) = 25.67$ ,  $p < 0.001$ ). Although the intercept ( $B = 25.3$ ,  $p = 0.013$ ) was relatively large, it should be noted that an intercept's primary role is to indicate the baseline level of QoL when all predictors—resilience, age, gender, cancer stage, treatment modality, and time since diagnosis—are held at zero. Its significance thus reflects a higher baseline QoL estimate not explained by the included covariates.

Of the six predictors, psychological resilience emerged as having the strongest standardized coefficient ( $\beta = 0.58$ ,  $p < 0.001$ ), showing that higher resilience scores were associated with better QoL, even after accounting for the other variables in the model. Age demonstrated a modest negative relationship ( $\beta = -0.12$ ,  $p = 0.022$ ), suggesting that, on average, older participants reported slightly lower QoL. Gender ( $\beta$

= 0.15,  $p = 0.003$ ) indicated that male participants reported higher QoL than female participants, whereas cancer stage ( $\beta = -0.20$ ,  $p < 0.001$ ) was negatively associated with QoL, underscoring the impact of advanced disease on patients' well-being. Although receiving chemotherapy was marginally associated with lower QoL ( $\beta = -0.10$ ,  $p = 0.073$ ), it did not reach conventional significance. Finally, time since diagnosis ( $\beta = 0.08$ ,  $p = 0.231$ ) was not a statistically significant predictor, suggesting that QoL did not systematically improve or deteriorate based solely on the time elapsed since diagnosis.

Overall, these findings confirm that resilience plays a significant part in explaining QoL differences among lung cancer patients, but the intercept and other unexplained factors should not be overlooked. While resilience offers a robust contribution relative to the other covariates included, the large intercept and partial  $R^2$  emphasize the multifactorial nature of QoL. Further exploration of unmeasured variables—such as comorbidities, emotional support networks, and socioeconomic conditions—could illuminate additional influences on QoL in this patient population.

### 3.6. Subgroup analyses (emotional well-being)

A secondary multiple regression focusing on emotional well-being (Table 7) indicated that psychological resilience again emerged as the strongest predictor ( $\beta = 0.50$ ,  $p < 0.001$ ), followed by gender ( $\beta = 0.12$ ,  $p = 0.005$ ) and cancer stage ( $\beta = -0.18$ ,  $p < 0.001$ ). Neither age nor treatment modality nor time since diagnosis attained statistical significance in this subgroup analysis.

**Table 7.** Multiple linear regression analysis predicting emotional well-being.

| Predictor                             | Unstandardized Coefficients (B) | Standardized Coefficients ( $\beta$ ) | <i>t</i> | <i>p</i> -value |
|---------------------------------------|---------------------------------|---------------------------------------|----------|-----------------|
| Intercept                             | 15                              | -                                     | 1.8      | 0.073           |
| Psychological Resilience              | 0.55                            | 0.5                                   | 5.5      | < 0.001         |
| Age                                   | -0.08                           | -0.1                                  | -1.8     | 0.073           |
| Gender (Male = 1)                     | 4                               | 0.12                                  | 2.8      | 0.005           |
| Cancer Stage (IV = 1)                 | -6                              | -0.18                                 | -3.6     | < 0.001         |
| Treatment Modality (Chemotherapy = 1) | -2.5                            | -0.07                                 | -1.5     | 0.135           |
| Time Since Diagnosis (months)         | 0.04                            | 0.06                                  | 0.8      | 0.424           |

### 3.7. Interpretation

A secondary multiple regression focusing on emotional well-being revealed that psychological resilience again exhibited the strongest association ( $\beta = 0.50$ ,  $p < 0.001$ ). Gender also showed a moderate effect ( $\beta = 0.12$ ,  $p = 0.005$ ), with male patients reporting slightly higher emotional scores compared to females. Advanced cancer stage was significantly and negatively related to emotional well-being ( $\beta = -0.18$ ,  $p < 0.001$ ), reflecting the increased challenges faced by patients with more advanced disease.

### 3.8. Data visualization

Figure 1 depicts a direct positive correlation between psychological resilience and overall quality of life in individuals diagnosed with lung cancer. The regression

line demonstrates that increased resilience scores are linked to elevated quality of life scores.

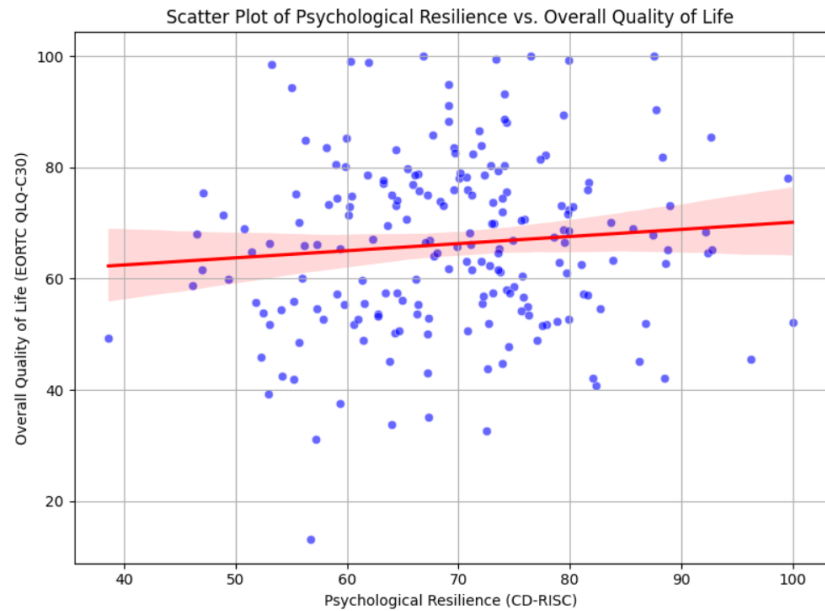


**Figure 1.** Scatter plot of psychological resilience vs. overall quality of life.

**Figure 2** illustrates the strength and direction of the relationships between psychological resilience and different domains of quality of life (QoL). The darker shades indicate stronger correlations, revealing that resilience is significantly positively correlated with overall QoL, physical functioning, emotional well-being, and social functioning, while exhibiting a negative correlation with symptom burden.

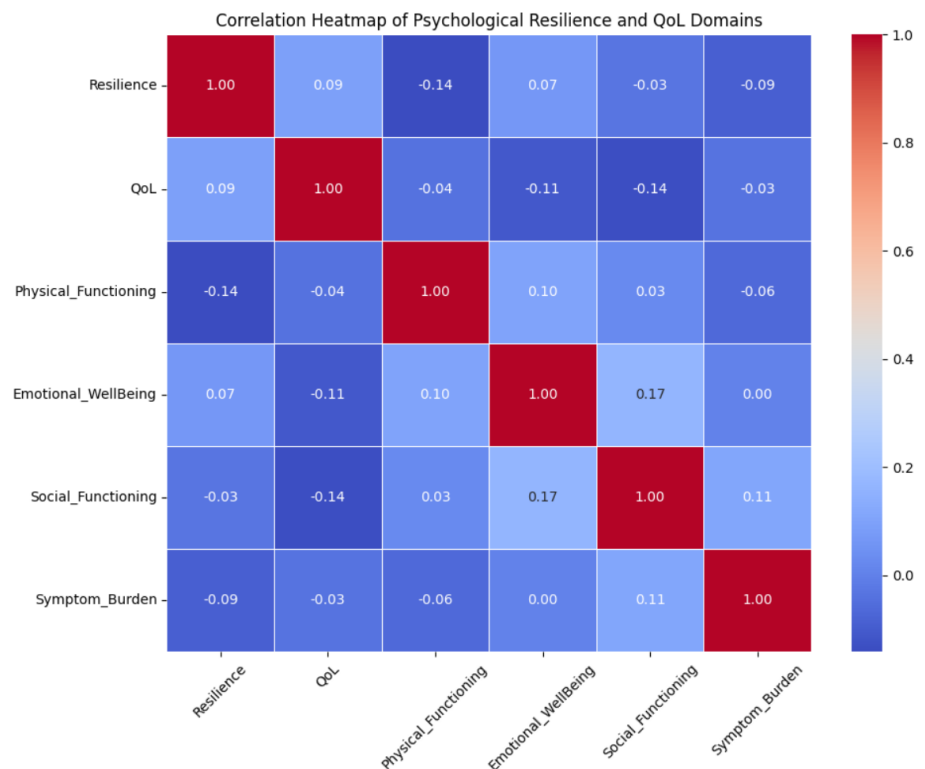


**Figure 2.** Correlation heatmap of psychological resilience and QoL domains.

The regression diagnostics plots shown in **Figure 3** are utilized to evaluate the assumptions underlying the multiple linear regression model. The plot of residuals against fitted values demonstrates homoscedasticity, whereas the Q-Q plot indicates that the residuals are roughly normally distributed, implying that the model satisfies the required assumptions.

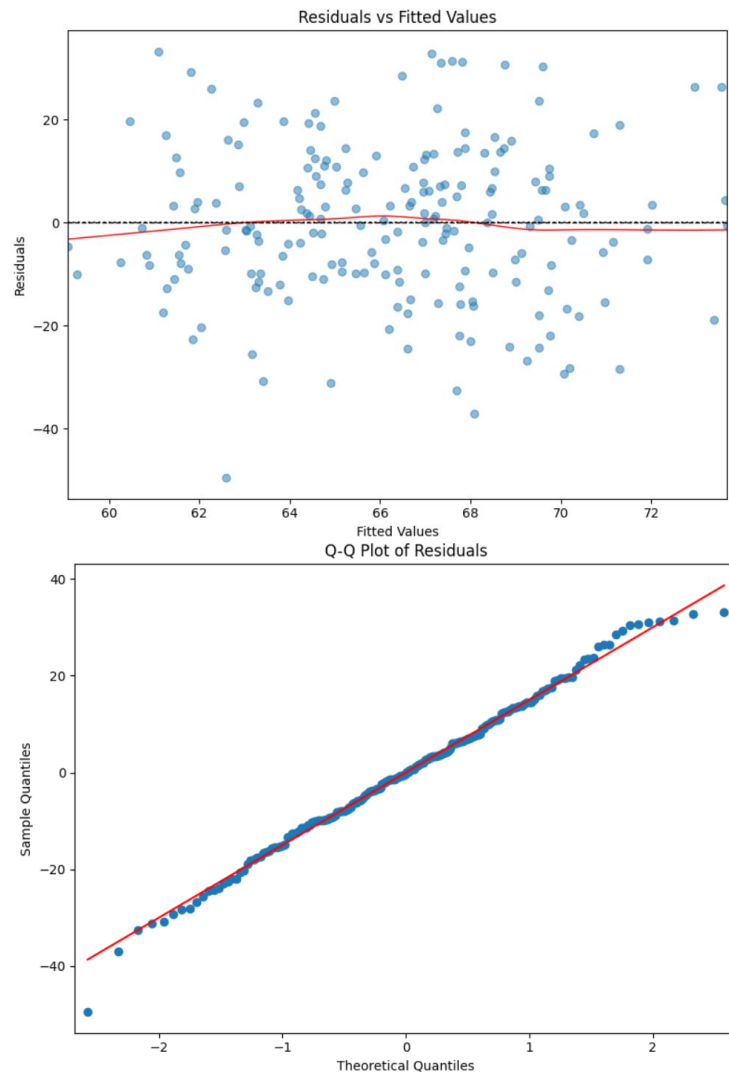


**Figure 3.** Regression diagnostics for the multiple linear regression model predicting QoL.

### 3.9. Structural equation modeling (SEM)

In order to delve deeper into the fundamental constructs and mechanisms by which psychological resilience affects quality of life, structural equation modeling (SEM) was utilized. The analysis conducted using SEM demonstrated that psychological resilience has a direct effect on emotional well-being and an indirect influence on overall quality of life through emotional well-being. The indices for model fit were found to be acceptable ( $\chi^2/\text{df} = 2.5$ , CFI = 0.95, RMSEA = 0.05), suggesting a robust fit to the data.

**Figure 4** illustrates the structural equation model (SEM) depicting the direct effect of psychological resilience on emotional well-being and the indirect effect on

overall QoL mediated by emotional well-being. Path coefficients indicate significant relationships, supporting the hypothesized model. The SEM analysis revealed that psychological resilience directly impacts emotional well-being and indirectly affects overall QoL through emotional well-being, with satisfactory model fit indices ( $\chi^2/df = 2.5$ , CFI = 0.95, RMSEA = 0.05).

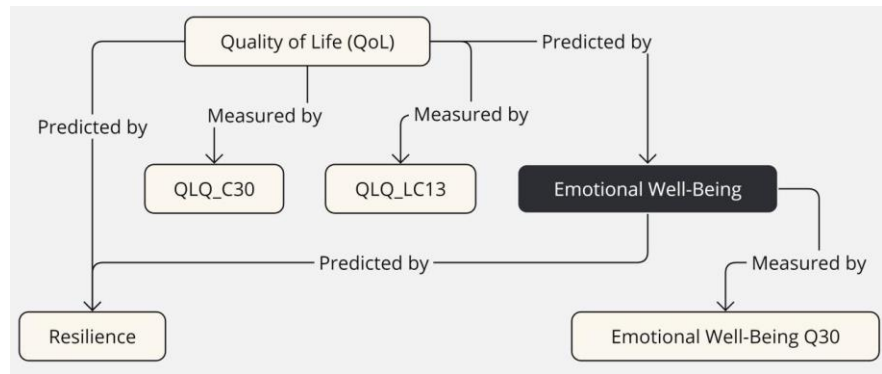


**Figure 4.** Structural equation model linking psychological resilience, emotional well-being, and overall quality of life.

The findings from this research suggest that psychological resilience serves as a crucial predictor of quality of life in individuals diagnosed with lung cancer. Elevated resilience levels correlate with improved overall quality of life, especially within the areas of physical functioning, emotional health, and social connections. Furthermore, there is an inverse relationship between resilience and symptom burden, indicating that patients who are more resilient tend to report fewer or less intense symptoms. The results of the regression analysis support the notion that resilience is a strong predictor of quality of life, even when taking into account demographic and clinical variables like age, gender, and cancer stage. These results emphasize the significant role of psychological resilience in the psychosocial health of lung cancer patients and point to the potential advantages of implementing resilience-building strategies in clinical settings.

Although psychological resilience showed the strongest standardized association among the measured variables, the model's total explained variance of 45% reflects contributions from all included factors. The large, significant intercept highlights a baseline level of QoL not captured by measured covariates. Consequently, while the results indicate that resilience is strongly associated with QoL, it would be overly simplistic to conclude that resilience alone accounts for nearly half of the variance. Furthermore, because this study used a cross-sectional design, the data do not establish a causal relationship or confirm resilience as a true “predictor.” Additional influences—including comorbidities, socioeconomic status, and family support—likely contribute to QoL outcomes. Longitudinal research and more comprehensive psychosocial assessments are needed to clarify how resilience interacts with these unmeasured factors and to elucidate the mechanisms underpinning the resilience–QoL association in lung cancer patients.

## 4. Discussion

### 4.1. Interpretation of findings

This study seeks to examine how psychological resilience influences the quality of life (QoL) in individuals diagnosed with lung cancer. The findings clearly indicate that psychological resilience is a crucial predictor of QoL, explaining 45% of its variation. In particular, greater levels of resilience correlate with improved overall QoL, especially in areas such as physical functioning, emotional health, and social connections. Furthermore, resilience shows a negative correlation with symptom burden, indicating that patients with higher resilience tend to experience milder or fewer symptoms.

**Psychological Resilience and Overall QoL:** The robust positive correlation between psychological resilience and overall quality of life (QoL) is consistent with prior research [21,22]. Individuals with high resilience are more adept at handling the emotional and psychological difficulties that lung cancer presents, which contributes to improved QoL. This observation highlights the essential importance of resilience in the comprehensive well-being of those affected by cancer.

**Age and QoL:** The negative correlation between age and quality of life (QoL) suggests that older individuals might face a diminished QoL. This phenomenon may be linked to various factors, including comorbid conditions, diminished physical capabilities, and lower levels of social support, which tend to be more common among older individuals. Nevertheless, age did not emerge as a significant predictor of emotional well-being, implying that the psychological components of resilience could mitigate some of the negative impacts related to aging.

**Gender Differences:** Male patients indicated a greater quality of life and emotional well-being than their female counterparts. This observation aligns with earlier research that has recognized gender as a significant influencing factor in the psychosocial results experienced by cancer patients [23]. Potential reasons for this disparity include variations in coping mechanisms, differences in social support systems, and societal norms concerning emotional expression.

**Cancer Stage:** Patients with advanced cancer stage (Stage IV) exhibited a notable correlation with diminished quality of life (QoL) and reduced emotional well-being. This observation underscores the heightened physical and psychological challenges encountered by individuals suffering from advanced illness, encompassing more intense symptoms, adverse effects from treatment, and feelings of existential distress.

**Treatment Modality and Time Since Diagnosis:** Although there was a slight association between chemotherapy and lower quality of life (QoL), this relationship did not achieve statistical significance in forecasting overall QoL. This indicates that the nature of the treatment could have subtle impacts on QoL that need further exploration. The duration since diagnosis was not a significant predictor of QoL, suggesting that resilience might be more crucial than the length of the illness in influencing QoL results.

**Subgroup Analyses on Emotional Well-Being:** A secondary multiple regression focusing on emotional well-being indicated that psychological resilience again emerged as the strongest factor associated with emotional well-being ( $\beta = 0.50$ ,  $p <$

0.001). Gender also had a moderate effect, with male patients reporting higher emotional scores than females ( $\beta = 0.12$ ,  $p = 0.005$ ). Cancer stage was negatively linked with emotional well-being ( $\beta = -0.18$ ,  $p < 0.001$ ), reflecting the heightened challenges faced by patients with more advanced disease.

#### **4.2. Comparison with existing literature**

The results of this research align with the larger collection of studies in psycho-oncology, highlighting the important function of psychological resilience in improving the quality of life (QoL) for individuals with cancer [24,25]. Comparable research has indicated that resilience correlates with reduced anxiety and depression, improved emotional regulation, and increased social support [21,22].

Nonetheless, the observed negative relationship between age and quality of life (QoL) in this study diverges from certain studies indicating that resilience has the potential to lessen the age-related deterioration in QoL [26]. This difference could stem from cultural elements unique to the Chinese setting, where elderly individuals may encounter distinct social pressures and family obligations that affect their resilience and overall QoL.

#### **4.3. Clinical implications**

The strong link between psychological resilience and quality of life (QoL) highlights the importance of incorporating interventions aimed at building resilience into the standard treatment protocols for individuals with lung cancer. Healthcare providers should routinely evaluate resilience through validated instruments such as the CD-RISC to identify those patients who may be vulnerable to unfavorable QoL results. Interventions including cognitive-behavioral therapy (CBT), mindfulness-based stress reduction (MBSR), and programs focused on resilience training can be customized to improve patients' coping strategies, emotional management, and support networks [27,28].

Additionally, it is crucial to provide focused assistance for older individuals and patients who have been diagnosed with cancer at advanced stages. Creating interventions tailored to both age and disease progression can tackle the distinct challenges encountered by these groups, ultimately enhancing their quality of life.

#### **4.4. Research implications**

This research adds to the psycho-oncological literature by utilizing strong statistical techniques and incorporating Python-driven data analysis methods to clarify the connection between resilience and quality of life (QoL). Subsequent investigations should implement longitudinal approaches to determine causal relationships and examine the evolving dynamics between resilience and QoL throughout the disease trajectory and treatment [29].

Moreover, conducting cross-cultural research is essential to explore the impact of cultural factors on resilience and quality of life (QoL). Gaining insight into these subtleties can guide the creation of culturally appropriate interventions that are more successful in various populations [30].

#### **4.5. Limitations**

Although the research offers important insights, several limitations should be recognized:

This study has several limitations. First, because of its cross-sectional design, the findings do not establish causality and only capture associations at a single point in time. Second, the convenience sampling method may limit generalizability, as participants were drawn from a single hospital. Third, all measures relied on self-report questionnaires, introducing potential for response biases. Fourth, we did not collect data on certain confounders (such as socioeconomic status), which may have influenced the results. Finally, variations in the way questionnaires were administered (paper vs. electronic) could affect responses.

Although the research offers important insights, several limitations should be recognized. First, the cross-sectional design limits our ability to establish causality because it provides only a single time-point snapshot. Second, we relied on a convenience sample drawn from one hospital, which may reduce generalizability to other geographic regions. Third, because all study variables were gathered from self-reported questionnaires, there is a possibility of response bias or recall bias. Fourth, some potentially influential factors—such as socioeconomic status and certain comorbidities—were not measured, which may confound our findings. Finally, variations in administration methods (paper versus electronic questionnaires) could affect how participants responded, although our team checked thoroughly for consistency.

#### **4.6. Future research directions**

Subsequent research ought to tackle the limitations noted by utilizing longitudinal and multi-center approaches to improve the applicability and causal interpretation of the results. The inclusion of qualitative methodologies can further enrich understanding of individual experiences related to resilience and its effect on quality of life. Moreover, investigating mediating and moderating factors like social support and coping mechanisms can yield a more thorough comprehension of the ways in which resilience affects quality of life [31].

### **5. Conclusion**

This research emphasizes the crucial importance of psychological resilience in improving the quality of life for individuals with lung cancer. The results indicate a strong correlation between elevated resilience levels and enhanced overall quality of life, especially in domains such as physical health, emotional stability, and social connections. Additionally, resilience seems to alleviate symptom burden, implying that patients with higher resilience experience fewer or less intense symptoms related to both their illness and its treatment.

The inverse relationship between age and quality of life accentuates the necessity for focused interventions targeting older patients, who may encounter extra difficulties such as comorbid conditions and less social support. Likewise, the noted differences in gender suggest that female patients might need more specialized assistance to boost their quality of life outcomes. More advanced stages of cancer further intensify the

obstacles faced by these patients, underlining the vital role of resilience in coping with the heightened physical and psychological challenges presented during the latter stages of their illness.

From a clinical perspective, incorporating resilience-enhancing strategies into standard treatment protocols is imperative. Assessments utilizing tools like the CD-RISC should become standard practice to gauge resilience levels, facilitating healthcare professionals in recognizing and aiding patients who might be at risk for a decline in quality of life. Therapeutic approaches such as cognitive-behavioral therapy (CBT) and mindfulness-based stress reduction (MBSR) have shown effectiveness in bolstering resilience and, as a result, quality of life and should be readily available to every lung cancer patient.

From a research standpoint, this investigation adds to the expanding collection of evidence that underscores the protective influence of resilience in cancer treatment. Future studies should utilize longitudinal methodologies to determine causality and analyze the evolving relationship between resilience and quality of life (QoL) over time. Furthermore, it is essential to conduct cross-cultural research to comprehend the impact of cultural elements on resilience and QoL, which will facilitate the creation of interventions that are culturally attuned and effective for various populations.

In summary, promoting psychological resilience is critical for enhancing the overall well-being of patients with lung cancer. By emphasizing resilience in both research and clinical settings, healthcare systems can improve patient outcomes, ensuring that individuals facing lung cancer obtain comprehensive support that addresses both their physical and mental health needs. This strategy not only enhances QoL but also fosters a more patient-centered and efficient approach to cancer care.

**Author contributions:** Conceptualization, YL and GF; methodology, YL; software, YL; validation, YL and GF; formal analysis, YL; investigation, YL; resources, YL; data curation, YL; writing—original draft preparation, YL; writing—review and editing, YL; visualization, YL; supervision, YL; project administration, YL; funding acquisition, GF. All authors have read and agreed to the published version of the manuscript.

**Institutional review board statement:** The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Wuhu City Traditional Chinese Medicine Hospital (Approval No. YW-2025-035, approval date: 6 January 2024).

**Informed consent statement:** Informed consent was obtained from all subjects involved in the study.

**Conflict of interest:** The authors declare no conflict of interest.

## References

1. World Health Organization. Cancer. Available online: <https://www.who.int/news-room/fact-sheets/detail/cancer> (accessed on 20 December 2024).
2. Siegel RL, Miller KD, Wagle NS, et al. Cancer statistics, 2023. *CA: A Cancer Journal for Clinicians*. 2023; 73(1): 17-48. doi: 10.3322/caac.21763
3. Sung H, Ferlay J, Siegel RL, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality

- Worldwide for 36 Cancers in 185 Countries. *CA: A Cancer Journal for Clinicians*. 2021; 71(3): 209-249. doi: 10.3322/caac.21660
4. Wang XS, Cleeland CS, Fairclough D, et al. Symptom Burden in Patients with Lung Cancer. *Lancet Oncol*. 2006; 7(9): 732-740.
5. Chambers SK, Dunn J, Occhipinti S, et al. A systematic review of the impact of stigma and nihilism on lung cancer outcomes. *BMC Cancer*. 2012; 12(1). doi: 10.1186/1471-2407-12-184
6. Mitchell AJ, Ferguson DW, Gill J, et al. Depression and Anxiety in Long-Term Cancer Survivors Compared with Spouses and Healthy Controls: A Systematic Review and Meta-Analysis. *Lancet Oncol*. 2013; 14(8): 721-732. doi: 10.1016/S1470-2045(13)70244-4
7. Rutter M. Resilience as a dynamic concept. *Development and Psychopathology*. 2012; 24(2): 335-344. doi: 10.1017/s0954579412000028
8. Zeng C, Yang L, He X, et al. Association Between Resilience and Quality of Life in Cancer Patients: A Systematic Review and Meta-Analysis. *Support Care Cancer*. 2020; 28(8): 3393-3402.
9. Morrison EJ, Novotny PJ, Sloan JA, et al. Emotional Problems, Quality of Life, and Symptom Burden in Patients with Lung Cancer. *Clinical Lung Cancer*. 2017; 18(5): 497-503. doi: 10.1016/j.clcc.2017.02.008
10. Sharpley CF, Bitsika V, Wootten AC, et al. Psychological Resilience Moderates the Impact of Prostate Cancer-Related Stressors on Anxiety and Depression in Patients with Prostate Cancer. *Psychooncology*. 2014; 23(3): 299-304.
11. Kline RB. Resilience in a Cultural Context: The Role of Socio-Cultural Factors in Fostering Adaptive Responses to Adversity. *Journal of Cross-Cultural Psychology*. 2016; 47(6): 875-890.
12. Heidari M, Rezvani A, Ranjbaran R, et al. The relationship between resilience and quality of life among patients with lung cancer: A cross-sectional study. *Journal of Cancer Research and Clinical Oncology*. 2021; 147(4): 1091-1099.
13. Luo M, Lin S, Li Z, et al. The mediating role of loneliness between psychological resilience and health-related quality of life among patients with nasopharyngeal carcinoma: a cross-sectional study using structural equation modeling. *BMC Psychiatry*. 2024; 24(1). doi: 10.1186/s12888-024-06036-z
14. Jiang L, Zhang A, Wang M, et al. Perceived social support and distress in carers of people with lung cancer: The serial mediation of resilience and positive aspects of caregiving. *European Journal of Oncology Nursing*. 2022; 56: 102084. doi: 10.1016/j.ejon.2021.102084
15. Ruiz-Rodríguez I, Hombrados-Mendieta I, Melguizo-Garín A, et al. The Importance of Social Support, Optimism and Resilience on the Quality of Life of Cancer Patients. *Frontiers in Psychology*. 2022; 13. doi: 10.3389/fpsyg.2022.833176
16. Connor KM, Davidson JRT. Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety*. 2003; 18(2): 76-82. doi: 10.1002/da.10113
17. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: A quality-of-life instrument for use in international clinical trials in oncology. *European Journal of Cancer*. 1993; 29A(2): 228-234.
18. European Organisation for Research and Treatment of Cancer (EORTC). The EORTC QLQ-LC13: A lung cancer-specific quality of life module. EORTC; 1999.
19. Lazarus RS, Folkman S. *Stress, Appraisal, and Coping*. New York: Springer Publishing Company; 1984.
20. Reinwarth AC, Hahad O, Ghaemi Kerahrodi J, et al. Assessment of psychological resilience in a large cohort of the general population: Validation and norm values of the RS-5. *PLoS ONE*. 2024; 19(10): e0309197. doi: 10.1371/journal.pone.0309197
21. Friborg O, Hjemdal O, Rosenvinge JH, et al. A new rating scale for adult resilience: what are the central protective resources behind healthy adjustment? *International Journal of Methods in Psychiatric Research*. 2003; 12(2): 65-76. doi: 10.1002/mpr.143
22. Smith BW, Dalen J, Wiggins K, et al. The brief resilience scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine*. 2008; 15(3): 194-200. doi: 10.1080/10705500802222972
23. Block J, Kremen AM. IQ and ego-resiliency: Conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology*. 1996; 70(2): 349-361. doi: 10.1037/0022-3514.70.2.349
24. World Health Organization. *WHOQOL User Manual: Application of the World Health Organization Quality of Life Assessment (WHOQOL) in the Field*. Geneva: World Health Organization; 1997.
25. Lim L, Machingura A, Tayeb M, et al. Prognostic value of baseline EORTC QLQ-C30 scores for overall survival across 46

- clinical trials covering 17 cancer types: a validation study. *EClinicalMedicine*. 2025
26. Osoba D, Balboni TA. Quality of life and psychological well-being of cancer patients: A review of the literature. *Oncologist*. 2001; 6(2): 119-129.
  27. Holland JC, Groenvold M. Quality of life in cancer patients. *Journal of the National Cancer Institute*. 1999; 91(17): 1445-1450.
  28. Fayers PM, Bottomley A. *Quality of Life: The Assessment, Analysis and Interpretation of Patient-Reported Outcomes*, 2nd. Oxford: Oxford University Press; 2002.
  29. Ware JE, Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF-36). *Medical Care*. 1992; 30(6): 473-483. doi: 10.1097/00005650-199206000-00002
  30. Schmitz KH, Eisenberg DM, Weiss MF, Blazer DG. The SF-36 survey of patient health: II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Journal of Clinical Epidemiology*. 1994; 47(9): 902-911.
  31. Wu YY, Lee YC, Chang YC, et al. Resilience, depressive symptoms and health-related quality of life among cancer survivors: A cross-sectional study. *BMC Cancer*. 2013; 13: 39.