



Original Article

Fear of cancer recurrence and associated factors in family caregivers of patients with hematologic malignancy receiving chemotherapy: A latent profile analysis

Li Sheng^{a, #}, Yingying Zhu^{a, #}, Yajiao Liu^b, Haiying Hua^{a, c, *}, Jingfen Zhou^c, Long Ye^c

^a Wuxi School of Medicine, Jiangnan University, Wuxi, China

^b Nursing Department, The Second Affiliated Hospital of Zhejiang University School of Medicine, Hangzhou, China

^c Department of Hematology, Affiliated Hospital of Jiangnan University, Wuxi, China

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ABSTRACT

Objective: This study identified the potential subgroups of fear of cancer recurrence (FCR) in family caregivers (FCs) of patients with hematologic malignancies receiving chemotherapy, as well as exploring factors associated with subgroups.

Methods: This was a cross-sectional study involving 206 pairs of participating patients with hematologic malignancies receiving chemotherapy and their FCs. Using Mplus 8.3 to perform the latent profile analysis of FCs' FCR, the FCs' burden, quality of life, psychological resilience, and anxiety as well as their demographic characteristics were compared between the subgroups, with a logistic regression analysis being applied to examine the factors associated with the FCR subgroups.

Results: A total of 206 FCs were classified into two subgroups: "a low level of FCR" (Class 1, 65.4%) and "a high level of FCR" (Class 2, 34.6%). Quality of life, anxiety, and frequency of chemotherapy were significantly associated with the two subgroups.

Conclusions: FCs of patients with hematologic malignancy receiving chemotherapy had two FCR subgroups, "a low level of FCR" and "a high level of FCR", in association with quality of life, anxiety, and frequency of chemotherapy. These findings provide the theoretical foundations for screening the FCR factor of FCs and conducting interventions for them.

Introduction

Hematologic malignancies are a group of malignant diseases that originate in hematopoietic organs with an incidence rate that ranks in the top 10 of the overall global cancer incidence rates.¹ Including leukemia, multiple myeloma, lymphoma, and other connected diseases, hematologic malignancies have diverse clinical characteristics, therapeutic responses, and outcomes stemming from their high heterogeneity of tumor biology, with a five-year survival rate of 70.5%.^{2–4} According to the statistics of the World Health Organization, in 2020, the incidence rates of leukemia, non-Hodgkin lymphoma, Hodgkin lymphoma, and multiple myeloma in China were 5.9/100,000, 6.4/100,000, 0.47/100,000, and 1.5/100,000, respectively.⁵ Despite the improvement in survival and prognosis of

patients with hematologic malignancies due to increasing and evolving medical research, they are still vulnerable to the risk of relapse.⁶

Fear of cancer recurrence (FCR) is defined as "fear, worry, or concern about the possibility of recurrence or progression of cancer," which is a common concern among cancer patients.⁷ Studies have indicated that high levels of FCR are associated with low family resilience, social support, physical health, and poor emotional well-being.^{8,9} Approximately 16.3%–56.4% of hematologic malignancy patients have experienced high levels of FCR.^{8,9} FCR is also one of the unmet needs among family caregivers (FCs).¹⁰

FCs, including partners, children, parents, relatives, friends, or neighbors, take up the duty of unpaid informal caregivers for cancer patients.¹¹ A study has indicated that caregivers also experience varying

* Corresponding author.

E-mail address: huaHY007@163.com (H. Hua).

These authors contributed equally to this work.

levels of FCR, and sometimes their FCR levels could be higher than those of the patients.¹² Even several years after diagnosis, 35% of FCs of cancer patients experience high levels of FCR.¹³ This fear not only increases the psychological burden on the caregivers,¹⁴ affecting their physical and mental health as well as their quality of life^{15,16} but also diminishes their caregiving abilities, thereby impacting the quality of life of the patients.¹⁷ In China, the primary caregiving responsibility for hematologic malignancy patients often falls on family members. Faced with the long-term side effects of the patient undergoing chemotherapy (such as anxiety, vomiting, fatigue)¹⁸ and the high cost of treatment, caregivers bear the burden of prolonged care, which can be physically and emotionally taxing.¹⁹ While providing comprehensive physical, psychological, and emotional care and support, they may encounter various pressures (such as financial difficulties, time conflicts, a sense of treatment futility, and the loss of loved ones),⁴ which may lead to adverse physical and mental consequences such as anxiety and fear.^{4,15,20} However, despite relevant reports on FCR in FCs of solid tumor patients,^{13,21–23} there is still a lack of research on FCR in FCs of hematologic malignancy patients receiving chemotherapy. Therefore, it is necessary to conduct FCR-related studies in this specific caregiving context.

According to the literature, good social support,²⁴ positive coping strategies²⁵ (Planning, Interpersonal, Relaxation, and Positive focus), and higher psychological resilience²⁶ have positive impacts on FCR in caregivers of solid tumor patients. In addition, psychosocial issues such as inadequate disease awareness,²⁷ anxiety,¹⁷ and self-disclosure inhibition²⁸ have negative impacts on FCR in caregivers of solid tumor patients. However, these studies only focus on exploring the factors related to FCR in caregivers of solid tumor patients and do not include FCR in FCs of hematologic malignancy patients. Hence, it is essential to investigate the FCR-related factors in FCs of hematologic malignancy patients.

Although previous studies have classified caregiver's FCR levels based on total scores on scales, they fail to capture individual heterogeneity. In order to develop more personalized strategies for reducing caregiver's FCR, latent profile analysis (LPA) can be used to identify distinct profiles of FCR in caregivers of hematologic malignancy patients, based on their scores across manifest measurement items. This approach can provide insights into the distribution and proportions of different profile types and further explore the characteristics and associated factors within each profile category. LPA is a person-centered approach that uses probabilistic estimation and comparison within a probability model to classify individuals based on their scores across manifest measurement items.²⁹ By fitting indicators and conducting statistical tests, this method identifies unique characteristics of each subgroup and aims to capture heterogeneity among individuals.²⁹ LPA takes into account the uncertainty of all variables, which make the

classification and results more accurate.³⁰ This provides a theoretical basis for precise interventions targeting FCR in FCs of hematologic malignancy patients.

The ABC-X model provides the theoretical framework for this study. This model, proposed by Reuben Hill in 1949, laid the foundation for the entire field of family stress research and has demonstrated strong applicability.³¹ Furthermore, the model has been widely applied in the analysis of negative events and also, analyses of relevant factors have been conducted on the basis of the ABC-X model.^{32,33} The ABC-X model considers stressors (i.e., events of adequate significance to give rise to change; A), existing resources (i.e., personal, family, and social resources; B), perceptions of a "A" (C), and the resulting level of stress or crisis (X).³³ In the ABC-X model, existing resources (B) and perceptions of "A" (C) are hypothesized to have the potential to moderate or mediate the connections between a stressor (A) and the resulting level of crisis (X). Certainly, it is true that stressor (A) can directly lead to varying degrees of crisis (X). We conceptualize the connections between care event, quality of life, psychological resilience, caregiver burden, anxiety, and FCR with these aspects of the ABC-X model in mind (Fig. 1).

Firstly, we conceptualize the care event as a stressor (A). We identified the care event as a stressor because it has been an event of adequate significance to give rise to change. The process of FCs providing care to hematologic malignancy patients receiving chemotherapy is inherently filled with stress and can lead to psychological burden, such as FCR. Because care event, the stressor, appears to be bringing about a greater level of FCR; we conceptualized these mental stress outcomes as the level of stress or crisis resulting from care event (A). Next, we deemed how existing resources (B) and perceptions (C) may influence the connection between care event and FCR subgroups. The care event has brought perceptions of anxiety and care burden to caregivers.¹¹ Quality of life and psychological resilience can serve as personal resources to help individuals cope with the psychological burden caused by care events.^{16,26} However, it is unknown whether these perceptions and personal resources will jointly affect the subgroups of FCR. Therefore, this study utilized the ABC-X model to analyze the associated factors of stress outcomes from an individual perspective, providing a comprehensive and systematic analysis of FCR levels and existing issues among different subgroups of FCs of hematologic malignancy patients during chemotherapy.

Hence, this study aimed to, firstly, conduct subgroup analysis of FCR among FCs of hematologic malignancy patients receiving chemotherapy and analyze the differences in caregiver burden, quality of life, psychological resilience, anxiety, and demographic characteristics among different FCR subgroups. Secondly, based on the ABC-X model, the study analyzes the relevant factors associated with FCR in the identified caregiver subgroups.

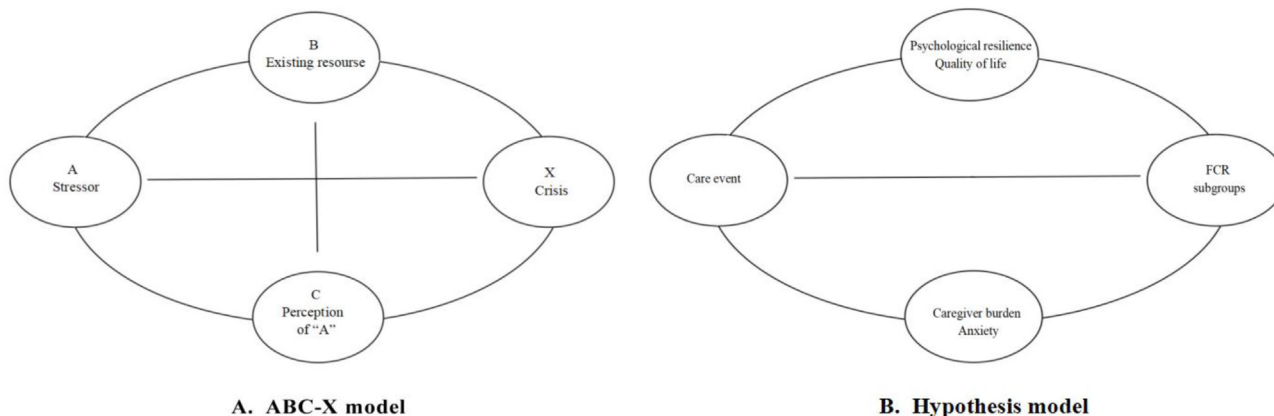


Fig. 1. ABC-X theory model for family caregivers of hematologic malignancy patients.

Methods

Study design, setting, and participants

This was a cross-sectional exploratory study. Between October 2022 and June 2023, 206 pairs of participating patients with hematologic malignancies receiving chemotherapy and their FCs were recruited from the department of hematology and oncology of a comprehensive hospital in Wuxi, Jiangsu Province. FCs were enrolled by a convenient sampling strategy and were considered qualified if they satisfied the following requirements:

Participants were selected based on the following criteria: (1) patients were diagnosed with a hematologic malignancy such as lymphoma, leukemia, multiple myeloma, myelodysplastic syndrome; (2) patients received the chemotherapy treatments more than once; (3) FCs (including spouses, children, parents, etc.¹¹) were aged ≥ 18 years and provided unpaid care and support to patients; (4) they were equipped with normal understanding and communication skills; and (5) they were aware of the patients' condition and volunteered to participate in this study.

The following participants were excluded: (1) patients who were in critical condition or in protective isolation; (2) patients or FCs with severe cognitive, communication, or psychiatric disabilities; and (3) FCs with serious physical illnesses.

Multiple factor analysis demands that sample size should be at least 5–10 times the number of variables. Since our study included 19 variables, we should include at least 95–190 FCs. Considering a 20% sample-loss rate, 114–228 cases are required. Finally, in this study, we enrolled 206 FCs. This study was reviewed and approved by the Ethics Committee of Wuxi School of Medicine, Jiangnan University (Approval No. JNU202212011RB30). In addition, our study was approved by the Nursing Psychology Professional Committee of the China Association for Mental Health (Approval No. 222359).

Measures

Socio-demographic characteristics questionnaire

The questionnaire was self-designed according to the purpose of the study, including patient's age, gender, primary disease, chemotherapy protocol, chemotherapy frequency, caregiver's age, gender, marital status, education, religion, per capita monthly household income, domicile, relationship with care recipient, work status, self-health status, hours of care per day, degree of understanding to the diseases, and comorbidities.

Fear of cancer recurrence inventory short form—caregiver version

Based on the work by Simard et al.,³⁴ Lin et al.¹⁷ amended the Fear of Cancer Recurrence Inventory short form—caregiver version (FCRI-SF-C) severity subscale, which can be used to determine the presence of FCR in FCs and measure its severity. Nine distinct items are evaluated on a 4-point Likert scale ranging from 1 (hardly) to 4 (always). The final score ranges from 0 to 36 points. FCR is present when the score is 13, whereas FCR is absent when the score is less than 13, and the FCR of FCs increases as the score rises. The Cronbach coefficient of FCRI-SF-C was 0.83, and in this study, the Cronbach α for FCRI-SF-C was 0.832.

Zarit caregiver burden interview scale

The Zarit Caregiver Burden Interview (ZBI) scale was designed by Zarit et al.³⁵ and was translated into Chinese by Wang Lie et al.³⁶ The ZBI is a 22-item scale to assess the impact of caregiving on the following 2 subdomains: personal burden (12 items) and responsibility burden (6 items), using a 5-point Likert scale ranging from 0 (no burden) to 4 (huge burden). The total score ranges from 0 to 88 points, and the higher scores indicate higher caregiver burden, with a score < 19 points for no burden, a score between 20 and 39 points for mild burden, a score between 40 and 59 points for moderate burden, and a score > 60 points for severe burden.³⁶ The Cronbach α for ZBI in this study was 0.850.

Family caregiver quality-of-life scale

The 16-item family caregiver quality of life (FAMQOL) scale uses a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to evaluate the effects of caregiving on the physiological, psychological, social, and spiritual subdomains.³⁷ The overall score ranges from 16 to 80 points, and the higher the score, the higher the life quality for FCs, and the Cronbach's α of FAMQOL is 0.89. The Chinese translation done by Qian Hailan et al.,³⁸ examined the applicability, reliability, and validity of FCs with good internal consistency and retest reliability. The Cronbach α for Chinese version of FAMQOL in this study was 0.813.

Connor–Davidson resilience scale

The Connor–Davidson Resilience Scale (CD-RISC-10) is a 10-item scale revised by Wang et al.³⁹ The scale of each item ranges from 0 (not true at all) to 4 (true nearly all the time), and the Cronbach α of this scale is 0.91, indicating that the higher the overall score, the greater the level of psychological resilience. The Cronbach α for CD-RISC-10 was 0.908 in the present study.

Seven-item generalized anxiety disorder scale

The Generalized Anxiety Disorder Scale (GAD-7) was designed by Spitzer et al.,⁴⁰ which consists of 7 items and mainly investigates patients about their mental and emotional changes during the last two weeks in order to detect generalized anxiety and gauge the severity of it. Each item takes a 4-point scale from 0 to 3, and the total score goes from 0 to 21, with a score of ≥ 4 points for anxiety symptoms and higher scores for greater severity of anxiety symptoms. The scale has a test–retest reliability of 0.76 and an internal consistency coefficient of 0.90. He Xiaoyan et al.⁴¹ translated and altered the GAD-7 to Chinese with a Cronbach α 's coefficient of 0.898. The Cronbach α for GAD-7 in the present study was 0.782.

Procedure and quality control

Before filling out the questionnaire, the participants were introduced to the purpose and significance of this survey by well-trained members of the research team using a standardized instruction. The questionnaires were distributed by research team's members and were completed independently by the FCs of the patients with hematologic malignancies, and the questionnaires were collected on the spot. The participants were immediately asked to furnish the corresponding information if any omissions were discovered. A total of 210 questionnaires were distributed in this study, and 206 valid questionnaires were obtained, with a valid questionnaire recovery rate of 98.1%.

Data analysis

Data analysis was performed by using Mplus version 8.3 (Muthén and Muthén, 1998–2015) and IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY). Measures that follow a normal distribution are described by the mean standard deviation. Frequencies and percentages were used to describe for count data or rank data. Using exploratory LPA by Mplus 8.3 software, FCs of patients with hematological malignancies were categorized according to varying FCR values. The differences in fit between the models were compared by Lo–Mendell–Rubin adjusted likelihood ratio test (LRT), Akaike information criterion (AIC), Bayesian information criterion (BIC), and the adjusted BIC (aBIC). Lower values for AIC, BIC, and aBIC denote a model that fits the data better. Absolute agreement between a $k-1$ -class model and a k -class model was evaluated using the LRT. Entropy values were used to gauge the model's classification performance, with values near to 1.0 indicating a respectable level of classification accuracy.⁴² A one-way analysis of variance was also performed to check for any significant differences between the main variables within the identified FCR subgroups. Chi square and t -tests were used to examine any differences in the FCs' socio-demographic and psychological characteristics between the latent classes. Finally, a logistic regression analysis was used to examine the factors associated with the

Table 1
Participants' demographics and mean score of psychological variables ($N = 206$ pairs).

Variables	Mean \pm SD (range)	n (%)
Caregiver characteristics		
Age (years)	57.61 \pm 13.73 (22–86)	
Gender		
Male		77 (37.38)
Female		129 (62.62)
Marital status		
Single		8 (3.88)
Married		197 (95.63)
Divorced		1 (0.49)
Education		
Primary school and below		46 (22.33)
Intermediate		63 (30.58)
High or vocational school		44 (21.35)
College and above		53 (25.73)
Religious belief		
Yes		12 (5.83)
No		194 (94.17)
Average monthly household income (RMB)		
≤ 1000		30 (14.56)
1001–3000		64 (31.07)
3001–5000		45 (21.84)
≥ 5000		67 (32.52)
Domicile		
Countryside		82 (39.81)
Town		124 (60.19)
Relationship with care recipient		
Spouse		146 (70.87)
Parents		5 (2.43)
Offspring		48 (23.30)
Others		7 (3.40)
Employment status		
Nonworking		135 (65.53)
On-the-job		71 (34.47)
Self-health status		
Poor		4 (1.94)
General		94 (45.63)
Good		108 (52.43)
Care duration		
3–8 h/d		28 (13.59)
8–13 h/d		38 (18.45)
> 13 h/d		140 (67.96)
Degree of disease understanding		
Ignorant		49 (23.79)
Partial		116 (56.31)
Full		41 (19.90)
Chronic disease		
Yes		72 (34.95)
No		134 (65.05)
Score of FCR	12.05 \pm 5.09 (2–34)	
Score of caregiver burden	33.01 \pm 10.34 (6–56)	
Score of quality of life	48.04 \pm 5.73 (24–64)	
Score of resilience	23.06 \pm 5.07 (10–39)	
Score of anxiety	4.56 \pm 3.09 (0–21)	
Care recipient characteristics		
Age (years)	63.46 \pm 12.50 (18–89)	
Gender		
Male		117 (56.80)
Female		89 (43.20)
Primary disease		
Lymphoma		140 (67.96)
Multiple myeloma		41 (19.90)
Leukemia		23 (11.17)
Myelodysplastic syndrome		2 (0.97)
Chemotherapy protocol		
R-CHOP/CHOP		84 (40.78)
R-CDOP/CDOP		19 (9.22)
VRD		25 (12.14)
Azacitidine/Azacitidine with venetoclax		6 (2.91)
IA/DA		11 (5.34)
Others		61 (29.61)

Table 1 (continued)

Variables	Mean \pm SD (range)	n (%)
Chemotherapy frequency		
1–3 times		108 (52.43)
4–6 times		48 (23.30)
> 6 times		50 (24.27)

CDOP, cyclophosphami, liposome doxorubicin, oncovin, prednisone; CHOP, cyclophosphamide, hydroxydaunomycin, oncovin, prednisone; DA, daunorubicin, azacitidine; FCR, fear of cancer recurrence; IA, idarubicin, azacitidine; R-CHOP, rituximab, cyclophosphamide, hydroxydaunomycin, oncovin, prednisone; R-CDOP, rituximab, cyclophosphami, liposome doxorubicin, oncovin, prednisone; SD, standard deviation; VRD, bortezomib, revlimid, dexamethasone.

identified latent classes adjusting for any covariates. A P value of < 0.05 was considered statistically significant.

Results

Demographic and psychological characteristics

Table 1 shows the general characteristics of the participants. The mean age of FCs was 57.61 years (standard deviation [SD] = 13.73), and their age range was from 22 to 86 years. The care recipients' mean age was 63.46 years (SD = 12.50), and the age range of them was 18–89 years. The mean score of FCR was 12.05 (SD = 5.09), range was 2–34. 41.7% FCs (86/206) scored ≥ 13 , indicating the presence FCR.

Classification of latent profile

An individual-centered LPA was conducted on the FCRI-SF-C scores of 206 FCs of patients with hematologic malignancies receiving chemotherapy. The scores of the 9 items were used as manifest indicators, and latent profile models with 1–3 categories were successively fitted, starting from the baseline model with 1 category. Among all the models, compared to the model with 2 profiles, the model with 3 profiles showed a decrease in AIC, BIC, and aBIC, but an increase in entropy. However, the P -value of the LMR test for the 3-profile model did not reach statistical significance, as can be seen in Table 2. Therefore, the classification of the 2-profile model has clinical interpretability. As a result, the ratio of categories in the two categories of models has a strong clinical explanation. Based on the aforementioned findings, two classes were ultimately chosen as the best models for the FCR category of FCs of chemotherapy-treated patients with hematological malignancies.

The LPA revealed that 65.4% ($n = 134$) of FCs fell into Class 1 and that 35.6% ($n = 72$) fell into Class 2 categories. Plotting a line graph of the FCRI-SF-C scores for each item will allow you to compare the traits of two potential categories of FCs (Fig. 2). Class 1 was named as “A low level of FCR” and Class 2 was named as “A high level of FCR” based on the variation of each entry's centerline plot. The FCRI-SF-C scores were (9.63 \pm 3.50), (16.54 \pm 4.52), respectively.

The mean values of the nine-dimensional FCR entries for the two prospective FC profiles were compared using a two-independent-sample t -test in order to further investigate if the two potential FCs' profiles are diverse. Compared to Class 2, Class 1 showed statistical significance ($P < 0.05$) for each entry, suggesting that the two subgroups of patients with hematological malignancy receiving chemotherapy show heterogeneity, as shown in Table 3.

The differences between Class 1 and Class 2 in terms of general data and caregiver burden, psychological resilience, quality of life, and anxiety were also compared in this study. Table 4 shows that the findings revealed that self-health status, comorbidities, caregiver burden, quality of life, and anxiety were statistically significant ($P < 0.05$).

Table 2
Model-fitting results of fear of cancer recurrence in family caregivers of hematological malignancy patients (Fit indices of LPA models).

Class	AIC	BIC	SABIC	Entropy	P		Categorical probability
					LMR	BLRT	
1	4706.9580	4766.8600	4709.8290	–	–	–	–
2	4197.5160	4290.6960	4201.9820	0.9750	0.0264	< 0.001	0.6538/0.3462
3	3768.8600	3895.3200	3774.9210	1.0000	0.6806	< 0.001	0.6553/0.2185/0.1262

AIC, Akaike information criterion; BIC, Bayesian information criterion; BLRT, bootstrapped likelihood ratio test; LMR, Lo-mendell-rubin; LPA, latent profile analysis; SABIC, sample-size adjusted BIC.

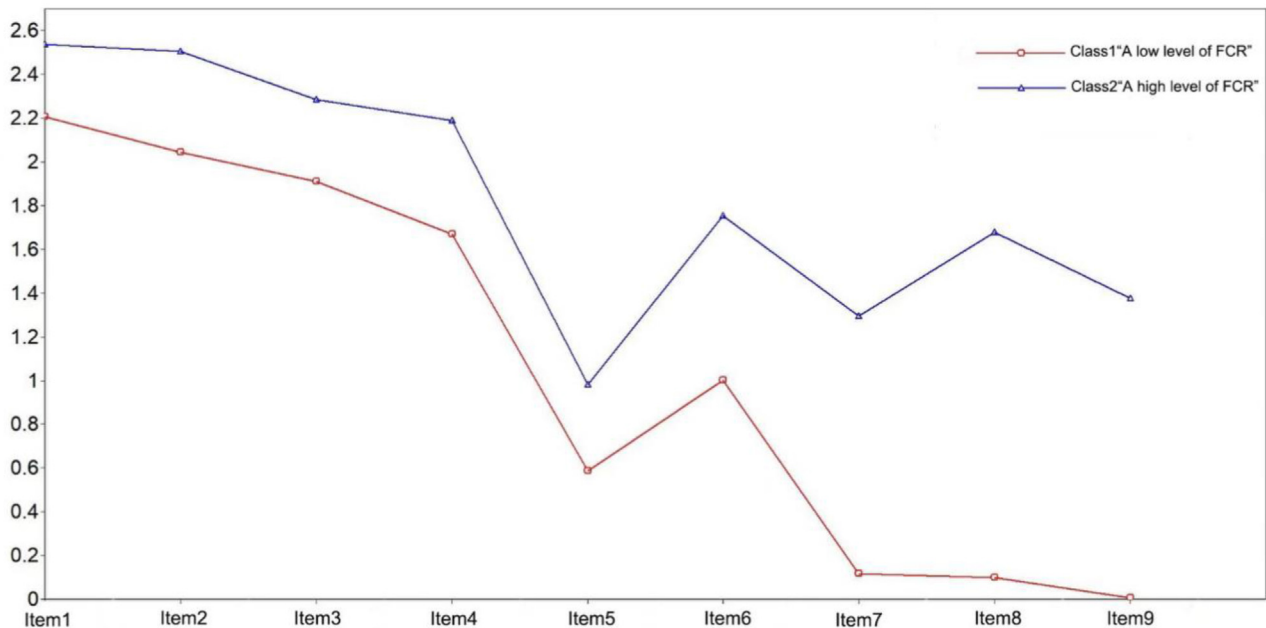


Fig. 2. Latent classes based on the items of FCR. FCR, fear of cancer recurrence.

Table 3
Differences in the items of FCR between latent classes.

Variables	Total sample (N = 206), Mean ± SD	Class 1 (n = 134, 65.4%), Mean ± SD	Class 2 (n = 72, 34.6%), Mean ± SD	t	P
Item 1	2.32 ± 1.03	2.21 ± 1.10	2.53 ± 0.87	-2.287	0.023
Item 2	2.20 ± 0.93	2.04 ± 0.93	2.50 ± 0.86	-3.626	0.001
Item 3	2.04 ± 0.83	1.91 ± 0.87	2.28 ± 0.68	-3.109	0.002
Item 4	1.85 ± 0.80	1.67 ± 0.76	2.18 ± 0.78	-4.537	< 0.001
Item 5	0.72 ± 0.94	0.59 ± 0.77	0.97 ± 1.15	-2.536	0.013
Item 6	1.26 ± 0.77	1.00 ± 0.69	1.75 ± 0.67	-7.502	< 0.001
Item 7	0.52 ± 0.76	0.11 ± 0.34	1.29 ± 0.72	-13.12	< 0.001
Item 8	0.65 ± 0.96	0.10 ± 0.32	1.67 ± 0.90	-14.26	< 0.001
Item 9	0.48 ± 0.74	0.00	1.38 ± 0.57	-20.555	< 0.001

FCR, fear of cancer recurrence; SD, standard deviation.

Associated factors of latent profile membership

Analyzing the factors related to FCR subgroups based on the ABC-X theory model (Fig. 1). The results of univariate analysis showed that self-health status, comorbidities, caregiver burden score, quality of life score, anxiety, and patient chemotherapy frequency had statistical significance (P < 0.05), as shown in Table 5.

Two categories identified by potential profiles were used as outcome variables (Class 1 group = 0, Class 2 group = 1), and statistically significant factors in a single factor were used as independent variables for binary logistic regression analysis, including self-health status (poor = 1, general = 2, good), comorbidities (no = 0, yes = 1), caregiver burden score, quality of life score, and anxiety

score. The frequency of chemotherapy for patients (1–3 times = 1, 4–6 times = 2, > 6 times = 3). The results showed that quality of life, anxiety, and chemotherapy frequency were statistically significant (P < 0.05), as shown in Table 5.

Discussion

Discussion of this study

This study utilized the LPA model to uncover the characteristics of FCR subgroups among FCs of hematologic malignancy patients during chemotherapy. Another innovative aspect of this study was that it analyzed the factors associated with FCR subgroups (X) based on the ABC-

Table 4
Differences in participants' characteristics between the subgroups of FCR.

Variables	Class 1 (n = 134, 65.4%), Mean ± SD (range)/n (%)	Class 2 (n = 72, 34.6%), Mean ± SD (range)/n (%)	χ^2/t	P
Age (years)	56.84 ± 13.87 (25–86)	59.04 ± 13.46 (22–79)	−1.1	0.273
Gender			0.869	0.351
Male	47 (35.07)	30 (41.67)		
Female	87 (64.93)	42 (58.33)		
Marital status			1.900	0.387
Single	5 (3.73)	3 (4.17)		
Married	129 (96.27)	68 (94.44)		
Divorced	0	1 (1.39)		
Education			3.077	0.380
Primary school and below	32 (23.88)	14 (19.44)		
Intermediate	41 (30.60)	22 (30.56)		
High or vocational school	24 (17.91)	20 (27.78)		
College and above	37 (27.61)	16 (22.22)		
Religious belief			0.015	0.904
Yes	8 (5.97)	4 (5.56)		
No	126 (94.03)	68 (94.44)		
Average monthly household income (RMB)			7.216	0.065
≤ 1000	16 (11.94)	14 (19.44)		
1001–3000	42 (31.34)	22 (30.56)		
3001–5000	25 (18.66)	20 (27.78)		
≥ 5000	51 (38.06)	16 (22.22)		
Domicile			1.194	0.275
Countryside	57 (42.54)	25 (34.72)		
Town	77 (57.46)	47 (65.28)		
Relationship with care recipient			3.133	0.372
Spouse	92 (68.66)	54 (75.00)		
Parents	5 (3.73)	0		
Offspring	32 (23.88)	16 (22.22)		
Others	5 (3.73)	2 (2.78)		
Employment status			0.749	0.387
Nonworking	85 (63.43)	50 (69.44)		
On-the-job	49 (36.57)	22 (30.56)		
Self-health status			9.796	0.007
Poor	1 (0.74)	3 (4.17)		
General	53 (39.55)	41 (56.94)		
Good	80 (59.70)	28 (38.89)		
Care duration			2.649	0.266
3–8 h/d	18 (13.43)	10 (13.89)		
8–13 h/d	29 (21.64)	9 (12.50)		
> 13 h/d	87 (64.93)	53 (73.61)		
Degree of disease understanding			3.648	0.161
Ignorant	35 (26.12)	14 (19.44)		
Partial	69 (51.49)	47 (65.28)		
Full	30 (22.39)	11 (15.28)		
Comorbidities			7.331	0.007
Yes	96 (71.64)	38 (52.78)		
No	38 (28.36)	34 (47.22)		
Score of caregiver burden	31.37 ± 9.43 (6–52)	36.06 ± 10.49 (13–56)	−3.266	0.001
Score of quality of life	46.76 ± 5.61 (24–61)	50.42 ± 5.20 (38–64)	−4.573	< 0.001
Score of resilience	23.42 ± 5.78 (12–38)	22.39 ± 5.52 (10–39)	1.238	0.217
Score of anxiety	3.88 ± 2.29 (0–14)	5.83 ± 3.90 (1–21)	−4.527	< 0.001
Age (patients)	62.72 ± 13.27 (18–89)	64.83 ± 10.86 (18–81)	−1.160	0.247
Gender (patients)			−0.262	0.793
Male	77 (57.46)	40 (55.56)		
Female	57 (42.54)	32 (44.44)		
Primary disease			1.257	0.211
Lymphoma	95 (70.90)	45 (62.50)		
Multiple myeloma	26 (19.40)	15 (20.83)		
Leukemia	12 (8.96)	11 (15.28)		
Myelodysplastic syndrome	1 (0.75)	1 (1.39)		
Chemotherapy protocol			−0.923	0.357
R-CHOP/CHOP	61 (45.52)	23 (31.94)		
R-CDOP/CDOP	10 (7.46)	9 (12.50)		
VRD	15 (11.19)	10 (13.89)		
Azacitidine/Azacitidine with venetoclax	1 (0.75)	5 (6.94)		
IA/DA	8 (5.97)	3 (4.17)		
Others	39 (29.10)	22 (30.56)		
Chemotherapy frequency			−1.996	0.047
1–3 times	77 (57.46)	31 (43.06)		
4–6 times	29 (21.64)	19 (26.39)		
> 6 times	28 (20.90)	22 (30.56)		

CDOP, cyclophosphami, liposome doxorubicin, oncovin, prednisone; CHOP, cyclophosphamide, hydroxydaunomycin, oncovin, prednisone; DA, daunorubicin, azacitidine; FCR, fear of cancer recurrence; IA, idarubicin, azacitidine; R-CDOP, rituximab, cyclophosphamide, hydroxydaunomycin, oncovin, prednisone; R-CHOP, rituximab, cyclophosphami, liposome doxorubicin, oncovin, prednisone; SD, standard deviation; VRD, bortezomib, revlimid, dexamethasone.

Table 5
Results of logistic regressions for the subgroups of FCR.

Variables	B	SE (B)	OR	95% CI	P
Self-health status	0.012	0.358	1.012	0.501–2.043	0.973
Comorbidities	0.702	0.382	2.018	0.954–4.270	0.066
Score of caregiver burden	0.036	0.019	1.037	1.000–1.075	0.051
Score of quality of life	0.110	0.036	1.117	1.041–1.197	0.002
Score of anxiety	0.208	0.060	1.231	1.094–1.384	0.001
Chemotherapy frequency	0.397	0.201	1.487	1.003–2.205	0.048

CI, confidence interval; FCR, fear of cancer recurrence; OR, odds ratio; SE, standard error.

X model, considering stressor (care event; A), existing resources (quality of life and psychological resilience; B), and perceptions of “A” (caregiver burden and anxiety; C), which makes the study more scientifically reliable. A notable finding in this study was the fact that the FCR of the participating FCs of hematologic malignancy patients receiving chemotherapy were classified into two subgroups: “a low level of FCR” and “a high level of FCR”. These findings showed a substantial incidence of FCR among FCs. As the number of patients with hematologic malignancies rises, the emotional toll on FCs was rising, suggesting us that medical professionals should pay close attention to management of FCR in FCs.

This study found that quality of life, anxiety, and frequency of chemotherapy were associated factors of FCR category characteristics among caregivers. More specifically, this study found that caregivers in the “a high FCR level” group exhibited poorer health status and comorbidity than those in the “a low level of FCR” group, and their FCR levels were higher, which was consistent with research on caregivers of breast cancer patients.^{21,43} However, a noteworthy finding in this study is that the “a high level of FCR” group exhibited a higher quality of life than did the “a low level of FCR” group, which contradicts previous research results indicating that lower quality of life is associated with higher FCR levels.¹³ The reason for this inconsistency may be due to variations in how FCs rated different aspects of quality of life (Supplementary Table 1). Specifically, the average scores for “Care increased my sense of purpose or mission in life” and “Care makes me inner strength” were higher than those for other items. The average scores for these two items were higher in the “a high level of FCR” group than in the “a low level of FCR” group. FCs in the “a high level of FCR” group displayed a more positive attitude and higher quality of life than did the “a low level of FCR” group ($P < 0.001$). FCs, even when faced with the illness of the patients, could experience a sense of satisfaction and accomplishment through their positive attitudes, allowing them to recognize their own value and thereby increasing their sense of fulfillment.⁴⁴ This sense of fulfillment enhances the caregivers' quality of life.⁴⁴ Furthermore, FCs in the “a high level of FCR” group had a higher average age than that of the “a low level of FCR” group. Research has shown that older caregivers tend to have higher levels of psychological adaptation.⁴⁵ They have experienced psychological challenges and growth during negative emotions and have learned coping strategies such as self-regulation and maintaining a positive attitude.²⁵ These coping strategies help them better deal with the difficulties in life and improve their quality of life.

Anxiety is a common psychological distress among caregivers of cancer patients,⁴⁶ with prevalence rates ranging from 32.6% to 53%.^{46,47} FCs of hematologic malignancy patients are prone to psychological distress, such as anxiety, they not only have to take care of the patients' daily life but also manage household tasks, medication, and provide psychological support to the patient.⁴⁸ Over time, this can exacerbate the FCs' psychological distress. Compared to the “a low level of FCR” group, the “a high level of FCR” group displayed higher levels of anxiety in caregivers, which may be attributed to the uncertainty brought about by cancer recurrence. FCs are unable to accurately predict the patient's disease progression and future treatment outcomes; consequently, they

may experience more severe symptoms of anxiety.⁴⁹ These findings align with research conducted on FCs of solid tumor patients, which demonstrated that higher FCR levels corresponded to increased levels of anxiety.⁵⁰ Consequently, it is beneficial not only to closely monitor the psychological distress of caregivers of hematologic malignancy patients during the chemotherapy period but also to actively take corresponding intervention measures aimed at resolving their mental issues and devising personalized care strategies for caregivers in need of assistance.

What's more, hematologic malignancy patients require long-term chemotherapy,⁵¹ which can bring psychological burden to caregivers.¹⁹ This study revealed a positive correlation between the number of chemotherapy sessions and the level of FCR among FCs. This finding aligns with previous studies conducted by Boehmer et al.²⁴ and Maguire et al.,⁵² which demonstrated the association between FCR levels among caregivers of solid tumor patients and chemotherapy. The increasing number of chemotherapy sessions may indicate a higher risk of cancer or severity of the disease in patients, which could contribute to heightened concerns about cancer recurrence among caregivers.⁵³ It is crucial for healthcare professionals to provide psychological support, education, and information to these caregivers in order to assist them in coping with their fears.

An interesting result was found in the demographic variables, where the majority of FCs had no religious belief, and only 5.83% of caregivers had a religious belief. It was also found that there was no significant relationship between religious belief and FCR subgroups of FCs ($P > 0.05$), which was inconsistent with the findings of Chien et al.⁵⁴ In fact, this was consistent with the social and cultural background of China, where the majority of Chinese people do not have religious beliefs and are more influenced by traditional Confucian thoughts. Caregivers with religious beliefs may only seek religious help when the patient is diagnosed with cancer and in a severe condition, hoping to alleviate their psychological distress and ease their fear of the patients' cancer recurrence and death.⁵⁵ Religious belief, as an important coping resource for FCs of cancer patients, can provide caregivers with hope and spiritual support, helping to alleviate their physical and mental burden.⁵⁶ Paiva et al.⁵⁵ found that caregivers with religious beliefs believe that they can gain strength and inner peace through prayer, alleviating the pain during the cancer caregiving process, and helping them find new meaning in life. Thus, healthcare professionals should pay attention to the positive role of religious belief in caregivers' coping with FCR and actively meet their religious needs.⁵⁷

In terms of psychological variables, this study found that FCs in the “a high level of FCR” group had higher psychological resilience than those in the “a low level of FCR” group, which is inconsistent with the findings of AĞAÇ et al.²⁶ This discrepancy may be attributed to the characteristics of the population included in this study. The FCs in this study were predominantly middle-aged to elderly individuals and were spouses of hematologic malignancy patients who were facing retirement and did not experience significant work pressure or family burden. They demonstrated a positive mindset and strong self-regulation abilities when facing the FCR, which has an important impact on their psychological well being. Van et al.¹³ revealed that older age was associated with a more positive mindset. This study also found that FCs in the “a high level of FCR” group had higher caregiving burden than did the “a low level of FCR” group, experiencing a moderate level of caregiving burden. The reason for this might be that the FCs of hematologic malignancy patients included in this study were informal caregivers lacking disease-related nursing knowledge, leading to a significant caregiving stress. Hematologic tumor patients are prone to recurrence and require active treatment, undoubtedly increasing the burden on caregivers who assume greater caregiving responsibilities.^{58,59} This finding is consistent with the study conducted by Peikert et al.⁶⁰ on parents of pediatric cancer patients. Therefore, healthcare professionals should assess the supportive

care needs of caregivers in a targeted manner and provide supportive interventions such as caregiver education programs to enhance their caregiving abilities and adaptability, better address caregiving issues, reduce their time burden, and decrease their FCR levels.

Implications for nursing practice and research

This research revealed that FCs of patients with hematologic malignancy receiving the chemotherapy are divided to two category characteristics, “A low level of FCR” and “A high level of FCR.” More than 40% of caregivers reported clinically significant FCR. This study identified factors related to the FCR subgroups of FCs, including quality of life, anxiety, and frequency of chemotherapy. Our findings have important implications for strengthening the assessment and intervention of FCR among FCs of hematologic malignancy patients during the chemotherapy period. Firstly, by understanding the FCR category characteristics and related factors among caregivers of hematologic malignancy patients, healthcare professionals can better tailor personalized support and intervention measures to help them cope with this emotional burden. Secondly, analyzing the FCR category characteristics of caregivers also helps identify potential mental health issues such as anxiety, allowing for timely intervention and treatment. Additionally, awareness of these underlying category characteristics can assist healthcare providers in better planning and providing appropriate support services to improve caregivers' mental health and overall quality of life. Currently, there are interventions being studied for FCR among cancer patient caregivers, such as e-Health interventions⁶¹ and the Family Caregiver—Fear of Recurrence Therapy.⁶² However, the application of these measures in different cultural contexts and FCR subgroups of caregivers of different cancer patients needs to be validated. Therefore, considering cultural sensitivity and the disease characteristics of hematologic malignancy patients, developing FCR intervention measures for caregivers is an important task.

Limitations

Nevertheless, this study has several limitations. Firstly, this study was only cross-sectional and could not capture the dynamics of FCR in FCs from patients with hematologic malignancies receiving chemotherapy. Secondly, this study was conducted in a single center and did not collect FCs of a single disease, which lacks specificity. In the future, a longitudinal study focusing on FCs of a single disease in multiple centers could be conducted. Thirdly, this study was conducted entirely in the form of questionnaires and the results were self-reported by the study participants, which was highly subjective and may lead to bias. Future research should combine the results of subjective and objective measurements to improve the scientific validity of the results. Fourthly, the FCR of patients with hematologic neoplasms and their caregivers were not studied simultaneously to compare their FCR category characteristics and analyze their correlations. Finally, in exploring the factors related to the FCR subgroups of caregivers, this study had limited factors included, only considering individual psychological factors and not incorporating social factors such as social support. Social support may also influence the FCR category characteristics of caregivers. Furthermore, there is a need to conduct even more comprehensive and prospective research in the future.

Conclusions

This study investigated the FCR among FCs of patients with hematologic malignancy receiving chemotherapy, with an incidence rate of 41.7%. From a people-centered perspective, our study used LPA to identify two subgroups of characteristics in FCs of patients with hematologic malignancies, “a low level of FCR” group and “a high level of FCR” group. Potential categorical factors, such as quality of life, anxiety, and chemotherapy frequency of patients, are associated with FCR in FCs of hematologic malignancy patients. These findings offer a theoretical

foundation for healthcare providers to identify high-risk populations and develop person-centered interventions that can relieve FCR for FCs.

CRedit authorship contribution statement

Li Sheng, Haiying Hua, Jingfen Zhou: Conceptualization, Methodology, Data curation, Formal analysis, Writing. **Li Sheng, Yingying Zhu:** Methodology, Writing – Original draft preparation. **Yajiao Liu, Long Ye:** Formal analysis, Writing – Revised draft preparation, Data curation. **Li Sheng, Yingying Zhu:** Conceptualization, Methodology, Data collection, Writing – Original and Revised draft preparation. All authors had full access to all the data in the study, and the corresponding author had final responsibility for the decision to submit for publication. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Ethics statement

This study was reviewed and approved by the Ethics Committee of Wuxi School of Medicine, Jiangnan University (IRB No. JNU20 2212011RB30). All participants provided written informed consent.

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Declaration of competing interest

The authors declare no conflict of interest.

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

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

Data availability statement

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.apjon.2024.100382>.

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