

## Research Article

# Fear of Progression and Resilience as Mediators of the Association between Family Function and Quality of Life among Patients with Cervical Cancer

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**Objective.** To explore the impact of family function on quality of life (QoL) and investigate the mediating effects of fear of progression (FoP) and resilience in the pathway from family function to QoL among patients with cervical cancer (CC). **Methods.** A multicenter cross-sectional survey with convenience sampling was conducted from December 2021 to December 2022. A total of 252 patients with cervical cancer were recruited from five tertiary hospitals in Jiangsu Province, China. Patients completed the 5-item self-administered Family Adaptation, Partnership, Growth, Affection, Resolve (APGAR) scale, the Fear of Progress Questionnaire short-form, the 14-item Resilience Scale, and the 12-item Short-Form Health Survey. Structural equation modeling (SEM) was performed to explore the mediation effect of FoP and resilience between family function and QoL for CC patients. Bootstrapping procedures were used to verify the significance of the indirect effects of the mediating variables. **Results.** The mean score of family function was  $7.97 \pm 2.41$  (scale range: 0–10), FoP was  $29.58 \pm 10.14$  (scale range: 12–60), and resilience was  $69.37 \pm 14.36$  (scale range: 14–98). The mean score for physical component summary (PCS) was  $41.87 \pm 10.00$  (scale range: 0–100), and the mean score for mental component summary (MCS) was  $46.68 \pm 11.78$  (scale range: 0–100). Family function positively predicted patients' resilience and negatively predicted their FoP, while FoP negatively predicted CC patients' resilience and QoL, and resilience positively predicted patients' QoL. Patients' family function was associated with their QoL directly and indirectly through the mediation of FoP and resilience, and the model explained 7% of the variation in FoP, 24% of the variation in resilience, and 42% of the variation in QoL. **Conclusions.** Chinese CC patients expressed poor QoL. FoP and resilience could mediate the association between patients' family function and QoL. Healthcare professionals could improve QoL of patients with cervical cancer through reducing FoP and enhancing resilience.

## 1. Introduction

Cervical cancer (CC) is one of the most common cancers worldwide among women, with an estimated 604,000 new cases and 342,000 deaths annually [1]. According to the latest global cancer data, nearly 110,000 women in China were newly diagnosed with CC in 2020, with China becoming the country with the second highest incidence of CC in the world (International Agency for Research on Cancer

(2021), Global Cancer Observatory: Cancer today: <https://gco.iarc.fr/today>). In China, with the development of medical technology, 59.8% of patients with cervical cancer have a survival of >5 years [2]. Depending on the clinical stage at presentation, CC is treated differently. At present, the treatment of cervical cancer includes surgery, chemotherapy, and radiotherapy, whether utilized singly or in combination, which can be associated with short and long-term side effects including sexual dysfunction, chronic pelvic

pain, lymphedema, and urinary symptoms. In addition, patients often suffer from anxiety, depression, fear, and other psychological problems, and the physical and psychological stresses seriously affect the quality of life (QoL) of women.

QoL is generally considered to be a multidimensional concept that includes physical, psychological, and social well-being, feelings of health, and symptoms associated with illness or treatment. It has already been an important indicator that monitors the process of cancer treatment and prognosis or rehabilitation effect in recent years [3]. Women with CC are exposed to late side effects of cancer treatment. They often experience symptoms that may adversely affect their QoL [4]. With the transformation of the biological psychological-social medical model, the goal of treatment for cervical cancer has been elevated to improve the quality of life of patients. It has become crucial for medical service providers to maintain and improve the quality of life for cervical cancer patients [5]. QoL can be used not only in the selection and effect evaluation of clinical treatment plans but also in the evaluation of prognosis and long-term survival status [6]. More and more people are also paying attention to the QoL of patients who survive cervical cancer. In China, cervical cancer had physical and psychological problems, financial hardships, and disruptions to their social functioning and sexual lives [7].

Family functioning encompasses emotional connections, rules, communication, and coping effectiveness within the family system [8]. For most Chinese cancer patients, family is the main source of social support, which is a protective determinant of health; therefore, previous studies have reported that family function was closely associated with QoL of the cancer patients [9, 10]. Functional families play an important role in patients' performance with daily routine planning, and positive family functioning promotes family members to take self-care behaviors meal planning such as blood pressure monitoring, physical activity, and adherence to medication [11–13]. At the same time, families in conflict tend to exhibit higher levels of depression and anxiety [14, 15]. Although many researchers have investigated the relationship between family functioning and QoL in the elderly [11], children [10], and cancer survivors [15], few studies have been conducted on the relationship between family functioning and QoL in patients with CC. A previous study showed that more than half of cancer patients experienced family dysfunction and inadequate resources [16], and as family functioning is one of the most important support systems for CC patients, therefore it is necessary to examine the association between family functioning and QoL in CC patients.

Resilience is defined as the resistance, recovery, or rebounding of psychological and physical health after a challenging life event [17]. It is considered an important trait or ability of individuals that sustains well-being in the face of the many stresses that individuals encounter in their lives. When individuals face stressful events and adversity, resilience can help them improve their ability to cope with the stressful event, reduce the emotional impact of the event, facilitate the adaptation process, and improve their quality of

life [18]. Individuals with resilience may be more actively adapting to the mental distress associated with a cancer diagnosis and related treatment, resulting in better disease adaptation, better clinical outcomes, and ultimately an improved overall quality of life [19–21]. A cross-sectional study about women with gynecological cancer by Manne et al. also found that higher resilience was related to higher quality of life [22]. According to Aydogan and Ozbay, the more intention couples have toward dyadic coping, the stronger their relationship resilience [23].

Fear of progression (FOP) denotes the fear of illness recurrence or progression in the same or different body parts [24]. FOP has become an important psychological burden of cervical cancer patients, such as a high level of psychological insecurity, anxiety, and depression [25], which seriously affects their QoL [26]. Previous research showed that probably 50% of cancer survivors experience moderate to severe FOP [24]. FOP does not only concern the survivor but also their caregivers, and some studies found that caregivers reported even higher levels of FOP than survivors [27]; FOP was significantly associated with lower family functioning [28]. Moreover, a cross-sectional study of FOP and RS for cancer survivors and their family caregivers presented that low levels of resilience were correlated with great FOP [29].

This study aims to explore family function's impact on QoL, investigating the mediating roles of FoP and resilience in the relationship between family function and QoL among CC patients. Notably, the scarcity of studies examining the link between FOP, family function, resilience, and QoL among CC patients emphasizes the need for further research in this area.

## 2. Methods

**2.1. Participants and Procedures.** A cross-sectional study was conducted between December 2021 and December 2022, involving participants from the inpatient oncology and gynecology departments across five tertiary hospitals in Jiangsu Province. The inclusion criteria included (1) Chinese-speaking female age  $\geq 18$  years; (2) newly diagnosed with cervical cancer via the confirmed pathological diagnosis; (3) starting cancer treatment; (4) possessing clear consciousness and cognition; and (5) having awareness of their disease condition and prognosis, expressing willingness to participate. Exclusion criteria were as follows: (1) concurrent malignant tumors; and (2) pre-existing psychological trauma, mental health issues, or cognitive impairment before cancer diagnosis. The study employed a sample size that was 40 times the number of variables [30]. This research observed four variables along with an anticipated 20% missed follow-up rate. Questionnaires were distributed to a total of 252 eligible participants who expressed interest in and fulfilled the criteria for participation.

**2.2. Hypotheses of the Study.** For the purpose of this study, serial multiple correlations were proposed in a mediator model, as shown in Figure 1, and the following working hypotheses were adopted:

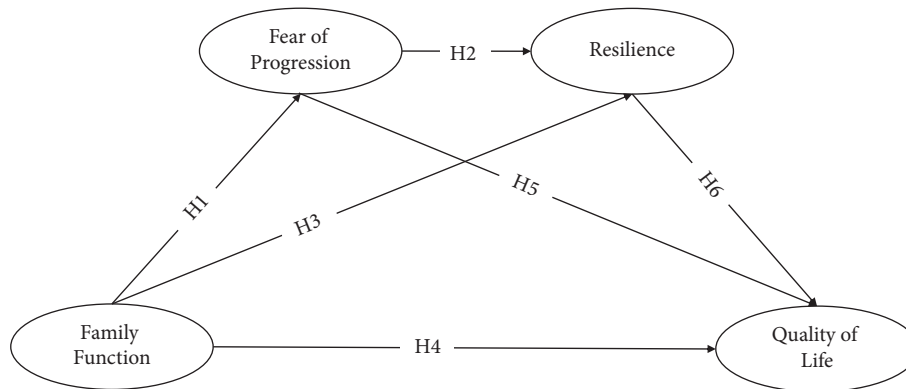


FIGURE 1: Serial multiple mediator model of family function and quality of life.

*Hypothesis 1.* Family function has a negative effect on fear of progression

*Hypothesis 2.* Fear of progression has a negative effect on resilience

*Hypothesis 3.* Family function has a positive effect on resilience

*Hypothesis 4.* Family function has a positive effect on QoL

*Hypothesis 5.* Fear of progression has a negative effect on QoL

*Hypothesis 6.* Resilience has a positive effect on QoL

### 2.3. Measures

**2.3.1. Demographics and Clinical Characteristics of the Participants.** We used researcher-designed items to collect the demographic and clinical information of the participants in this study. The variables included age, marital status, education level, occupation, residence, payment method for medical costs, monthly income, the type of pathology of cervical cancer, and the awareness of the “cervical and breast cancer screening service.”

**2.3.2. Family Function.** This study used the 5-item Chinese version of the self-administered family APGAR scale to measure the CC patients’ satisfaction with family support. Fan and Songnuan [31] translated and validated the Chinese iteration of the family APGAR scale, encompassing five dimensions: adaptation, partnership, growth, affection, and resolve. Each item was rated on a Likert-type scale as follows: 0-never, 1-just a little, and 2-often. The total possible score ranged from 0 to 10, with higher totals indicating elevated family functionality. A score of 0 to 3 indicates a serious lack of family function. A score of 4 to 6 indicates a moderate lack of family support, and a score of 7 to 10 indicates a high family support. The internal consistency reliability of the scale by Cronbach’s alpha coefficient was estimated as 0.929 in our study.

**2.3.3. Fear of Progression.** The Fear of Progression Questionnaire short-form (FoP-Q-SF) in Chinese, validated by Qi-Yun et al. [32], has been reliably employed to assess fear of progression in cancer patients [33]. Comprising 12 items, the FoP-Q-SF includes two dimensions: physical health (items 1, 2, 3, 5, 9, and 10) and social family function (items 4, 6, 7, 8, 11, and 12). Responses are recorded on a five-point Likert scale, ranging from 1 (never) to 5 (very often). Total scores range from 12 to 60, with higher scores indicating greater fear of progression. A score exceeding 34 indicates the onset of psychological dysfunction. In this study, Cronbach’s alpha coefficient was 0.929.

**2.3.4. Resilience.** Patients’ resilience was measured with the Chinese version of the 14-item Resilience Scale (RS-14) [34]. The Chinese version of the RS-14 had been used in previous studies, and the reliability and validity had been confirmed [35]. RS-14 is a 14-item scale that is clustered into two subscales: personal competence (10 items, including personal and self-control abilities) and the acceptance of self and life (4 items, including acceptance of life and a sense of peace despite adversity). Each item is measured on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating greater resilience. Resilience fell into the low category when the score was  $\leq 63$ , moderate when the score was 64–73, and high when the score was  $\geq 74$  [36]. In this study, Cronbach’s alpha coefficient was 0.932.

**2.3.5. Quality of Life.** The 12-item Short-Form Health Survey (SF-12), which was derived from the 36-item Short-Form Health Survey, was used to assess CC patients’ QoL [37]. It contains 12 items and 8 subscales: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), role-emotional (RE), social functioning (SF), and mental health (MH). The eight SF-12 domains hypothetically form two dimensions: the physical component summary (PCS) and the mental component summary (MCS). The score of PCS is obtained from GH, PF, RP, and BP. The score of MCS is obtained from VT, RE, SF, and MH. According to the scoring manual, the summary score of SF-12 is converted into a score within a range of 0 to

100. In this study, QoL scores were transformed into T-scores using normative data from the general U.S. population [38]. If T-scores <50 for the PCS, MCS and eight subscales, it would indicate below-average health status. The SF-12 has shown satisfactory reliability and validity in the Chinese population [39]. There were 0.918 Cronbach's alpha coefficients for the full scale and 0.848 and 0.897 for the PCS and MCS subscales.

**2.4. Data Collection Procedure.** The original authors granted permission to utilize the standard instruments in the survey. Data collection was conducted in Jiangsu from December 2021 to September 2022. During hospitalization, doctors and nurses referred patients to the study. The researcher used standardized instructions to explain the purpose, methodology, significance, requirements, and content of this study to the participants and instructed the participants to scan the QR code with their cell phones and complete the online questionnaire independently. Informed consent was obtained from all participants. The questionnaire was online, and participants were not allowed to submit until the last question was answered to complete the questionnaire. Therefore, there were no missing values in this study. Participants who answered the questions too short (less than 2 minutes) or too long (20 minutes) were excluded from the study. The entire survey lasted between 10 and 25 min.

**2.5. Ethical Considerations.** This study which involved human participants was reviewed and approved by the Ethics Committee for Human Research at Burapha University, and all study procedures were approved (No. IRB3-067/2565). Informed written consent was also taken from each participant before the study.

**2.6. Statistical Analysis.** The data were analyzed using SPSS Version 23.0 (IBM Corp., Armonk, NY, USA) and Amos 28.0 programs (IBM Corp., Armonk, NY, USA). The normality of variables was tested based on examinations of skew and kurtosis, using cutoff scores of  $\pm 2$  for skew and  $\pm 7$  for kurtosis [40]. Characteristics of the data are presented as the mean values, standard deviations (SDs), and frequencies. The internal consistency, construct reliability (CR), and convergent validity for each instrument were evaluated through confirmatory factor analysis (CFA). Exploratory factor analysis (EFA) was used to conduct Harman's single-factor test to identify the existence of common method bias. The differences among sociodemographic characteristics and clinical data in the main variables were examined using one-way ANOVA. Partial correlation analysis was conducted to examine the associations among family function, FoP, resilience, and QoL. A mediator variable, also called "intervening or process variable," is the variable that causes mediation in the relationship between the dependent variable and the independent variable [41]. To test the aforementioned research hypothesis, we utilized structural equation modeling (SEM) to design a chain-mediating

model with family function as the independent variable, FOP and resilience as the mediating variables, and QoL as the dependent variable. A structural model path analysis was employed with maximum likelihood estimation to test the hypothesized relationships. The model was proven to have a good fit with a chi-square/degrees of freedom ( $\chi^2/df$ ) value <3, goodness-of-fit (GFI) value  $\geq 0.90$ , root mean square approximation error (RMSEA) value <0.08, relative fit index (RFI) value  $\geq 0.90$ , and normed fit index (NFI) value  $\geq 0.90$  [42]. Finally, the bootstrapping method was used to test the effects of the study model. All statistical tests were conducted by two-sided tests, and a *P* value less than 0.05 indicated statistical significance.

### 3. Results

**3.1. Demographic and Clinical Characteristics.** The socio-demographic characteristics and clinical data of the patients are summarized in Table 1. The mean age was 56.32 years (SD = 12.87, range = 21–86, skewness = -0.150, and kurtosis = -0.447). In terms of marital status distribution, the groups married within 20–30 years (67/252, 26.6%) and over 30 years (139, 55.2%) were the most represented. Education level was relatively low, with high school and above accounting for only 16.3% (41/252). The surveyed samples were mainly working people, with employees accounting for 59.2% (149/252). The residence distribution was relatively even. Most of the participants paid the medical costs via medical insurance (238/252, 94.4%), and 85.7% of them reported their monthly income less than 5000RMB. The pathological type of patients diagnosed with cervical cancer was mainly squamous cell carcinoma of the uterine cervix (170/189, 89.9%). The majority of participants were aware of the "cervical and breast cancer screening service" (208/252, 82.5%).

**3.2. Family Function, Fear of Progression, Resilience, and Quality of Life of Patients with Cervical Cancer.** CFA was used to examine the reliability and validity of the instruments. Measurement fit indices and most of them achieving the cutoff scores for fitness are shown in supplemental information Table S1. The results of construct reliability (CR) and convergent validity for the instruments are displayed in supplemental information Table S2. The factor loadings of all items were high, ranging from 0.83 to 0.86 for the family APGAR Scale, 0.54 to 0.92 for the FoP Questionnaire-short form, 0.62 to 0.87 for the Resilience Scale, and 0.79 to 1 for the 12-item Short-Form Health Survey (SF-12). Regarding squared multiple correlations, all items presented moderate to high reliability, with values ranging from 0.29 to 1 [43]; therefore, all of them remained in this study. The CR of each domain was higher than 0.7 (ranging from 0.87 to 1), indicating that the construct had excellent internal consistency [42]. The average variance extracted (AVE) value was used to evaluate the convergent validity and was found to be acceptable (ranging from 0.52 to 1), as it was greater than 0.5 [44].

TABLE 1: Sociodemographic characteristics and clinical data of the cervical cancer patients.

Characteristics	Participants (n = 252)
Age (years), n (%)	
<40	32 (12.7)
40~59	118 (46.8)
≥60	102 (40.5)
Marital status, n (%)	
Married for 20 years	46 (18.3)
Married for 20~30 years	67 (26.6)
Married for more than 30 years	139 (55.2)
Education level, n (%)	
Elementary school or less	138 (54.8)
Junior high school	73 (29.0)
High school or more	41 (16.3)
Occupation, n (%)	
Employed	149 (59.2)
Retired	22 (11.1)
Unemployed	81 (32.1)
Residence, n (%)	
Rural	95 (37.7)
Town	63 (25.0)
County	47 (18.7)
City	47 (18.7)
Payment method of medical costs, n (%)	
Self-supporting	14 (5.6)
New rural cooperative medical care system	142 (56.3)
Medical insurance for urban residents	96 (38.1)
Monthly income (RMB), n (%)	
<3000	111 (44.0)
3000~5000	105 (41.7)
>5000	36 (14.3)
Type of pathology (n = 189, n %)	
Squamous carcinoma of the uterine cervix	170 (89.9)
Cervical adenocarcinoma	17 (8.9)
Other	2 (1.2)
Aware of the “cervical and breast cancer screening service,” n (%)	
Know	96 (38.1)
Know some	112 (44.4)
Don't know at all	44 (17.5)

The descriptive statistics of the constructs included in the model are listed in Table 2, including family function, FoP, resilience, and QoL. To avoid potential common method biases arising from the questionnaire methodology, this study employed Harman’s single-factor test. In exploratory factor analysis, an examination of the unrotated factor analysis results revealed that the maximum unrotated factor variance accounted for was 33.28%, which is below the critical threshold of 40% [45]. This indicates that there is no single factor in the sample data that explains the vast majority of variance, suggesting the absence of significant common method biases in this study. The variables had skewness values ranging from -0.77 to 0.48 and kurtosis values ranging from -1.03 to 0.96, indicating that all variables had a relatively normal distribution. The mean score of family function was (7.97 ± 2.41), indicating a low lack of family support level. The mean score of FoP was

(29.58 ± 10.14), indicating a relatively serious FoP level. The mean resilience score was (69.37 ± 14.36), indicating a moderate resilience level. The mean T-score for PCS was (41.87 ± 10.00), and for MCS, it was (46.68 ± 11.78), with most of the subscales also registering below 50, suggesting a lower QoL level (Table 2).

**3.3. Preliminary Correlation Analyses.** The results of the one-way multivariate analysis are shown in supplemental information Table S3. Age, education level, residence, payment method of medical costs, monthly income, the stage of cervical cancer, and awareness of the “cervical and breast cancer screening service” were significantly associated with family function, FoP, resilience, and QoL scores. The QoL levels of the participants were higher among those less than 40 years old, those who had high school education or more, those who had an income of more than 5000 RMB per month, those who were diagnosed with the precancerous lesion stage, and those who do not have awareness of the “cervical and breast cancer screening service.” The correlation analysis and correlation matrix among the dependent and independent variables are illustrated in Table 3. Family function was negatively correlated with FoP and positively correlated with resilience, physical, and mental component summary scores. FoP was negatively correlated with resilience, physical, and mental component summary scores. Resilience was positively correlated with the physical and mental component summary scores. Physical component summary scores were positively correlated with mental component summary scores.

**3.4. Measurement Model Analysis.** As shown in Table 4, the factor-loading parameters in the FoP matrix (0.87–0.92), resilience matrix (0.89–0.92), and QoL matrix (0.82–0.86) were all significant ( $P < 0.01$ ). The CR of each latent variable ranged from 0.83 to 0.90, exceeding the 0.7 threshold value and showing good internal consistency. Moreover, the AVE value of each construct was also higher than 0.5, showing acceptable convergent validity. Furthermore, the square roots of the AVE coefficients were greater than the squared correlation coefficient between the constructs (supplemental file Table S4), denoting satisfactory discriminant validity.

**3.5. Structural Model Analysis.** The goodness-of-fit indices of the structural model were  $\chi^2/df = 1.18$ , GFI = 0.99, RESEA = 0.03, RFI = 0.97, and NFI = 0.99, indicating a good fit. As shown in Table 5 and Figure 2, the model explained 7% of the variation in FoP, 24% of the variation in resilience, and 42% of the variation in QoL. The results for the direct effect of family function on FoP ( $\beta = -0.27, P < 0.01$ ), the direct effect of FoP on resilience ( $\beta = -0.38, P < 0.01$ ), and the direct effect of FoP on QoL ( $\beta = -0.45, P < 0.01$ ) were negative and statistically significant. The results for the direct effect of family function on resilience ( $\beta = 0.23, P < 0.01$ ) and the direct effect of resilience on QoL ( $\beta = 0.30, P < 0.01$ ) were positive and statistically significant. Moreover, family function exerted an indirect positive effect on QoL through

TABLE 2: Descriptive characteristics for family function, fear of progression, resilience, and quality of life.

Variable	Raw score range	Rating, mean (SD)	Sk	Ku
Family function	0–10	7.97 (2.41)	–0.77	–0.61
Fear of progression				
Physical health	6–30	16.27 (5.44)	–0.09	–0.66
Social family	6–30	13.31 (5.26)	0.48	–0.29
Total	12–60	29.58 (10.14)	0.11	–0.61
Resilience				
Personal competence	4–28	20.48 (4.22)	–0.32	0.55
Acceptance of oneself and life	10–70	48.88 (10.71)	–0.47	0.98
Total	14–98	69.37 (14.36)	–0.37	0.77
Quality of life <sup>a</sup>				
Physical component summary	0–100	41.87 (10.00)	–0.39	–0.43
Physical functioning	0–100	42.05 (11.54)	–0.29	–0.92
Role-physical	0–100	43.32 (10.90)	–0.35	–0.76
Bodily pain	0–100	43.45 (11.34)	–0.45	–0.49
General health	0–100	37.37 (12.75)	0.43	–1.03
Mental component summary	0–100	46.68 (11.78)	–0.39	–0.28
Vitality	0–100	54.30 (10.95)	–0.43	–0.56
Social functioning	0–100	42.94 (11.98)	–0.47	–0.75
Role-emotional	0–100	39.81 (12.21)	–0.42	–0.40
Mental health	0–100	46.91 (12.16)	–0.57	0.05

<sup>a</sup>Transformed into *T*-scores based on the normative data from the 1998 general U.S. population. SD, standard deviation; Sk, skewness; Ku, kurtosis.

TABLE 3: Correlation matrix among family function, fear of progression, resilience, and quality of life while controlling for the effect of sociodemographic variables.

Variable	1	2	3	4	5
1. Family function	1.00				
2. Fear of progression	–0.258**	1.00			
3. Resilience	0.317**	–0.383**	1.00		
4. Physical component summary	0.159*	–0.441**	0.399**	1.00	
5. Mental component summary	0.231**	–0.486**	0.384**	0.708**	1.00

\*\* $P < 0.01$ ; \* $P < 0.05$ .

TABLE 4: The confirmatory factor analysis of the measurement model.

Latent variable	Measured variable	<i>B</i>	$\beta$	C.R.	SMC	CR	AVE
Fear of progression	Social family	1	0.87		0.75		
	Physical health	1.09	0.92	12.78**	0.84	0.89	0.80
Resilience	Acceptance of oneself and life	1	0.89		0.79		
	Personal competence	0.4	0.92	12.77**	0.84	0.90	0.82
Quality of life	Mental component summary	1	0.86		0.74		
	Physical component summary	0.99	0.82	10.84**	0.67	0.83	0.71

*B*, unstandardized coefficients;  $\beta$ , standardized coefficients; C.R., critical ratio; SMC, squared multiple correlations; CR, construct reliability; AVE: average variance extracted. \*\* $P < 0.01$ .

FoP ( $\beta = 0.12$ ,  $P < 0.01$ ) and resilience ( $\beta = 0.07$ ,  $P < 0.01$ ). Likewise, the serial mediating effect of FoP and resilience was also significant ( $\beta = 0.03$ ,  $P < 0.01$ ). However, the direct effect of family function on QoL was not significant ( $\beta = 0.02$ ,  $P = 0.24$ ), indicating a complete mediating effect on QoL through FoP and resilience. To verify the indirect effects of the dependent variable through the mediators, bias-corrected percentile bootstrapping at a 95% confidence interval with 5,000 samples was performed. The results shown in Table 5 confirmed the existence of significant

indirect effects of FoP and resilience between family function and QoL, and the lower- and upper-level confidence intervals did not include zero.

#### 4. Discussion

Cervical cancer is the most prevalent malignant tumor of the reproductive system, often affecting women between 30 and 55 years [46]. With the development of early screening and the improvement of diagnosis and treatment in cervical

TABLE 5: Total, direct, and indirect effects of the structural model.

Structural path	Path analysis coefficient				Bootstrapping 95% CI		
	<i>B</i>	$\beta$	S.E.	C.R.	Lower	Upper	<i>P</i>
<b>Total effects</b>							
Family function $\rightarrow$ QoL	1.89	0.24	0.57	3.62**	0.09	0.36	<0.01
<b>Direct effects</b>							
Family function $\rightarrow$ FoP	-0.51	-0.27	0.12	-4.12**	-0.39	-0.15	<0.01
Family function $\rightarrow$ RS	0.91	0.23	0.25	3.64**	0.10	0.34	<0.01
Family function $\rightarrow$ QoL	0.12	0.02	0.51	0.24	-0.11	0.14	0.83
FoP $\rightarrow$ RS	-0.79	-0.38	0.15	-5.41**	-0.50	-0.24	<0.01
FoP $\rightarrow$ QoL	-1.92	-0.45	0.31	-6.13**	-0.59	-0.32	<0.01
RS $\rightarrow$ QoL	0.60	0.30	0.15	4.09**	0.14	0.43	<0.01
<b>Indirect effects</b>							
Family function $\rightarrow$ FoP $\rightarrow$ QoL	0.99	0.12	0.29	3.08**	0.49	1.61	<0.01
Family function $\rightarrow$ RS $\rightarrow$ QoL	0.55	0.07	0.20	3.99**	0.22	1.02	<0.01
Family function $\rightarrow$ FoP $\rightarrow$ RS $\rightarrow$ QoL	0.24	0.03	0.10	2.18**	0.1	0.5	<0.01

*B*, unstandardized coefficients;  $\beta$ , standardized coefficients; S.E., standard error; C.R., critical ratio; CI, confidence interval; QoL, quality of life; FoP, fear of progression; RS, resilience. \*\**P* < 0.01.

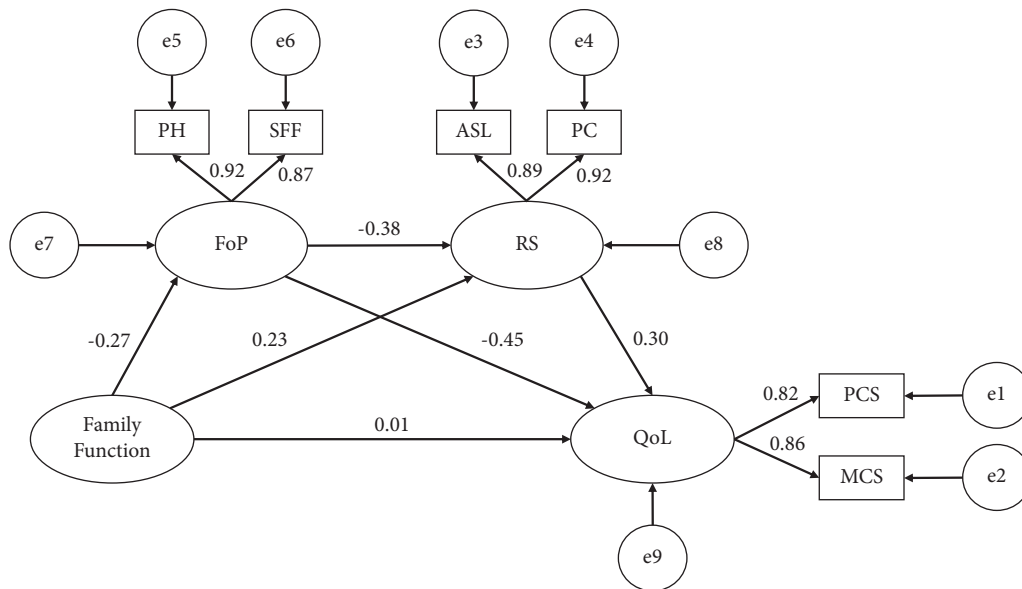


FIGURE 2: Structural model predicted fear of progression and resilience in the relationship between family function and quality of life. FoP, fear of progression; PH, physical health; SFF, social family function; RS, resilience; PC, personal competence; ASL, the acceptance of self and life; QoL, quality of life; PCS, physical component summary; MCS, mental component summary.

cancer, the 5-year survival rate of CC patients in China has been significantly improved. However, cervical cancer has the characteristics of easy recurrence and metastasis, which may easily lead to anxiety, and depression and even cause patients to have FoP and other negative psychology, thus reducing efficacy and prognosis and impacting the QoL [47]. Patients usually worry about losing their financial source, fertility, and sexual function and even worry about being alienated by family, friends, and society [26]. In the long run, the family function and resilience of patients may also be affected to varying degrees, which is not conducive to rehabilitation. The present study described the current level of family function, FoP, resilience, and QoL in patients with cervical cancer. In addition, this study proposed and tested a serial mediator model evaluating the internal mechanism

of family function in predicting QoL, with FoP and resilience as mediators. This mediation model explained 42% of the variation in QoL.

The level of family function in CC patients was found to be generally in good condition in our research, which was consistent with previous study results [48]. Family function directly reflects the degree to which the family supports the individual, the intimacy among family members, and the ability to work together to solve and cope with stress [49]. The above results indicate that CC patients can get relatively satisfactory emotional support and material resources from their families, which is inseparable from the traditional family concept in China, such as the family becoming prosperous through union and filial piety as the first. In China, families generally meet most of the reasonable needs

of family members, and the whole family can overcome the crisis in a united way. Therefore, good family function conditions can help the family members usually give patients more care, and psychological and spiritual support, increasing the patients' hope for life and actively dealing with the negative impact of the disease; patients with cervical cancer can experience more positive feelings in the process of care. Thus, nurses should pay attention to patients' family functions, regularly hold family get-togethers, knowledge lectures, and other activities to enhance the intimacy within the family, create a relaxed and happy family atmosphere, and improve family functions.

Our results showed that the mean score of FoP value of CC patients was  $29.58 \pm 10.14$  in the present study, similar to the level of FoP ( $30.48 \pm 10.10$ ) reported in south China among female patients with cervical cancer [50], which suggests that the CC patient has a relatively serious level of FoP. At present, many researchers have carried out relevant research on the FoP of CC patients, and previous results show that the incidence of FoP psychological dysfunction in CC patients is high in China [50]. It may be because the treatment process is painful, the treatment cycle is long, and the prognosis is poor in patients with cervical cancer, and surgery or other relevant treatments of cervical cancer may change patients' sexual function, which affects the relationship between the husband and wife, increasing the level of FoP in CC patients [51], and seriously affecting personal life and work. Fear bringing a burden to the family, fear of pain, and fear of disease progression are the 3 greatest fears in patients with cervical cancer [52]. Therefore, medical staff should pay attention to the impact of FoP on patients with cervical cancer, timely assess the level of FoP in patients, and make early interventions to enhance patients' confidence in overcoming the disease and reduce their level of FoP, such as introducing the possible complications of treatment to patients in advance and informing them of preventive measures. In addition, it is also necessary to provide patients with systematic guidance on sexual knowledge, correct their misconceptions, help establish a close relationship between the husband and wife, and reduce the level of FoP in CC patients.

The participants had a moderate level of resilience. The level of resilience of CC patients in our study is moderate ( $69.37 \pm 14.36$ ), which was lower than the level of resilience ( $70.57 \pm 12.14$ ) reported in China among women with abnormal cervical cancer screening results [53]. This may be because the participants in this study are patients who have been diagnosed and have received treatment for cervical cancer. In addition, 59.5% of the participants in this study are younger than 59 years old, and 59.2% of the participants were still employed to work; they also had to work or raise children while treating diseases. Thus, they may bear more responsibilities and pressures from family and society and are prone to physical and mental fatigue, which affects their level of psychological resilience. At the same time, our research also found that only 38.1% of the patients were aware of the "cervical and breast cancer screening service," and this

lack of cognition may lead to an increase in the patient's FoP level and a decrease in the patient's resilience level. Therefore, it is recommended that medical staff should timely observe and alleviate patients' adverse emotional reactions, expand the awareness and participation rate of screening, and strengthen efficient and sufficient education of prevention, and home-based self-management methods are the keys to improving the resilience of the affected women.

In general, QoL is viewed as a holistic notion that encompasses sentiments of health as well as those related to disease or treatment, as well as physical, psychological, and social well-being [54]. In recent years, it has already played a significant role in monitoring the course of cancer treatment and its prognosis or effects on rehabilitation [55]. In this analysis, the T-scores for PCS were below 50 compared to the general U.S. population, indicating poor physical health. In addition, the physical component values in the SF-12 were  $45.36 \pm 0.17$  from a nationally representative survey in the United States among CC patients [56], which exceeded the PCS score of  $41.87 \pm 10.00$  found in this study. This variance might stem from the inclusion of newly diagnosed cervical cancer patients in our study. As indicated in prior research, individuals with cervical cancer experience a significant decline in sexual and physiological function during the initial six weeks posttreatment, with gradual recovery over the subsequent year due to adaptation to disease-related stress [56]. Moreover, the MCS score in this study ( $46.68 \pm 11.78$ ), akin to the mental component score of the SF-12 in CC patients in the United States ( $46.16 \pm 0.99$ ), indicated lower mental health levels [56]. Millet et al. posited that the psychological burden associated with a cervical cancer diagnosis and coping with treatment-related issues remains significant, irrespective of treatment modality [57]. The emotional challenges faced by cervical cancer patients due to diagnosis and treatment can lead to heightened anxiety and depressive moods, stemming from concerns about the future, disease impact, and treatment side effects. These affect emotional well-being and daily functionality. Moreover, changes in body image can impact self-esteem and social relationships, posing identity challenges [57]. This interplay of psychological stressors and emotional distress reduces life satisfaction and mental health status among cervical cancer patients, substantially impacting overall quality of life. Therefore, it is imperative to provide comprehensive support and psychological interventions that address these factors to enhance the mental well-being and life quality of affected patients.

As hypothesized, our findings revealed that family function significantly positively predicted CC patients' resilience and significantly negatively predicted their FoP. These findings were consistent with previous studies, showing a positive association with resilience [58] and a negative association with FoP [59]. This may be because good relationships among family members can create love and trust and provide encouragement and reassurance that help improve patients' resilience [60]. When CC patients



perceive that their family members love and trust, they tend to show good problem-solving skills and a low level of FoP. Our findings confirmed the hypothesis that FoP significantly negatively predicted CC patients' resilience and QoL, which was consistent with previous study results [3, 61]. Due to the pathological and physiological characteristics of cancer itself, the FoP of cancer has not been effectively solved and prevented [24]. The high level of FoP may bring psychological stress to patients, weaken the patient's resilience, and impair their QoL [62]. We also find that resilience can significantly positively predict CC patients' QoL; this discovery has also been confirmed in previous studies [63]. Resilience is a transdiagnostic protector against mental disorders and a decreasing QoL among individuals faced with diverse adversities [64, 65]. This suggests that patients with high resilience have ability to adapt to difficult situations, and thus, it can be easier to adapt to a cancer diagnosis. For this reason, resilience would play a key role in maintaining and improving QoL [66].

However, the family function could not directly predict CC patients' QoL, indicating a complete mediating effect on QoL through FoP and resilience. Furthermore, our research examined whether and how CC patients' family function was associated with their QoL directly and indirectly through the mediation of their FoP and resilience. Our research found that the FoP and resilience acted separately as a mediator in the relationship between family function and QoL among Chinese CC patients. At the same time, FoP and resilience were found to be a chain-mediating effect in the relationship between family function and QoL in the outcomes of the mediating effect, which shows that the family function of CC patients can affect QoL in turn or alone through FoP and resilience. The level of family function reflects the degree of communication, cooperation, and mutual care between patients and caregivers. Patients with low family function may lack emotional connection and effective communication with family members, which may lead to lack of understanding and appreciation, resulting in serious self-burden falling into a state of self-isolation, and avoiding dealing with all problems [67]. When the disease progresses, if CC patients' family function is in a poor state, patients' emotional distress may become increasingly severe and eventually lead to a higher FoP, which decreases resilience, and as a result, reduces their level of QoL. Consequently, our findings suggest that family function influences QoL in CC patients through a psychological mechanism, and the effect of internal psychological state including FoP and resilience on QoL in CC patients should be given enough attention by medical staff and family caregivers.

**4.1. Study Limitations.** This research is the first to evaluate FoP, resilience, family function, and QoL among patients with cervical cancer in China and to examine the mediating function of FoP and resilience between family function and QoL. In addition, our research has three main limitations. First, the small sample size limits its representativeness. Second, due to the self-reported nature of the survey, bias is inevitable. Third, selecting participants from one city might limit the generalizability of the findings.

**4.2. Conclusions.** Our findings suggested that the QoL level was poor in women with cervical cancer. There are multiple mediating effects of FoP and resilience on the relationship between patients' family function and QoL, which was the first attempt to use the SEM method to investigate the chain-mediating effect of psychological variables in the relationships between family function and QoL. The present study highly recommended that medical staff should pay attention to CC patients with weak family function and take interventions to reduce FoP and enhance resilience, which might be helpful to improve their QoL.

### Data Availability

The datasets that were employed and analyzed for this research can be obtained from the corresponding author upon reasonable request.

### Ethical Approval

This study which involved human participants was reviewed and approved by the Ethics Committee for Human Research at the University of Brafa, and all study procedures were approved (No. IRB3-067/2565).

### Conflicts of Interest

The authors declare that they have no conflicts of interest.

### Authors' Contributions

Chuntao Wang and Yaling Wang have contributed equally to this work and share first authorship.

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### Supplementary Materials

Table S1: fit indices of the measurement models for the instruments. Table S2: the reliability and validity of the research instruments. Table S3: comparison level of dyadic coping, resilience, self-efficacy, and quality of life in different characteristics of cervical cancer patients. Table S4: the

discriminant validity of the measurement model. (*Supplementary Materials*)

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