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Original Article

Fear of cancer recurrence in patients with early-stage non-small cell lung cancer: A latent profile analysis

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ABSTRACT

Objective: This study aimed to identify latent profiles of fear of cancer recurrence (FCR) among patients with early-stage non-small cell lung cancer (NSCLC) and examine the associated factors.

Methods: A cross-sectional survey was conducted with 677 patients with early-stage NSCLC who underwent surgical treatment at a tier-three cancer hospital in Beijing between January 2022 and August 2023. Data collection included demographic variables and assessments using the Fear of Progression Questionnaire-Short Form (FoP-Q-SF), Herth Hope Index (HHI), and Social Support Rating Scale (SSRS). Latent profile analysis was employed to classify FCR levels and identify influencing factors.

Results: Three distinct FCR profiles emerged: "low FCR" (27.6%), "moderate FCR" (66.2%), and "high FCR" (6.2%). Independent risk factors for moderate FCR included individuals aged 36–60 years (odds ratio [OR] = 1.871, 95% confidence interval [CI] 1.208–2.899) and a household income below 5000 yuan (OR = 1.86, 95% CI 1.059–3.267). Protective factors for moderate FCR included lower levels of education (OR = 0.505, 95% CI 0.283–0.902), religious beliefs (OR = 0.355, 95% CI 0.152–0.833), and smoking (OR = 0.461, 95% CI 0.284–0.747). High FCR was strongly associated with being 36–60 years old, lower HHI scores (OR = 11.055, 95% CI 4.441–27.522), and poor social support (OR = 3.392, 95% CI 1.385–8.308).

Conclusions: FCR among patients with early-stage NSCLC can be categorized into distinct profiles, with specific demographic and psychosocial factors influencing severity. Tailored nursing interventions addressing varying FCR levels are critical to improving patient care and psychological well-being.

Introduction

Cancer remains a significant global health challenge. On February 2, 2024, the International Agency for Research on Cancer (IARC) published its latest report on the worldwide cancer burden, reporting nearly 20 million new cancer diagnoses in 2022. Lung cancer accounted for 2.48 million cases, representing 12.4% of all cancers. The report also indicated that there were 9.7 million cancer-related deaths globally in 2022, with lung cancer accounting for 1.8 million deaths, or 18.7% of the total. Lung cancer has now surpassed breast cancer as both the most prevalent and the deadliest cancer worldwide.[1]

Non-small cell lung cancer (NSCLC), which constitutes approximately 85% of all lung cancer cases,[2] has seen improved outcomes due to advancements in diagnosis and treatment. The five-year survival rate for patients with early-stage NSCLC has reached 84.20%.[3] For patients with early-stage NSCLC, addressing postoperative psychological health is a critical focus of cancer care. Despite surgical interventions, over 50% of these patients face a significant risk of recurrence or metastasis.[4] Consequently, patients with early-stage NSCLC often experience a psychological state of fear, worry, or worry about the possibility of cancer recurrence or progression, known as cancer recurrence fear (FCR).[5] The incidence of fear of cancer recurrence among cancer survivors ranges from 33% to 97%.[6] Studies have shown that patients experience fear of cancer recurrence for a long period of time after initial diagnosis and treatment.[7] Persistent FCR is strongly associated with heightened anxiety and depression, eroding patients' confidence in disease management and potentially compromising long-term survival.[8,9] High FCR levels can severely diminish the quality of life, causing insomnia, functional impairments, poor treatment adherence, increased health care costs, and uncertainty about the future.[10]

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Conversely, lower FCR levels are associated with improved treatment compliance and healthier lifestyle adoption.[11] Previous studies have found that the FCR scores of lung cancer chemotherapy patients are significantly negatively correlated with social support scores.[12] This means that the higher the patients' perceived level of social support, the lower their level of fear of cancer recurrence. Social support, as a kind of material and spiritual support, is conducive to patients' positive and optimistic treatment of their condition and reduces the level of psychological distress in cancer patients. It has also been shown that the level of hope of patients with recurrent malignant tumors may be related to their level of fear of cancer recurrence.[13] Patients with a high level of hope may be more able to face the disease positively, thus reducing the fear of recurrence. Therefore, this study included social support and hope level to further explore the relationship between the three. Addressing FCR remains one of the most significant unmet needs in cancer care. Early identification and intervention by health care providers are essential to mitigate its adverse effects and enhance patients' psychological well-being.

With the rising prevalence of population-based cancer screening and advancements in early detection techniques for lung cancer, addressing the frequently overlooked issue of elevated FCR in patients has become increasingly important. While earlier studies have explored FCR among patients with lung cancer, they frequently lack a comprehensive examination of the factors influencing this psychological burden. Latent Profile Analysis (LPA), a person-centered statistical approach, categorizes individuals into subgroups based on their response patterns across various observable variables. Unlike traditional variable-centered methodologies, LPA emphasizes individual differences, providing nuanced insights into the complexity and diversity of patient experiences.[14] In recent years, LPA has gained traction in mental health, education, management, and medical research due to its capacity to analyze heterogeneous populations. This study aimed to apply LPA to comprehensively assess FCR and its influencing factors in patients with early-stage NSCLC. The findings were expected to enhance clinical screening practices and serve as a foundation for developing targeted evidence-based intervention strategies.

Methods

Study participants

This study employed a continuous enrollment approach to recruit 677 patients with early-stage NSCLC who underwent surgical treatment at the Cancer Hospital of the Chinese Academy of Medical Sciences between January 2022 and August 2023. Inclusion criteria: (1) age $\geq$ 18 years; (2) The pathological result was early-stage NSCLC; (3) Tumor size-Nodal involvement-Metastasis (TNM) pathological staging of IA-IIB; and (4) provision of informed consent and willingness to participate in the survey. Exclusion criteria: (1) Severe physical illnesses, including terminal cancer, significant cardiovascular disease, or major organ failure. (2) Severe psychological illnesses, such as major depressive disorder or schizophrenia. (3) Communication or comprehension barriers, including visual impairment, lack of fluency in Mandarin, or hearing disabilities. (4) Incomplete or inconsistent questionnaire information.

Methodology

Survey instruments

General information questionnaire. This researcher-designed questionnaire gathered demographic and clinical data, including gender, age, smoking history, residence, occupation, monthly income, tumor markers, parental status, children's maturity, education level, religious beliefs, pathological stage, and method of medical expense payment.

Fear of progression questionnaire–short form (FoP-Q-SF). Developed by Mehnert et al.[15] and adapted into Chinese by Wu Qi Yun et al.,[16] this unidimensional scale evaluates fear of disease progression. The scale consists of 12 items with total scores ranging from 12 to 60. A score of $\geq$ 34 indicates psychological dysfunction. Medium-level FCR is characterized by at least 50% of items rated four or higher, while high-level FCR is defined as 75% or more of items rated four or higher. Responses are scored on a five-point Likert scale, ranging from "never" to "always," with higher scores reflecting greater fear. The scale demonstrated strong reliability (Cronbach's $\alpha = 0.883$) and validity.

Herth hope index (HHI). The HHI, developed by Herth[17] and translated into Chinese by Zhao Hai Ping,[18] assesses the level of hope among patients with cancer. It includes 12 items divided into three subscales: attitudes toward reality and the future, proactive actions, and maintaining close relationships. Scores range from 12 to 48, with higher scores reflecting more significant levels of hope. Hope levels are categorized as low (12–23), medium (24–35), and high (36–48). The HHI demonstrates robust reliability (retest reliability = 0.92) and internal consistency (Cronbach's $\alpha = 0.87$).

Social support rating scale (SSRS). The SSRS, developed by Xiao et al.,[19] measures levels of social support through 10 items distributed across three dimensions, including subjective support ($n = 3$), objective support ($n = 4$), and support availability ($n = 3$). Among them, responses to item 6 (source of financial support or practical help) and item 7 (source of comfort and concern) are scored as follows: a response of "no source" is assigned 0 points, while responses indicating one or more sources (A–H) are scored based on the number of sources selected. The remaining items are rated on a four-point scale, with higher scores reflecting more significant levels of social support. The SSRS demonstrates excellent reliability, with test-retest reliability of 0.92 and item consistency ranging from 0.89 to 0.91, indicating strong validity and robustness.

Survey methodology

Electronic surveys were postoperatively administered to patients with early-stage NSCLC who met the inclusion criteria. The required sample size was determined using the cross-sectional survey formula for continuous variables. Based on prior studies, calculations were performed in Power Analysis and Sample Size (PASS) 2020 software, configured for a two-sided test with an α of 0.05, a mean of 29.66, and a permissible error of 1. The calculated minimum sample size was 309, with an additional 20% buffer to account for potential loss, resulting in a target of at least 387 participants. Surveyors underwent online training to clearly understand the study's objectives, survey tools, and data collection protocols. Surveys were completed in distraction-free environments, with visually impaired participants supported by caregivers. A total of 715 questionnaires were distributed, and the accuracy of the survey data was cross-validated against records from the hospital's Health Information System (HIS).

Data analysis

Data entry and verification were conducted independently by two individuals to minimize errors. Descriptive statistics were employed for quantitative data following normal distribution, while frequencies and percentages were used for categorical variables. Exploratory LPA was performed using R software version 3.6.3, classifying patients based on their FCR scores. Model fit was assessed using multiple statistical criteria, including Pearson's χ^2 test, likelihood ratio tests, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), adjusted BIC (aBIC), bootstrap likelihood ratio test (BLRT), Lo-Mendell-Rubin (LMR)

test, and entropy scores. Each statistical method provides unique insights into assessing model fit. Lower AIC, BIC, and aBIC values indicate better model fit, while significant *P*-values ($P < 0.05$) from likelihood ratio tests and BLRT suggest the model's adequacy. Entropy values close to one reflect high classification accuracy. These criteria serve as mathematical tools for model selection. However, inconsistencies among them are not uncommon. Therefore, they should be used as supplementary guides rather than definitive measures. The final decision regarding the number of classes in the model should prioritize interpretability and its relevance to clinical decision-making, supported by statistical outcomes. Further statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) statistical software (version 25.0, International Business Machines Corporation, New York, USA), including Fisher's exact tests or one-way analysis of variance (ANOVA), to compare demographic and psychosocial factors across FCR categories. Proportional odds assumptions were tested, and depending on their results, either ordered or unordered multi-categorical logistic regression models were employed. Variables identified as significant in univariate analyses were analyzed using multivariate models to identify independent predictors ($P < 0.05$).

Ethical considerations

Ethical approval for this study was formally obtained from the Ethics Committee of the Cancer Hospital, Chinese Academy of Medical Sciences (Approval No. 23/313–4055). All participants provided written informed consent.

Results

Participant demographics

After excluding individuals who did not meet the inclusion criteria, 677 patients with early-stage NSCLC were included in the final analysis, yielding a high response rate of 94.7%. The flowchart is shown in Fig. 1. The cohort comprised 421 women and 256 men. The age distribution was as follows: 57 patients aged 18–35, 409 aged 36–60, and 211 aged over 60 years. Regarding smoking status, 110 participants were smokers, while 567 were non-smokers. Monthly income levels were categorized as follows: 114 patients earned less than 3000 yuan, 226 earned between 3000 and 5000 yuan, 200 earned between 5001 and 10,000 yuan, and 137 earned over 10,000 yuan (Table 1).

Latent profile analysis of fear of cancer recurrence

LPA of individual FCR scores explored models with one to five classes. The three-class model emerged as the optimal solution, evidenced by progressively lower AIC, BIC, and aBIC values, and an entropy score of 0.718. Significant likelihood ratio tests (LMR and BLRT) ($P < 0.05$) further validated the clinical relevance of this classification. Based on the analysis, three distinct FCR categories were identified (Table 2): Class 1 (low FCR) included 27.6% of patients (187 individuals), Class 2 (medium FCR) comprised 66.2% (448 individuals), and Class 3 (high FCR) accounted for 6.2% (42 individuals). Violin plots illustrate the

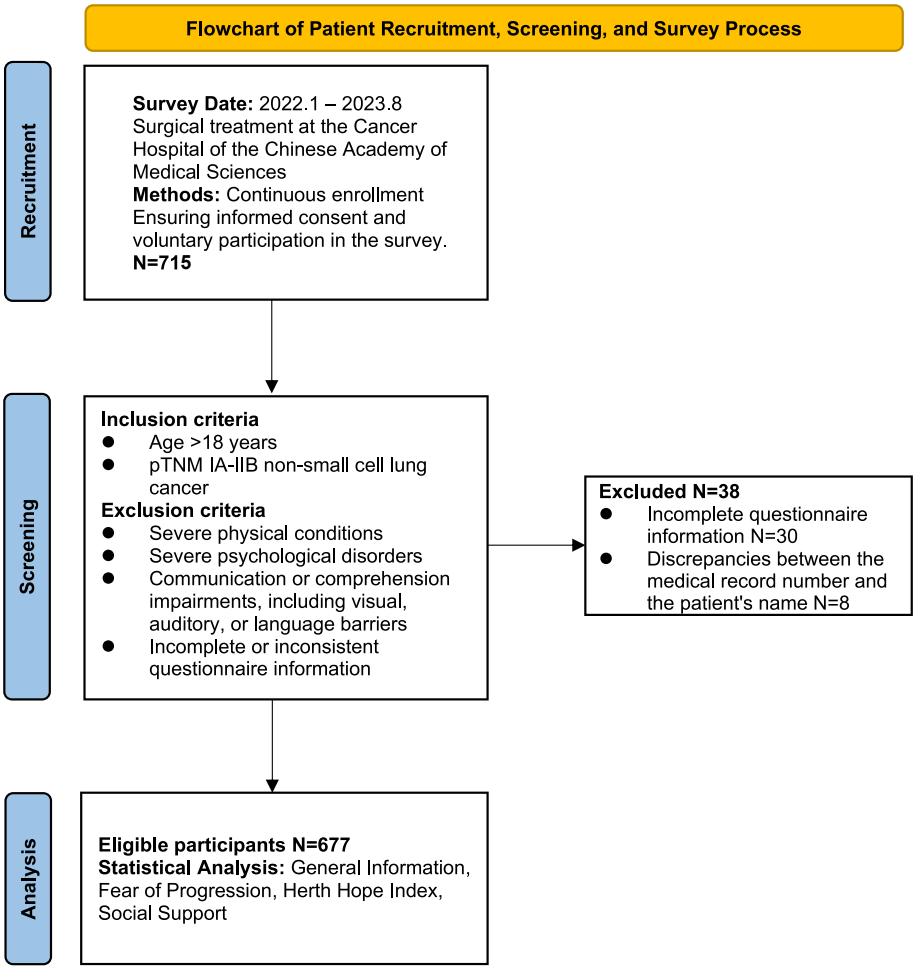

Fig. 1. Flowchart of patient recruitment, screening, and survey process. pTNM, pathological tumor-node-metastasis.

Table 1
Baseline characteristics and variance analysis ($N = 677$).

Variables	*n* (%)[c]	Mean	SD	*P*
Sex				
Male	256 (37.8)	28.4	9.5	0.001[b]
Female	421 (62.2)	30.7	8.7	
Age (years)				
18–35	57 (8.4)	32.5	8.1	<0.001[b]
36–60	409 (60.4)	31.0	9.0	
> 60	211 (31.2)	26.9	8.9	
Number of episodes				
Initial onset	651 (96.2)	29.9	9.0	0.198
Recurrence	26 (3.8)	27.6	10.7	
Course classification (months)				
0–12	505 (74.6)	29.7	9.0	0.454
13–36	120 (17.7)	29.9	9.8	
> 36	52 (7.7)	31.3	8.9	
Number of lesions				
A single	358 (52.9)	29.2	9.4	0.048[a]
Multiple	319 (47.1)	30.6	8.7	
Surgical modality				
Thoracotomy	9 (1.3)	29.3	10.7	0.868
Thoracoscopy	668 (98.7)	29.8	9.1	
Smoking				
Yes	110 (16.2)	28.4	10.8	0.077
No	567 (83.8)	30.1	8.7	
Education level				
Junior high school or below	150 (22.2)	28.5	10.7	0.089
High school grad	141 (20.8)	29.7	9.3	
College graduate or above	386 (57.0)	30.4	8.3	
Ethnicity				
Han nationality	628 (92.8)	29.7	9.0	0.215
Ethnic minorities	49 (7.2)	31.4	9.9	
Religion				
Yes	33 (4.9)	31.4	11.9	0.313
No	644 (95.1)	29.8	8.9	
Place of residence				
City	491 (72.5)	29.2	8.7	0.007[b]
Villages and towns	146 (21.6)	31.9	9.2	
Rural	40 (5.9)	30.4	12.1	
Occupation				
Worker	57 (8.4)	29.9	10.2	0.116
Technical personnel	77 (11.4)	31.0	8.2	
Farmer	50 (7.4)	30.0	12.1	
Businessmen or self-employed workers	41 (6.1)	30.7	8.9	
Administrative staff	126 (18.6)	31.5	8.1	
Health care workers	34 (5.0)	30.0	8.5	
Unemployed or retired	292 (43.1)	28.7	9.0	
Monthly income (yuan)				
< 3000	114 (16.8)	31.5	10.1	0.004[b]
3000–5000	226 (33.4)	30.8	9.1	
5001–10000	200 (29.5)	28.5	8.7	
> 10,000	137 (20.2)	28.8	8.4	
Medical payment method				
Own expense	31 (4.6)	30.6	8.6	0.532
Public expense	54 (8.0)	28.6	8.1	
Medical insurance	592 (87.4)	29.9	9.2	
Type of pathology				
Squamous cell carcinoma	34 (5.0)	29.2	10.3	0.832
Adenocarcinoma	641 (94.7)	29.9	9.0	
Large cell carcinoma	2 (0.3)	27.0	9.9	
T stage				
0	98 (14.5)	30.6	7.9	0.407
1	506 (74.7)	29.9	9.3	
2	66 (9.7)	29.0	9.3	
3	7 (1.0)	25.3	10.3	
N stage				
0	667 (98.5)	29.9	9.1	0.322
1	10 (1.5)	27.0	8.0	
Preoperative tumor markers				
Normal or unchecked	520 (76.8)	30.2	8.9	0.089
Abnormal	157 (23.2)	28.8	9.6	
Family history				
Yes	178 (26.3)	30.2	9.5	0.498
No	499 (73.7)	29.7	9.0	
Marital status				
Unmarried	28 (4.1)	32.7	9.6	0.225
Married	618 (91.3)	29.7	9.1	
Divorced	31 (4.6)	29.3	9.2	
Whether you have children				
Yes	635 (93.8)	29.6	9.1	0.033[a]
No	42 (6.2)	32.7	8.8	
Whether the child is an adult				
The children are all adults	488 (72.1)	28.9	9.3	0.001[b]
Children are partially adults	30 (4.4)	31.6	8.5	
All underage	117 (17.3)	32.1	8.0	
Childless	42 (6.2)	32.7	8.8	
Living alone				
Yes	176 (26.0)	30.0	9.3	0.845
No	501 (74.0)	29.8	9.0	
Combined with the underlying disease				
Yes	232 (34.3)	29.1	8.9	0.111
No	445 (65.7)	30.2	9.2	
Chemotherapy				
Yes	34 (5.0)	32.7	9.5	0.062
No	643 (95.0)	29.7	9.1	
Radiotherapy				
Yes	16 (2.4)	34.4	9.8	0.041[a]
No	661 (97.6)	29.7	9.1	
Herth hope index				
≤ 35	88 (13.0)	35.0	11.0	< 0.001[b]
> 35	589 (87.0)	29.1	8.5	
Social support rating scale				
≤ 40	114 (16.8)	33.6	10.2	< 0.001[b]
> 40	563 (83.2)	29.1	8.7	

SD, Standard deviation.
[a] $P < 0.05$.
[b] $P < 0.01$.
[c] Due to rounding, the sum of the percentages may not equal exactly 100%.

distribution of FCR scores across the three classes, with mean scores of 18.59 ± 3.96 for Class 1, 32.76 ± 4.78 for Class 2, and 48.67 ± 3.59 for Class 3 (Fig. 2A). Furthermore, mean item scores for each category (Fig. 2B) substantiated the validity of LPA in stratifying FCR levels among patients with early-stage NSCLC.

Univariate analysis of factors influencing FCR categories

Univariate analysis revealed significant differences ($P < 0.001$) across the three FCR categories based on various factors, including age, smoking status, educational level, religious beliefs, residence, occupation, monthly income, tumor marker levels, parental status, children's maturity, hope index scores, and social support levels (Table 3).

Multivariate analysis of factors influencing FCR categories

Since no valid linear trend was observed among FCR categories ($P < 0.001$), unordered multi-categorical logistic regression was used for multivariate analysis. Variables identified as significant in the univariate analysis were included in the model.

For the medium FCR group, compared to the low FCR group (reference category), independent risk factors were identified as age 36–60 years (odds ratio [OR] = 1.871, 95% confidence interval [CI] 1.208–2.899) and a household income below 5000 yuan (OR = 1.86, 95% CI 1.059–3.267). Protective factors associated with medium FCR included having an educational level of junior high school or below (OR = 0.505, 95% CI 0.283–0.902), holding religious beliefs (OR = 0.355, 95% CI 0.152–0.833), and smoking (OR = 0.461, 95% CI 0.284–0.747).

Conversely, for the high FCR group, significant independent risk factors were identified as being aged 36–60 years (OR = 3.828, 95% CI 1.309–11.192), having diminished hope (OR = 11.055, 95% CI 4.441–27.522), and reporting low social support (OR = 3.392, 95% CI 1.385–8.308) (Table 4).

Table 2
Summary of models.

Classes	AIC	BIC	aBIC	Entropy	LMR_*P* value	BLRT_*P* value	Classification number
1	4914.978	4924.013	4917.663				
2	4918.029	4936.100	4923.399	0.717	0.413	0.500	6698
3	4898.055	4925.161	4906.111	0.718	< 0.001**	< 0.001**	18,744,842
4	4893.193	4929.335	4903.934	0.701	0.073	< 0.001**	12,739,248,263
5	4894.406	4939.583	4907.832	0.744	0.400	0.235	127,922,327,642

*$P < 0.05$, **$P < 0.01$. AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; aBIC, adjusted Bayesian Information Criterion; Entropy, information entropy; LMR, Likelihood Ratio Test; BLRT, Bootstrap Likelihood Ratio Test.

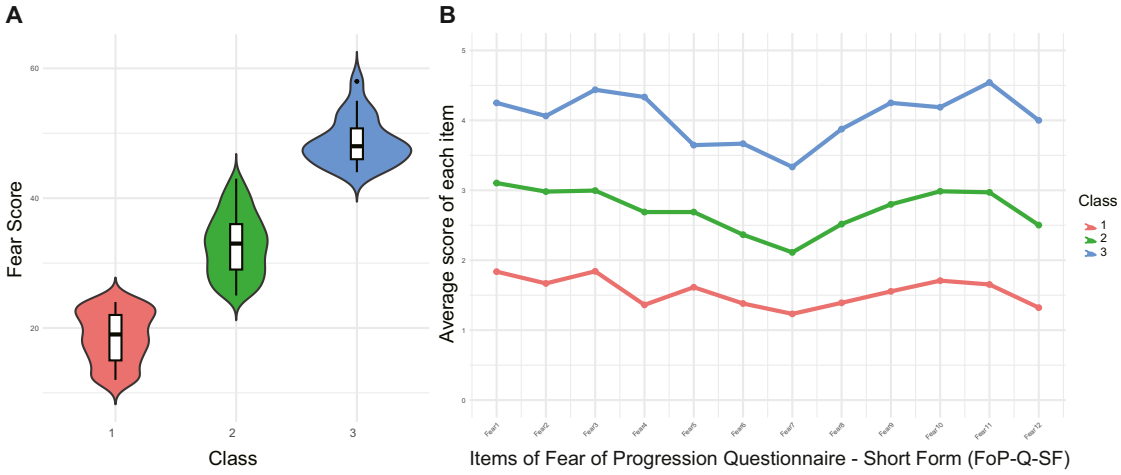

Fig. 2. Total fear scores and average item scores for each group identified through the latent profile analysis.

Discussion

This study categorized fear of recurrence in patients with early-stage NSCLC into three distinct levels. Notably, we identified both independent risk and protective factors, which had not been thoroughly examined in previous studies. Patients aged 36–60 years were found to be at an increased risk of experiencing moderate to high levels of fear of recurrence. Additionally, patients with a monthly family income below 5000 were more likely to exhibit moderate fear of recurrence. Low social support and diminished hope levels were identified as independent risk factors for high fear of recurrence. Interestingly, factors such as having a junior high school education or lower, religious beliefs, and smoking emerged as independent protective factors against moderate fear of recurrence. These findings offer valuable insights for clinical health care professionals to develop effective, targeted interventions.

Current status of fear of cancer recurrence (FCR) in those with early-stage NSCLC

This study analyzed FCR levels in 677 patients with early-stage NSCLC. The findings indicate that the majority of these patients experienced moderate FCR after surgery, while a smaller proportion exhibited high levels of FCR. These results align with previous research,[20] highlighting the need to systematically identify FCR levels in clinical practice. Special attention must be given to patients with moderate FCR, as they face an increased risk of progressing to severe FCR. Targeted preventive interventions are essential to curb this escalation, along with ongoing monitoring to identify and address psychological concerns that could adversely affect treatment adherence and overall recovery.

The FCR scale is a validated pan-cancer assessment tool, demonstrating excellent reliability and broad applicability across cancer populations. It is appropriate for evaluating FCR in patients with early-stage NSCLC. However, the standard severity classifications outlined in the original scale were not adopted, as those with early-stage NSCLC represent a distinct group with unique psychological characteristics. Therefore, the LPA was employed, providing a more refined classification of FCR severity tailored to this population. Our findings revealed apparent differences in FCR scores across the three LPA-defined categories: low, moderate, and high FCR, demonstrating the utility of LPA in accurately stratifying FCR severity among patients with early-stage NSCLC. Moreover, compared to the original FCR scale severity classifications, our results show strong alignment for high and low FCR categories. However, moderate FCR in our study was comparatively lower than the original definition, with mean item scores below 4. This discrepancy may reflect the relatively lower overall FCR in those with early-stage lung cancer compared to the broader cancer population, highlighting the distinct psychological characteristics of this subgroup. Despite this, a substantial proportion of patients with early-stage lung cancer experienced moderate to high FCR, manifesting as decompensated emotional states that severely impacted their overall quality of life and mental health. This phenomenon, frequently described as “mild disease, high fear,” highlights the urgency of identifying the factors contributing to elevated fear levels in this patient group, warranting further investigation.

Factors influencing FCR in patients with early-stage NSCLC

Risk and protective factors for moderate FCR

An in-depth analysis revealed distinct factors in each FCR category. For moderate FCR, two independent risk factors were identified: being aged 36–60 years (OR = 1.871, 95% CI 1.208–2.899) and household income below 5000 yuan (OR = 1.86, 95% CI 1.059–3.267). Individuals aged 36–60 years are primary financial providers and caregivers for their families.[21] A cancer diagnosis in this demographic frequently triggers fears of physical decline, potential loss of income, and an increased financial burden, particularly given the substantial costs associated with cancer treatment. Concerns about their ability to care for their children or older parents may exacerbate these anxieties, resulting in guilt and heightened

Table 3
Results of univariate analysis.

Variables	Low Fear ($n = 187$) n (%)	Middle Fear ($n = 448$) n (%)	High Fear ($n = 42$) n (%)	P
Sex				
Male	83 (44.4)	159 (35.5)	14 (33.3)	0.09
Female	104 (55.6)	289 (64.5)	28 (66.7)	
Age (years)				
18–35	8 (4.3)	44 (9.8)	5 (11.9)	< 0.001[b]
36–60	91 (48.7)	289 (64.5)	29 (69.0)	
> 60	88 (47.1)	115 (25.7)	8 (19.0)	
Number of episodes				
Initial onset	176 (94.1)	435 (97.1)	40 (95.2)	0.169
Recurrence	11 (5.9)	13 (2.9)	2 (4.8)	
Course classification (months)				
0–12	139 (74.3)	338 (75.4)	28 (66.7)	0.439
13–36	37 (19.8)	74 (16.5)	9 (21.4)	
> 36	11 (5.9)	36 (8.0)	5 (11.9)	
Number of lesions				
A single	111 (59.4)	225 (50.2)	22 (52.4)	0.109
Multiple	76 (40.6)	223 (49.8)	20 (47.6)	
Surgical modality				
Thoracotomy	3 (1.6)	6 (1.3)	0 (0.0)	0.847
Thoracoscopy	184 (98.4)	442 (98.7)	42 (100.0)	
Smoking				
Yes	45 (24.1)	57 (12.7)	8 (19.0)	0.002[b]
No	142 (75.9)	391 (87.3)	34 (81.0)	
Education level				
Junior high school or below	59 (31.6)	78 (17.4)	13 (31.0)	< 0.001[b]
High school grad	40 (21.4)	90 (20.1)	11 (26.2)	
College graduate or above	88 (47.1)	280 (62.5)	18 (42.9)	
Ethnicity				
Han nationality	171 (91.4)	420 (93.8)	37 (88.1)	0.245
Ethnic minorities	16 (8.6)	28 (6.3)	5 (11.9)	
Religion				
Yes	12 (6.4)	15 (3.3)	6 (14.3)	0.006[b]
No	175 (93.6)	433 (96.7)	36 (85.7)	
Place of residence				
City	141 (75.4)	331 (73.9)	19 (45.2)	< 0.001[b]
Villages and towns	32 (17.1)	98 (21.9)	16 (38.1)	
Rural	14 (7.5)	19 (4.2)	7 (16.7)	
Occupation				
Worker	18 (9.6)	36 (8.0)	3 (7.1)	0.003[b]
Technical personnel	13 (7.0)	59 (13.2)	5 (11.9)	
Farmer	20 (10.7)	21 (4.7)	9 (21.4)	
Businessmen or self-employed workers	11 (5.9)	26 (5.8)	4 (9.5)	
Administrative staff	27 (14.4)	92 (20.5)	7 (16.7)	
Health care workers	9 (4.8)	24 (5.4)	1 (2.4)	
Unemployed or retired	89 (47.6)	190 (42.4)	13 (31.0)	
Monthly income (yuan)				
< 3000	28 (15.0)	72 (16.1)	14 (33.3)	0.045[a]
3000–5000	54 (28.9)	157 (35.0)	15 (35.7)	
5001–10,000	62 (33.2)	129 (28.8)	9 (21.4)	
> 10,000	43 (23.0)	90 (20.1)	4 (9.5)	
Medical payment method				
Own expense	7 (3.7)	22 (4.9)	2 (4.8)	0.709
Public expense	15 (8.0)	38 (8.5)	1 (2.4)	
Medical insurance	165 (88.2)	388 (86.6)	39 (92.9)	
Type of pathology				
Squamous cell carcinoma	11 (5.9)	21 (4.7)	2 (4.8)	0.738
Adenocarcinoma	175 (93.6)	426 (95.1)	40 (95.2)	
Large cell carcinoma	1 (0.5)	1 (0.2)	0 (0.0)	
T stage				
0	25 (13.4)	69 (15.4)	4 (9.5)	0.867
1	140 (74.9)	331 (73.9)	35 (83.3)	
2	19 (10.2)	44 (9.8)	3 (7.1)	
3	3 (1.6)	4 (0.9)	0 (0.0)	
N stage				
0	183 (97.9)	442 (98.7)	42 (100.0)	0.733
1	4 (2.1)	6 (1.3)	0 (0.0)	
Preoperative tumor markers				
Normal or unchecked	131 (70.1)	358 (79.9)	31 (73.8)	0.024[a]
Abnormal	56 (29.9)	90 (20.1)	11 (26.2)	
Family history				
Yes	48 (25.7)	118 (26.3)	12 (28.6)	0.903
No	139 (74.3)	330 (73.7)	30 (71.4)	
Marital status				
Unmarried	5 (2.7)	19 (4.2)	4 (9.5)	
Married	171 (91.4)	411 (91.7)	36 (85.7)	
Divorced	11 (5.9)	18 (4.0)	2 (4.8)	
Whether you have children				
Yes	181 (96.8)	417 (93.1)	37 (88.1)	0.046[a]
No	6 (3.2)	31 (6.9)	5 (11.9)	
Whether the child is an adult				
The children are all adults	157 (84.0)	301 (67.2)	30 (71.4)	0.001[b]
Children are partially adults	5 (2.7)	24 (5.4)	1 (2.4)	
All underage	19 (10.2)	92 (20.5)	6 (14.3)	
Childless	6 (3.2)	31 (6.9)	5 (11.9)	
Living alone				
Yes	47 (25.1)	116 (25.9)	13 (31.0)	0.718
No	140 (74.9)	332 (74.1)	29 (69.0)	
Combined with the underlying disease				
Yes	71 (38.0)	149 (33.3)	12 (28.6)	
No	116 (62.0)	299 (66.7)	30 (71.4)	
Chemotherapy				
Yes	6 (3.2)	24 (5.4)	4 (9.5)	0.182
No	181 (96.8)	424 (94.6)	38 (90.5)	
Radiotherapy				
Yes	2 (1.1)	12 (2.7)	2 (4.8)	0.182
No	185 (98.9)	436 (97.3)	40 (95.2)	
Herth hope index				
≤ 35	15 (8.0)	52 (11.6)	21 (50.0)	<0.001[b]
> 35	172 (92.0)	396 (88.4)	21 (50.0)	
Social support rating scale				
≤ 40	25 (13.4)	86 (19.2)	18 (42.9)	<0.001[b]
> 40	162 (86.6)	362 (80.8)	24 (57.1)	

[a] $P < 0.05$.
[b] $P < 0.01$.

fear of disease progression or recurrence.[22] This finding emphasizes the need for health care professionals to focus on this vulnerable age group, as they are uniquely burdened by overlapping work, family, and health-related responsibilities. To address their specific challenges, clinicians should provide tailored support, including comprehensive FCR assessments, guidance, and regular follow-ups. Targeted and timely interventions to alleviate this ambivalence can significantly mitigate FCR levels and improve psychological outcomes. Furthermore, patients with a monthly household income below 5000 yuan demonstrated a higher likelihood of experiencing FCR, consistent with previous research findings.[23] Despite advancements in national health insurance coverage, out-of-pocket expenses continue to impose a significant financial burden strain, particularly on low-income families. These patients face substantial economic and psychological pressures during treatment, frequently compounded by neglect from family members or societal systems. Therefore, health care providers should focus on developing cost-effective treatment plans while encouraging support from family, friends, charitable organizations, and community initiatives to alleviate financial burdens and reduce FCR.

Our study revealed some intriguing insights. First, a higher education level (high school or above) did not significantly lower the risk of moderate FCR compared to lower education levels (OR = 0.505, 95% CI 0.283–0.902). This finding contradicts the conventional assumption that higher education correlates with improved mental health outcomes.[24] The findings suggest that complex social, psychological, and environmental factors may modulate the relationship between education and FCR. Religious beliefs (OR = 0.355, 95% CI 0.152–0.833) emerged as an

Table 4
Results of Multivariate analysis.

Variables	Middle Fear/Low Fear				High Fear/Low Fear			
	OR	95% CI Low	95% CI High	*P*	OR	95% CI Low	95% CI High	*P*
Age (years)								
18–35	2.255	0.772	6.588	0.137	5.479	0.796	37.741	0.084
36–60	1.871	1.208	2.899	0.005[b]	3.828	1.309	11.192	0.014[a]
> 60[c]								
Smoking								
Yes	0.461	0.284	0.747	0.002[b]	0.517	0.185	1.441	0.207
No[c]								
Education level								
Junior high school or below	0.505	0.283	0.902	0.021[a]	0.509	0.122	2.135	0.356
High school grad	0.852	0.493	1.474	0.568	1.716	0.520	5.660	0.376
College graduate or above[c]								
Religion								
Yes	0.355	0.152	0.833	0.017[a]	2.351	0.643	8.599	0.196
No[c]								
Place of residence								
City	0.794	0.289	2.181	0.655	0.269	0.050	1.439	0.125
Villages and towns	1.098	0.397	3.039	0.857	0.804	0.170	3.791	0.783
Rural[c]								
Occupation								
Worker	0.932	0.468	1.856	0.841	0.804	0.177	3.657	0.778
Technical personnel	1.415	0.681	2.939	0.352	2.381	0.558	10.162	0.241
Farmer	0.572	0.218	1.500	0.256	2.682	0.508	14.164	0.245
Businessmen or self-employed workers	1.091	0.478	2.489	0.836	2.308	0.472	11.301	0.302
Administrative staff	1.061	0.594	1.894	0.842	1.313	0.372	4.644	0.672
Health care workers	0.846	0.350	2.044	0.710	0.636	0.063	6.467	0.702
Unemployed or retired[c]								
Monthly income (yuan)								
< 3000	2.244	1.078	4.672	0.031[a]	4.645	0.933	23.114	0.061
3000–5000	1.860	1.059	3.267	0.031[a]	3.533	0.852	14.649	0.082
5001–10,000	1.108	0.652	1.880	0.705	1.658	0.398	6.899	0.487
> 10,000[c]								
Preoperative tumor markers								
Normal or unchecked	1.235	0.799	1.910	0.342	0.936	0.381	2.299	0.886
Abnormal[c]								
Whether you have children								
Yes	1.023	0.334	3.133	0.968	0.645	0.103	4.026	0.639
No[c]								
Whether the child is an adult								
The children are all adults	0.657	0.349	1.238	0.194	0.660	0.190	2.298	0.514
Children are partially adults	1.381	0.426	4.480	0.591	0.172	0.012	2.534	0.200
All underage	0.937	0.343	2.558	0.899	0.379	0.085	1.699	0.205
Childless[c]								
Herth hope index								
≤ 35	1.487	0.785	2.818	0.223	11.055	4.441	27.522	< 0.001[b]
> 35[c]								
Social support rating scale								
≤ 40	1.641	0.971	2.774	0.064	3.392	1.385	8.308	0.008[b]
> 40[c]								

OR, Odds ratio; CI, confidence interval.
[a] $P < 0.05$.
[b] $P < 0.01$.
[c] Indicates the reference group.

independent protective factor against FCR. This finding contrasts with Mehnert et al.'s study,[25] which found no significant association between religious beliefs and FCR. Religious faith likely offers spiritual support[26] and psychological comfort during the challenging experience of cancer diagnosis and treatment. For some patients, faith may function as a form of psychological "placebo," fostering resilience and alleviating emotional distress. Future studies focusing on diverse cultural and religious groups are warranted to elucidate the role of religious beliefs in mitigating FCR among patients with cancer.

Interestingly, smoking (OR = 0.461, 95% CI 0.284–0.747) was identified as a protective factor against moderate FCR, a finding that contrasts with previous research linking smoking to increased FCR levels.[27] One possible explanation is that patients with lung cancer who smoke may experience lower FCR due to a form of psychological preparedness related to their smoking habits. Many smokers recognize the risks associated with tobacco use, which may foster mental readiness for a potential diagnosis. Moreover, the postoperative act of quitting smoking may provide patients with a sense of control and empowerment, further alleviating FCR. Conversely, non-smokers may experience more significant confusion and uncertainty about their diagnosis, leading to heightened FCR due to the unclear origins of their illness.

Our findings provide valuable insights into the factors contributing to moderate FCR and extend the understanding of its risk profile by incorporating education level, religious beliefs, and smoking status as influential variables. This enriched perspective lays the groundwork for designing targeted interventions to address FCR.

Independent risk factors for high FCR

A detailed analysis of factors associated with high FCR revealed that being aged 36–60 years (OR = 1.871, 95% CI 1.208–2.899) was a significant determinant. This age group, already identified as a key risk factor for moderate FCR, warrants particular focus in future intervention strategies.

Our findings highlighted the critical influence of psychosocial factors. Diminished hope as measured by HHI scores (OR = 11.055, 95% CI 4.441–27.522) and limited social support (OR = 3.392, 95% CI 1.385–8.308) emerged as independent predictors of high FCR. These results underscore the strong negative correlation between hope and FCR, where diminished hope is closely linked to heightened FCR.[13] For patients with early-stage NSCLC, a decline in hope can erode treatment motivation, worsening psychological outcomes such as anxiety and depression. This finding underscores the critical need for a comprehensive, multidimensional assessment of FCR in patients with early-stage NSCLC, particularly on psychosocial and emotional factors. Social support and hope play interdependent roles in alleviating FCR. While social support provides essential external resources and emotional reassurance, hope is an internal driver, fostering resilience and a constructive mindset. Integrating these two elements enables health care professionals to offer more holistic and effective psychological interventions, empowering patients to manage their FCR better. Furthermore, this approach highlights opportunities to improve FCR screening and develop tailored, evidence-based strategies that address the unique psychological needs of this patient population.

Implications for nursing practice and research

FCR is a prevalent concern that affects more than half of all cancer survivors, making it a critical issue in cancer care. Unresolved low to moderate FCR can progress to high FCR, leading to significant declines in patients' quality of life, reduced treatment efficacy, and shorter survival. This study's approach to profiling FCR in patients with early-stage NSCLC has highlighted key factors influencing FCR, offering clear direction for clinical interventions aimed at prevention and reduction.

Limitations

This study focused on patients with early-stage NSCLC. However, existing research indicates that FCR is prevalent across various cancer types. Given its widespread impact, future studies should explore FCR in patients with other cancer types, using the findings of this study as a reference and further investigating whether FCR similarly plays a critical role in these populations. Cross-cancer validation would not only expand the scope of this research but also enhance our understanding of the psychological challenges faced by cancer patients. Although this study was conducted at a leading Grade A tertiary oncology hospital in China, ensuring a high level of representativeness, it was limited by its single-center, cross-sectional design. To better evaluate the trajectory of FCR over time, future research should adopt a large-sample, multi-center, longitudinal approach.

Conclusions

In summary, LPA facilitates a more accurate classification of FCR levels, identifying distinct factors influencing moderate and high FCR. This enhanced precision enables health care providers to implement more targeted interventions, offering clinical guidance and yielding immediate benefits. Our comprehensive, multidimensional analysis deepened the understanding of FCR's complexity and variability across different patient groups.

Future research should investigate the interactions among these factors and develop strategies to manage and mitigate FCR in clinical settings. Such efforts are essential for improving patients' quality of life and enhancing treatment outcomes.

CRediT authorship contribution statement

ML: Conceptualization, Data curation, Writing. LL: Conceptualization, Methodology, Data curation. ZHL: Methodology, Data curation, Formal analysis. JZ: Writing – Revised draft preparation, Data curation. QPZ: Writing – Revised draft preparation, Data curation. All authors had full access to all the data in the study, and the corresponding authors had final responsibility for the decision to submit for publication. The corresponding authors attest that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Ethics statement

The study was approved by the Ethics Committee of the Cancer Hospital, Chinese Academy of Medical Sciences (Approval No. 23/313–4055) and was conducted in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All participants provided written informed consent.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, Jun Zhao, upon reasonable request.

Declaration of generative AI and AI-assisted technologies in the writing process

No AI tools/services were used during the preparation of this work.

Declaration of competing interest

The authors declare no conflict of interest.

References

1. Global cancer burden growing, amidst mounting need for services. *Saudi Med J*. 2024 Mar;45(3):326–327.
2. Gridelli C, Rossi A, Carbone DP, et al. Non-small-cell lung cancer. *Nat Rev Dis Primers*. 2015 May 21;1:15009. https://doi.org/10.1038/nrdp.2015.9.
3. Wang C, Shao J, Song L, et al. Persistent increase and improved survival of stage I lung cancer based on a large-scale real-world sample of 26,226 cases. *Chin Med J (Engl Ed)*. 2023 Aug 20;136(16):1937–1948. https://doi.org/10.1097/CM9.0000000000002729.
4. Gowing S, Baker L, Tran A, et al. Postoperative adverse events are associated with oncologic recurrence following curative-intent resection for lung cancer. *Lung*. 2020 Dec;198(6):983. https://doi.org/10.1007/s00408-020-00409-3.
5. Schapira L, Zheng Y, Gelber SI, et al. Trajectories of fear of cancer recurrence in young breast cancer survivors. *Cancer*. 2022;128(2):335–343. https://doi.org/10.1002/cncr.33921.
6. Simard S, Thewes B, Humphris G, et al. Fear of cancer recurrence in adult cancer survivors : a systematic review of quantitative studies. *Cancer Surv*. 2013 Sep;7(3):300–322. https://doi.org/10.1007/s11764-013-0272-z.
7. Cohre AA, Adams RN, Johns SA, et al. Long-term fear of recurrence in young breast cancer survivors and partners. *Psychooncology*. 2017;26(1):22–28. https://doi.org/10.1002/pon.4008.
8. Kim SY, Kim S. Do COVID-19–related treatment changes influence fear of cancer recurrence, anxiety, and depression in breast cancer patients? *Cancer Nurs*. 2022;45(2):E628–E638. https://doi.org/10.1097/NCC.0000000000000937.
9. Yang Y, Sun H, Luo X, et al. Network connectivity between fear of cancer recurrence, anxiety, and depression in breast cancer patients. *Affect Disord*. 2022;309:358–367. https://doi.org/10.1016/j.jad.2022.04.119.
10. Hao X, Li H, Zhan T. Research status on fear of cancer recurrence. *Chin J Mod Nurs*. 2022;(17):2376–2380. https://doi.org/10.3760/cma.j.cn115682-20210912-04124.
11. Li W, Li X, Chen T, et al. Factors affecting lung cancer patients' intention to perform early postoperative exercise: a qualitative study based on theory of planned behavior. *Support Care Cancer*. 2023;31(11):649. https://doi.org/10.1007/s00520-023-08107-5.

12. Yu Z, Sun D, Sun J. Social support and fear of cancer recurrence among Chinese breast cancer survivors: the mediation role of illness uncertainty. *Front Psychol*. 2022 Mar 16;13:864129. https://doi.org/10.3389/fpsyg.2022.864129.
13. Liu M, Liu L, Zhang S, et al. Fear of cancer recurrence and hope level in patients receiving surgery for non-small cell lung cancer: a study on the mediating role of social support. *Support Care Cancer*. 2022 Nov;30(11):9453–9460. https://doi.org/10.1007/s00520-022-07318-6.
14. Yin K, Peng J, Zhang J. Application of potential profile analysis in the field of organizational behavior. *Prog Psycholog Sci*. 2020;28(7):1056–1070. https://doi.org/10.3724/SP.J.1042.2020.01056.
15. Mehnert A, Herschbach P, Berg P, et al. Fear of progression in breast cancer patients–validation of the short form of the Fear of Progression Questionnaire (FoP-Q-SF). *Zeitschrift fur Psychosomatische Medizin und Psychotherapie*. 2006;52(3):274–288. https://doi.org/10.13109/zptm.2006.52.3.274.
16. Wu Q, Ye Z, Li L, et al. Sinicization and reliability and validity analysis of simplified scale of fear of disease progression in cancer patients. *Chin J Nurs*. 2015;50(12):1515–1519. https://doi.org/10.3761/j.issn.0254-1769.2015.12.021.
17. Herth K. Enhancing hope in people with a first recurrence of cancer. *J Adv Nurs*. 2000;32(6):1431–1441. https://doi.org/10.1046/j.1365-2648.2000.01619.x.
18. Zhao H, Wang J. Social support and hope for hemodialysis patients. *Chin J Nurs*. 2000;35(5):306–308.
19. Xiao S. Theoretical basis and research application of "social support assessment scale". *Clin Psychol*. 1994;2:98–100.
20. Luigjes-Huizer YL, Tauber NM, Humphris G, et al. What is the prevalence of fear of cancer recurrence in cancer survivors and patients? A systematic review and individual participant data meta-analysis. *Psychooncology*. 2022;31(6):879–892. https://doi.org/10.1002/pon.5921.
21. Sun H, Yang Y, Zhang J, et al. Fear of cancer recurrence, anxiety and depressive symptoms in adolescent and young adult cancer patients. *Neuropsychiatric Dis Treat*. 2019:857–865. https://doi.org/10.2147/NDT.S202432.
22. Faraji A, Dehghani M, Khatibi A. Familial aspects of fear of cancer recurrence: current insights and knowledge gaps. *Front Psychol*. 2023 Nov 15;14:1279098. https://doi.org/10.3389/fpsyg.2023.1279098.
23. Götze H, Taubenheim S, Dietz A, et al. Fear of cancer recurrence across the survivorship trajectory: results from a survey of adult long-term cancer survivors. *Psychooncology*. 2019;28(10):2033–2041. https://doi.org/10.1002/pon.5188.
24. Li J, Yang L, Zhu J, et al. Analysis of negative social expectations and influencing factors in 200 patients with concurrent chemoradiotherapy for nasopharyngeal carcinoma. *J Nurs*. 2023;30(11):65–70.
25. Mehnert A, Berg P, Henrich G, et al. Fear of cancer progression and cancer-related intrusive cognitions in breast cancer survivors. *Psychooncology J Psychol Social Behav Dimen Cancer*. 2009;18(12):1273–1280. https://doi.org/10.1002/pon.1481.
26. Yuanling Tao, Sun Li, Zhang Lili. Spiritual coping status and influencing factors in patients with advanced cancer. *J Nurs Manag*. 2022;22(2):105–110. https://doi.org/10.3969/j.issn.1671-315x.2022.02.006.
27. Fisher A, Beeken R, Heinrich M, et al. Health behaviours and fear of cancer recurrence in 10 969 colorectal cancer (CRC) patients. *Psychooncology*. 2016;25(12):1434–1440. https://doi.org/10.1002/pon.4076.