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Understanding the role of resourcefulness in family functioning: mediating effects of family coping and social support in caregivers of young and middle-aged lymphoma patients

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Abstract

Background Families of young and middle-aged lymphoma patients face significant burdens affecting their overall functioning and well-being. Caregivers play a critical role in managing these challenges, yet the factors that enhance their ability to support their families effectively, such as caregiver resourcefulness, remain inadequately understood.

Aims This study aimed to explore the relationships between caregiver resourcefulness and family functioning, focusing on the mediating roles of family coping and perceived social support.

Methods This cross-sectional study was conducted in the oncology units of two tertiary hospitals in China from May to November 2022. Data were collected on caregiver resourcefulness, family coping, perceived social support, and family functioning, and were analyzed using parallel mediation techniques.

Results The study included 211 caregivers. Those with higher levels of resourcefulness demonstrated better family functioning. Mediation analysis revealed that family coping and perceived social support partially mediated these relationships ($\beta = -0.132$, 95% CI $[-0.208, -0.063]$; $\beta = -0.123$, 95% CI $[-0.200, -0.054]$, respectively). Both factors jointly mediated the relationships between resourcefulness and the communication and general functioning dimensions. However, neither significantly mediated the relationship between resourcefulness and behavioral control.

Conclusions Family coping and perceived social support act as partial parallel mediators in the relationship between caregiver resourcefulness and family functioning. Caregivers who exhibit higher resourcefulness, stronger family coping, and greater perceived social support experience enhanced family functioning, particularly in communication and general functioning domains. These findings highlight the importance of contextual factors, indicating that

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interventions designed to boost caregiver resourcefulness while promoting effective family coping and support systems are essential for improving outcomes for families navigating the challenges of lymphoma.

Clinical trial number Not applicable.

Keywords Young and middle-aged lymphoma, Caregiver, Resourcefulness, Family functioning, Multiple mediation

Introduction

Approximately 635,000 new cases of lymphoma are diagnosed globally each year, with China accounting for about 85,200 of these cases [1]. In China, lymphoma ranks 11th in incidence among all malignant tumors and has become one of the top ten causes of death from malignant tumors [2]. The incidence of lymphoma is increasingly seen in younger populations, with over 30% of global lymphoma patients being young and middle-aged [3]. Cancer imposes multiple challenges on patients, including the physical and psychological stress of treatment and disruptions to social and occupational life, while also placing significant pressure on caregivers [4]. Family caregivers of lymphoma patients shoulder multifaceted responsibilities, ranging from symptom management and daily care provision to offering financial and emotional support throughout treatment and recovery [5–7]. These demands are compounded by disease-specific challenges: lymphoma's relapsing-remitting nature and prolonged treatment protocols (e.g., chemotherapy, immunotherapy, stem cell transplantation) impose unique emotional and logistical burdens on caregivers, as evidenced by Fisher et al. [6] and Mullis et al. [8] who highlighted persistent psychosocial distress in survivors and caregiver strain extending beyond active treatment phases. Consequently, caregivers frequently experience heightened anxiety, depression, and psychological distress, all of which can impair family functioning—a critical determinant of both patient health behaviors/outcomes [9, 10] and caregivers' own psychological well-being and quality of life [11–13].

Family functioning encompasses the abilities of family members to effectively communicate, complete household tasks, fulfill familial roles and responsibilities, manage and adapt to family stressors, and maintain close and supportive relationships [14]. Research by Yu et al. shows that in the first year following a cancer diagnosis and treatment, family caregivers typically experience moderate levels of family functioning, which is significantly correlated with their psychological health status [12]. This underscores the importance of paying attention to family functioning in caregivers of young and middle-aged lymphoma patients during their treatment process. Previous studies have demonstrated the protective role of family functioning in the psychological health and quality of life of caregivers [11–13]. However, the protective psychological factors influencing family functioning

remain largely unexplored. This study focuses on the concept of resourcefulness, examining its impact on family functioning and the potential mediating mechanisms involved.

Resourcefulness and family functioning

Resourcefulness encompasses an individual's capacity to manage stress independently and mobilize external resources [15, 16]. It plays a crucial role in enhancing stress-coping abilities, improving psychological functioning, and alleviating both psychological and physiological symptoms [17]. In cancer caregiving, resourcefulness is an essential coping skill that helps individuals navigate the complex pressures of their roles, potentially improving family dynamics. McCubbin and Patterson's Double ABC-X Model posits that A represents stressors, B refers to resources, C denotes appraisal, and X signifies adaptation. The model underscores the importance of resources in helping family systems avert crises and mitigate disruptions caused by stressful events [18]. These resources, from existing to newly acquired assets at individual (B_1), family (B_2), and societal (B_3) levels, are critical for promoting family adaptation and maintaining system balance. Resourcefulness, as an individual-level resource, enhances coping abilities, reducing the impact of family demands (A-stressors) on family functioning (X-adaptation) [19]. While studies have shown a correlation between resourcefulness and depressive symptoms in various populations, the association between resourcefulness and family functioning, though approaching significance, has not been statistically significant [15]. Research on this topic remains limited. Our previous research demonstrated a significant positive correlation between resourcefulness and family functioning among young and middle-aged lymphoma patients [20]. However, there is a lack of studies focusing on the direct impact of resourcefulness on family functioning among lymphoma caregivers.

The mediating role of family coping and perceived social support

Resourcefulness may impact family functioning through its influence on family coping and social support. Interactions between resourcefulness and family coping, as well as between resourcefulness and social support, further shape family functioning. McCubbin and Patterson's Double ABC-X model, alongside Bronfenbrenner's

ecological systems theory, provides a comprehensive understanding of caregiver-family adaptation [18, 21]. According to the Double ABC-X model, resourcefulness, family coping, and social support represent resources at the individual (B_1), family (B_2), and societal levels (B_3), respectively [18]. Together, these resources play a critical role in maintaining family functioning balance. Ecological systems theory emphasizes the interaction of resources across different levels (micro, meso, macro), and their cumulative impact on family functioning [21]. This theory highlights resourcefulness as a cross-system catalyst — affecting not only the individual level (micro) through self-regulation and proactive coping, but also enhancing family coping (meso) and facilitating access to broader social support (macro). This perspective suggests that individuals can affect their development and functioning through interactions and resource acquisition within these systems.

Family coping refers to family-level strategies to manage challenges, including communication, role fulfillment, emotional support within the family, and seeking help from external sources [22]. Individuals with higher resourcefulness often manage stress and conflict more effectively, potentially altering family interaction patterns through personal behavioral and strategic changes [19]. They may enhance family coping abilities by fostering understanding and cooperation among family members through active communication and problem-solving. The Double ABC-X model emphasizes how families adjust and respond to stressors, highlighting the role of family resources and coping behaviors in maintaining family functioning equilibrium [18]. Research indicates a positive correlation between cancer survivors' levels of family coping and their family functioning, with higher family coping abilities corresponding to stronger family functioning [23]. However, the relationship between resourcefulness, family coping, and family functioning among lymphoma caregivers warrants further investigation.

Social support includes assistance and support from friends, relatives, community organizations, and professional services. Perceived social support operates at the societal level and refers to the perceived availability of emotional or instrumental support from both internal (family) and external (community) sources [24]. Individuals with high resourcefulness are inclined to actively seek external support and resources when needed, fully utilizing available social resources such as medical services, psychological counseling, and community support groups [15, 16]. Simultaneously, they establish and maintain broad support networks through proactive social interactions. Studies show that individuals with high resourcefulness perceive higher levels of social support [25, 26]. Adequate social support has been proven to improve family functioning in the context of cancer, enhancing individuals' self-esteem and family functioning levels, as well as reducing negative perceptions of stressful events and providing effective strategies for coping with stress, thereby promoting psychological health [25, 26]. However, the relationship between resourcefulness, perceived social support, and family functioning among lymphoma caregivers remain unclear.

Therefore, resourcefulness, which emphasizes the caregiver's individual capacity to cope, exerts a comprehensive positive impact on family functioning through both its direct influence and its indirect effects on family coping and perceived social support. Although there is limited research on the relationships between resourcefulness, family coping, perceived social support, and family functioning in the context of young and middle-aged lymphoma caregiving, this study aims to explore these relationships and their mediating effects, as depicted in Fig. 1. The research hypotheses are as follows:

H1 Caregivers' resourcefulness directly influences their family functioning.

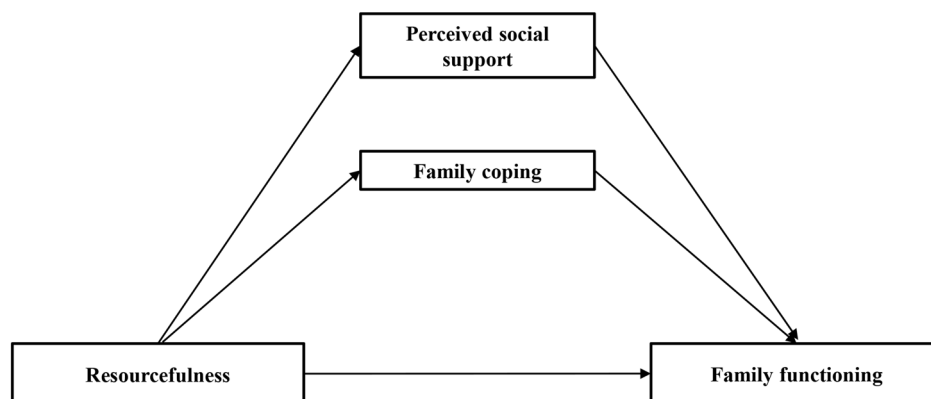


Fig. 1 Hypothesized conceptual model of the multiple mediation

H2 Family coping and perceived social support mediate the relationship between resourcefulness and family functioning, including its sub-dimensions.

Methods

Study design and settings

Between May and November 2022, a cross-sectional study was conducted in the oncology units of two tertiary hospitals in Henan Province, China.

Participants and procedure

Caregivers of young and middle-aged lymphoma patients were included in the study through convenience sampling. The inclusion criteria for patients were: (1) diagnosed with lymphoma, (2) aged 18–59 years, as individuals aged 60 and above are considered elderly by the WHO [27], (3) informed of their diagnosis, (4) able to read and speak Chinese, and (5) willing to participate and provide informed consent. Exclusion criteria included: (1) serious cognitive impairment or mental illness, or (2) severe complications. Caregivers were eligible if they: (1) were at least 18 years old, (2) were identified by the patient as the primary informal unpaid caregiver, (3) provided continuous care and support at home and during hospitalization, and (4) participated in medical decisions and provided informed consent. Paid caregivers and those with severe mental illness or cognitive impairment were excluded. Sample size calculations were conducted using G*Power 3.1 [28] with a significance level of 0.05, a medium effect size ($f^2 = 0.15$), and 95% power, which indicated a minimum requirement of 129 subjects. To account for a potential 20% non-response rate, we aimed to recruit 162 participants. However, in line with SEM guidelines that recommend a sample size of over 200 participants for stable parameter estimates [29], we decided to recruit 250 dyads, anticipating more than 200 valid responses. Ultimately, the study included 211 valid subjects.

The recruitment process utilized convenience sampling, facilitated by four experienced research assistants who were all registered nurses, with each pair associated with a different hospital. For participants who had difficulty with the survey, these assistants read questions aloud and recorded responses without bias. They also meticulously gathered patient-related clinical information from the hospital's records system. To enhance participant concentration and the quality of responses, surveys were typically distributed in the afternoons when treatment activities were less frequent. Assistants were available to clarify any ambiguities, ensuring participants fully understood the survey questions. After survey completion, assistants reviewed the forms for any missing sections and requested participants to fill in any gaps immediately. Surveys with over 10% of sections

unanswered or showing evident response patterns (e.g., straight-line responding, where a participant selects the same answer for multiple questions regardless of content; alternating responding, where answers follow a fixed pattern like alternating between 'agree' and 'disagree'; or contradictory responses, where answers conflict on reverse-coded and positively-worded items) were excluded to maintain data integrity. Identifying these patterns involved reviewing individual response consistency and cross-checking for contradictions or repeating patterns throughout the questionnaire. Additionally, several strategies were employed to minimize response fatigue, including dividing the questionnaire into smaller, more manageable sections based on individual scales and alternating colors (such as gray and white) between items to maintain participant attention and reduce visual fatigue.

Measurements

Sociodemographic characteristics and clinical patient data

Comprehensive sociodemographic data were collected from caregivers, including age, sex, marital status, education level, employment status, average monthly family income per capita, presence of chronic diseases, relationship to the patient, prior caregiving experience, and duration of caregiving. Similar sociodemographic information was gathered from patients, such as age, sex, marital status, place of residence, education level, average monthly family income per capita, and employment status. Additionally, clinical data were extracted by research assistants, including whether it was the first diagnosis, time since diagnosis, cancer stage, and treatment methods. These variables were considered potential influences on caregivers' family functioning and were used as control variables in subsequent analyses.

Family functioning

The Family Assessment Device (FAD), developed by Epstein et al. [30], comprises seven subscales: Problem-solving (PS), Communication (CM), Roles (RL), Affective Responsiveness (AR), Affective Involvement (AI), Behavior Control (BC), and General Functioning (GF), totaling 60 items. It uses a 4-point Likert scale, with scores ranging from 1 ('very like my family') to 4 ('not like my family'). The total score ranges from 60 to 240, with lower scores indicating better family functioning. Family functioning is classified as good (60–120), average (121–180), or poor (181–240). The FAD was translated into Chinese by Liu and He [31], and the validity and reliability of the Chinese version have been well-established [31, 32]. Moreover, the scale demonstrated good reliability (Cronbach's $\alpha = 0.87$) in a study of Chinese caregivers of cancer patients [12]. In this study, the Cronbach's α coefficient was 0.827.

Resourcefulness

The 28-item Resourcefulness Scale (RS), developed by Zauszniewski et al., was used to assess the resourcefulness of caregivers [33]. The scale comprises two dimensions: personal resourcefulness (16 items) and social resourcefulness (12 items), distinguishing self-reliant coping and external resource mobilization. Each item is rated on a 6-point Likert scale, ranging from 0 ('extremely non-descriptive of one's behavior') to 5 ('extremely descriptive'). The total score ranges from 0 to 140, with higher scores reflecting greater resourcefulness [34]. The RS has demonstrated strong reliability and validity and is widely applied in the Chinese context [35, 36]. In this study, the Cronbach's α coefficient was 0.916.

Family coping

The Family Crisis-Oriented Personal Evaluation Scales (F-COPES), developed by McCubbin et al. in 1981 [37], assess family coping strategies. Wang et al. [38] translated and adapted the scale into Chinese, resulting in a version with six dimensions: acquiring relatives' support, acquiring friends' support, acquiring neighbors' or others' support, seeking spiritual support, reframing, and passive appraisal, comprising a total of 30 items. The scale's Cronbach's α coefficient is 0.86. It uses a 5-point Likert scale, with scores ranging from 1 ('strongly disagree') to 5 ('strongly agree'). The total score ranges from 30 to 150, with higher scores indicating better family coping and problem-solving skills. In this study, the Cronbach's α coefficient was 0.868.

Perceived social support

The Chinese version of the 12-item Perceived Social Support Scale (PSSS), adapted from Zimet's original scale [24], served as a tool to evaluate perception of social support among caregivers. This version of the PSSS consists of two factors, reflecting distinct sources of social support: internal family (4 items) and external family (8 items) [39]. Participants assessed each item using a 7-point Likert scale, ranging from 1 ('very strongly disagree') to 7 ('very strongly agree'). Total scores range from 12 to 84, with higher scores indicating a stronger perception of social support. In our study, the PSSS demonstrated robust internal consistency, with a Cronbach's α coefficient of 0.922.

Statistical analysis

Descriptive analysis was conducted to analyze the data. Demographic variables, including age, sex, and education level, were categorized and summarized using frequencies and percentages. Continuous variables, such as scale scores, were presented as means and standard deviations (mean \pm SD). *Pearson* correlation analysis was employed to investigate the relationships between

different variables. The effects of various factors on family functioning and its sub-dimensions for caregivers were evaluated using independent *t*-tests and one-way ANOVA where applicable. Additionally, a multiple mediation analysis was performed using the PROCESS 3.4 macro within SPSS 21.0, selecting Model 4. In this analysis, resourcefulness was the independent variable, family functioning and its sub-dimensions were the dependent variables, and family coping and perceived social support acted as mediators. Control variables included any statistically significant characteristics identified in the univariate analysis. The Bootstrap method, with a sample size of 5000, was used to assess mediation effects [40]. A mediation effect was considered significant if its confidence interval did not include 0. A significance level of $P < 0.05$ was adopted for this study, with α set for a two-tailed test.

Results

Common method deviation test

Harman single-factor test was performed to check for common method bias [41]. The results showed that there were 38 factors with characteristic roots greater than 1, and the variance explained by the first factor was 16.857%, less than the critical standard of 40%. Therefore, there are no serious common methodological biases in this study and it can be continued.

Descriptive statistics

Of the 230 returned questionnaires (92.0%), 211 (84.4%) were valid for analysis. Table 1 details the characteristics of the patients and caregivers. The mean ages of the patients and caregivers were 41.32 and 42.06 years, respectively. The sex distribution differed, with a higher proportion of males among patients and a higher proportion of females among caregivers. Both groups were predominantly married (78.7% of patients and 86.7% of caregivers), though not necessarily to each other, as 50.7% of caregivers were adult children or parents of the patients. Patients generally had lower educational levels than caregivers. Regarding employment, 41.7% of caregivers were employed compared to 17.0% of patients. Additionally, 53.6% of caregivers reported a monthly per capita household income exceeding 3000 RMB, compared to 51.7% of patients. 55.9% of patients were from rural areas. Among patients, 34.6% had been diagnosed more than six months prior, 43.6% were in stages III or IV of cancer, and 76.3% had undergone chemotherapy or radiotherapy. Nearly half of the caregivers had provided care for at least five months, and 25.1% had prior caregiving experience.

Statistically significant differences were observed in caregivers' family functioning scores concerning the patient's average monthly family income per capita, first-time diagnosis status, caregiver's age, marital status,

Table 1 Univariate analyses of the differences in family functioning of caregivers by patient and caregiver characteristics (N= 211)

Variables		Group	N (%)	Family functioning		P value
<i>Patient characteristics</i>				Mean ± SD	F/t	
Age (year)		18~44	106 (50.2)	125.84±16.96	-0.224	0.823
		45~59	105 (49.8)	126.33±15.02		
Sex		Male	120 (56.9)	127.04±16.21	0.998	0.320
		Female	91 (43.1)	124.82±15.69		
Marital status		Married	166 (78.7)	125.80±15.44	-0.495	0.621
		Unmarried/divorced/widowed	45 (21.3)	127.13±18.03		
Place of residence		Rural	118 (55.9)	126.14±15.28	0.004	0.952
		Urban	93 (44.1)	126.01±16.93		
Education Level		Junior high school and below	107 (50.7)	126.67±16.55	0.400	0.671
		High school/Vocational school	62 (29.4)	126.40±16.50		
		College and above	42 (19.9)	124.12±13.83		
Average monthly family income per capita (RMB)		<3000	102 (48.3)	129.04±16.40	2.633	0.009
		≥3000	109 (51.7)	123.32±15.15		
Working status		Employed	36 (17.0)	128.14±16.88	0.624	0.600
		Sick leave	27 (12.8)	124.70±18.79		
		Retired	21 (10.0)	122.52±12.23		
		Unemployed	127 (60.2)	126.39±15.70		
Whether first diagnosis		Yes	171 (81.0)	123.87±14.54	-4.331	<0.001
		No	40 (19.0)	135.55±18.48		
Time since diagnosis/month		1~3	88 (41.7)	127.77±15.62	0.827	0.480
		4~6	50 (23.7)	124.76±12.82		
		7~9	25 (11.8)	127.28±21.21		
		>9	48 (22.8)	123.75±16.61		
Cancer stage		I	40 (19.0)	127.03±15.34	2.274	0.081
		II	79 (37.4)	122.91±14.79		
		III	44 (20.8)	130.55±16.50		
		IV	48 (22.8)	126.44±17.27		
Treatment methods		Chemotherapy/ Radiotherapy	161 (76.3)	126.04±16.36	0.491	0.689
		Surgery	33 (15.6)	128.12±14.22		
		Hematopoietic stem cell transplantation	10 (4.8)	121.40±20.91		
		Others	7 (3.3)	124.29±3.40		

Table 1 (continued)

Variables		Group	N (%)	Family functioning Mean±SD	F/t	P value
Caregiver characteristics	Age (year)	<45	117 (55.5)	128.42±17.19	2.392	0.018
		≥45	94 (44.5)	123.18±13.91		
	Sex	Male	84 (39.8)	125.23±16.46	-0.634	0.527
		Female	127 (60.2)	126.65±15.71		
	Marital status	Married	183 (86.7)	125.22±15.55	-2.028	0.044
		Unmarried/divorced/widowed	28 (13.3)	131.75±17.88		
	Education Level	Junior high school and below	101 (47.9)	126.51±16.62	0.554	0.575
		High school/Vocational school	56 (26.5)	124.21±16.86		
		College and above	54 (25.6)	127.22±13.83		
	Working status	Employed	88 (41.7)	124.75±15.65	1.281	0.280
		Retired	12 (5.7)	121.67±9.60		
		Unemployed	111 (52.6)	127.62±16.70		
	The presence of chronic diseases	Yes	65 (30.8)	133.54±14.61	4.744	<0.001
		No	146 (69.2)	122.77±15.49		
	Average monthly family income per capita (RMB)	<3000	98 (46.4)	126.77±16.00	0.574	0.566
		≥3000	113 (53.6)	125.50±16.03		

Relationship to the patient

Spouse
Parents
Adult children
Others (siblings/cousins)

Prior caregiving experience

Yes
No

Duration of caregiving (month)

≤4
5~
9~
≥12

For dichotomous variables, independent samples t-tests were used while one-way ANOVA was used for variables with three or more categories
Bold P-values (P < 0.05) indicate statistically significant results

presence of chronic diseases, and relationship to the patient ($P < 0.05$). Detailed information on statistically significant differences in the sub-dimensions of family functioning related to these characteristics can be found in Supplementary Table 1.

Correlation analysis of resourcefulness, family coping, perceived social support, and family functioning, including its sub-dimensions

Table 2 presents the mean values, SDs, and correlations among the variables. The average family functioning score was 126.09 with a SD of 15.99. Resourcefulness demonstrated a positive correlation with both family coping ($r = 0.569$, $P < 0.01$) and perceived social support ($r = 0.565$, $P < 0.01$), and a negative correlation with family functioning and its sub-dimensions ($r = -0.525$ to -0.201 , $P < 0.01$). Family coping was negatively correlated with family functioning and its sub-dimensions ($r = -0.566$ to -0.263 , $P < 0.01$) and positively correlated with perceived social support ($r = 0.606$, $P < 0.01$). Similarly, perceived social support exhibited a negative correlation with family functioning and its sub-dimensions ($r = -0.555$ to -0.228 , $P < 0.01$). These significant correlations support the investigation of subsequent mediation analyses.

Test of mediation

A parallel mediation model was employed to examine the mediating effects of family coping and perceived social support on the relationship between resourcefulness and family functioning, controlling for the patient's average monthly family income per capita, first diagnosis status, caregiver's age, marital status, presence of chronic diseases, and relationship to the patient. A bootstrap test confirmed the mediation roles. The results generated by

the PROCESS macro are presented in Tables 3, 4, and Fig. 2.

The findings revealed significant mediating effects of both family coping and perceived social support in the association between resourcefulness and family functioning. The total effect of resourcefulness on family functioning was significant ($\beta = -0.423$, 95% CI $[-0.537, -0.310]$). Resourcefulness had a significant direct effect on family functioning ($\beta = -0.168$, 95% CI $[-0.291, -0.045]$), accounting for 39.72% of the total effect. Indirectly, the effect through family coping was significant ($\beta = -0.132$, 95% CI $[-0.208, -0.063]$), accounting for 31.20% of the total effect. The indirect effect through perceived social support was also significant ($\beta = -0.123$, 95% CI $[-0.200, -0.054]$), explaining 29.08% of the total effect. There was no significant difference in the mediating effects between family coping and perceived social support ($\beta = -0.008$, 95% CI $[-0.125, 0.111]$). These results indicate that both family coping and perceived social support partially mediate the relationship between resourcefulness and family functioning.

To further explore how specific aspects of resourcefulness affect family functioning through family coping and social support, this study examined the mediating effects on each of the seven dimensions of family functioning individually. The results, generated using the PROCESS macro, are presented in Supplementary Table 2. Table 5 shows the decomposition of the effects of resourcefulness on these sub-dimensions. The total effects of resourcefulness on each sub-dimension of family functioning were significant ($\beta = -0.115$ to -0.023 , $P < 0.05$), except for behavioral control. Resourcefulness had a significant direct effect on problem-solving ($\beta = -0.039$, 95% CI $[-0.063, -0.015]$), communication ($\beta = -0.030$, 95% CI $[-0.060, -0.001]$), affective responsiveness ($\beta = -0.023$, 95% CI $[-0.045, -0.002]$), and general functioning

Table 2 Correlations among resourcefulness, family coping, social support, and family functioning along with its sub-dimensions

Variables	1	2	3	4	5	6	7	8	9	10	11
1.FAD	1										
2.PS	0.627**	1									
3.CM	0.812**	0.554**	1								
4.RL	0.812**	0.375**	0.565**	1							
5.AR	0.722**	0.408**	0.551**	0.466**	1						
6.AI	0.599*	0.171*	0.418**	0.444**	0.347**	1					
7.BC	0.689**	0.227**	0.408**	0.645**	0.446**	0.433**	1				
8.GF	0.824**	0.514**	0.626**	0.558**	0.572**	0.365**	0.410**	1			
9.RS	-0.525**	-0.477**	-0.444**	-0.360**	-0.419**	-0.201**	-0.265**	-0.495**	1		
10.F-COPES	-0.566**	-0.472**	-0.469**	-0.456**	-0.411**	-0.311**	-0.263**	-0.487**	0.569**	1	
11.PSSS	-0.555**	-0.431**	-0.491**	-0.406**	-0.407**	-0.228**	-0.318**	-0.516**	0.565**	0.606**	1
Mean	126.09	12.76	19.06	23.55	12.74	14.55	19.59	23.84	79.98	95.85	58.52
SD	15.99	2.57	3.23	3.80	2.37	2.52	2.74	4.31	15.82	12.16	9.26

AI: Affective involvement; AR: Affective responsiveness; BC: Behavior control; CM: Communication; FAD: Family Assessment Device; F-COPES: Family Crisis-Oriented Personal Evaluation Scales; GF: General functioning; HSCT: Hematopoietic stem cell transplantation; PS: Problem-solving; PSSS: Perceived Social Support Scale; RL: Roles; RS: Resourcefulness Scale; SD: Standard deviation. ** $P < 0.01$.

Table 3 Testing the mediation effect of resourcefulness on family functioning

Outcome variable	Variables	R ²	F	β	Std. β	SE	t	P
Mediator 1: Family coping	Average monthly family income per capita (patient)	0.370	13.100***	3.553	0.146	1.403	2.532	0.012
	Whether first diagnosis (patient)			-1.999	-0.065	1.805	-1.107	0.270
	Age (caregiver)			-0.672	-0.028	1.576	-0.427	0.670
	Marital status (caregiver)			-0.962	-0.027	2.210	-0.435	0.664
	The presence of chronic diseases (caregiver)			2.868	0.109	1.587	1.808	0.072
	Spouses (caregiver)			-2.617	-0.107	2.809	-0.932	0.353
	Adult children (caregiver)			-1.478	-0.052	2.998	-0.493	0.623
	Parents (caregiver)			-1.426	-0.052	2.955	-0.483	0.630
	Resourcefulness			0.387	0.503	0.046	8.343	<0.001
Mediator 2: Perceived social support	Average monthly family income per capita (patient)	0.414	15.790***	2.397	0.130	1.030	2.326	0.021
	Whether first diagnosis (patient)			-2.316	-0.098	1.326	-1.747	0.082
	Age (caregiver)			0.906	0.049	1.157	0.783	0.435
	Marital status (caregiver)			1.630	0.060	1.623	1.004	0.317
	The presence of chronic diseases (caregiver)			3.598	0.180	1.165	3.088	0.002
	Spouses (caregiver)			2.549	0.136	2.062	1.236	0.218
	Adult children (caregiver)			2.826	0.130	2.202	1.284	0.201
	Parents (caregiver)			-0.922	-0.044	2.170	-0.425	0.671
	Resourcefulness			0.274	0.469	0.034	8.056	<0.001
Family functioning	Average monthly family income per capita (patient)	0.558	22.803***	1.169	0.037	1.586	0.737	0.462
	Whether first diagnosis (patient)			5.966	0.147	2.015	2.962	0.003
	Age (caregiver)			-2.535	-0.079	1.750	-1.449	0.149
	Marital status (caregiver)			1.860	0.040	2.458	0.757	0.450
	The presence of chronic diseases (caregiver)			-7.224	-0.209	1.799	-4.014	<0.001
	Spouses (caregiver)			1.633	0.051	3.140	0.520	0.604
	Adult children (caregiver)			11.224	0.299	3.343	3.358	<0.001
	Parents (caregiver)			0.013	0.0004	3.273	0.004	0.997
	Resourcefulness			-0.168	-0.167	0.062	-2.696	0.008
	Family coping			-0.340	-0.259	0.085	-3.995	<0.001
	Perceived social support			-0.450	-0.261	0.116	-3.878	<0.001

SE: Standard error; Std. β = Standard β . *** $P < 0.001$ **Table 4** Direct, indirect, and total effects of resourcefulness on family functioning

Model pathways	Effect value	Total effect ratio	Boot 95% CI	Significance
Direct effect				
Resourcefulness → Family functioning	-0.168	39.72%	(-0.291, -0.045)	√
Indirect effect 1				
Resourcefulness → Family coping → Family functioning	-0.132	31.20%	(-0.208, -0.063)	√
Indirect effect 2				
Resourcefulness → Perceived social support → Family functioning	-0.123	29.08%	(-0.200, -0.054)	√
DIFF (Indirect effect 1 - Indirect effect 2)	-0.008	-	(-0.125, 0.111)	-
Total indirect effect	-0.255	60.28%	(-0.342, -0.171)	√
Total effect	-0.423	100%	(-0.537, -0.310)	√

CI: Confidence interval. The model was adjusted for patient characteristics (average monthly family income per capita and whether first diagnosis) and caregiver characteristics (age, marital status, the presence of chronic diseases, and relationship to the patient)

($\beta = -0.055$, 95% CI [-0.093, -0.018]), but not on roles, affective involvement, and behavioral control ($P > 0.05$). The direct effects of resourcefulness accounted for 41.10% (communication) to 57.35% (problem-solving) of the total effect.

Indirectly, family coping significantly mediated the relationship between resourcefulness and each sub-dimension of family functioning ($\beta = -0.033$ to -0.015),

with the exception of behavioral control. The 95% CIs for the paths were as follows: resourcefulness → family coping → problem-solving [-0.036, -0.007], resourcefulness → family coping → communication [-0.039, -0.003], resourcefulness → family coping → roles [-0.058, -0.012], resourcefulness → family coping → affective responsiveness [-0.026, -0.004], resourcefulness → family coping → affective involvement

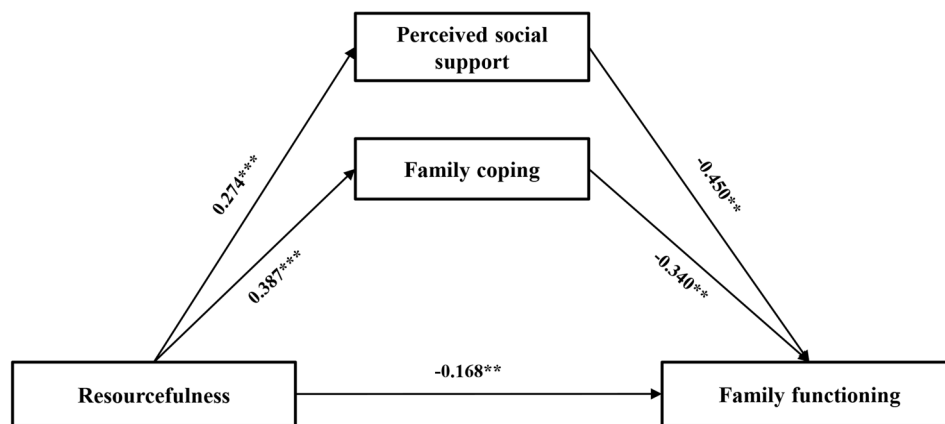


Fig. 2 The mediation model of the relationship between resourcefulness and family functioning. The model was adjusted for patient characteristics (average monthly family income per capita and whether first diagnosis) and caregiver characteristics (age, marital status, the presence of chronic diseases, and relationship to the patient). A lower family functioning score indicates better family functioning. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

$[-0.034, -0.006]$, and resourcefulness \rightarrow family coping \rightarrow general functioning $[-0.043, -0.005]$. The indirect effects of family coping accounted for 20.87% (general functioning) to 73.08% (affective involvement) of the total effect.

Perceived social support significantly mediated the relationship between resourcefulness and only two sub-dimensions: communication ($\beta = -0.022$) and general functioning ($\beta = -0.036$). The 95% CIs were resourcefulness \rightarrow perceived social support \rightarrow communication $[-0.040, -0.007]$ and resourcefulness \rightarrow perceived social support \rightarrow general functioning $[-0.059, -0.017]$. The indirect effects of perceived social support for these dimensions were 30.13% and 31.30% of the total effect, respectively.

Notably, family coping and perceived social support jointly mediated the relationships between resourcefulness and communication, and resourcefulness and general functioning, with joint mediating effects accounting for 58.90% and 52.17% of the total effect, respectively. However, only family coping mediated the relationships between resourcefulness and problem-solving, roles, affective responsiveness, and affective involvement. Neither family coping nor perceived social support significantly mediated the relationship between resourcefulness and behavioral control. The total indirect effects of resourcefulness on each sub-dimension of family functioning were significant, except for behavioral control, ranging from 42.65% (problem-solving) to 100.00% (affective involvement). The 95% CIs for these indirect effects were: problem-solving $[-0.047, -0.012]$, communication $[-0.064, -0.025]$, roles $[-0.070, -0.024]$, affective responsiveness $[-0.037, -0.012]$, affective involvement $[-0.044, -0.009]$, and general functioning $[-0.083, -0.037]$.

In summary, all dimensions of family functioning conform to the multiple mediation model, except for behavioral control (Fig. 3).

Discussion

This study investigates the relationship between resourcefulness and perceived family functioning among caregivers of young and middle-aged lymphoma patients, examining the potential impact and mediating roles of family coping and perceived social support. Consistent with the hypothesis, higher caregiver resourcefulness correlates with improved family functioning. Both family coping and social support act as parallel mediators in this relationship. Analysis across the seven dimensions of family functioning reveals that, for communication and general functioning, both family coping and social support act as parallel mediators. However, for the dimensions of problem-solving, roles, affective responsiveness, and affective involvement, only family coping serves as a mediator. Neither family coping nor social support mediates the relationship between resourcefulness and the dimension of behavior control.

Caregivers in this study reported moderately satisfactory family functioning, comparable to findings on caregivers of patients undergoing active cancer treatment [12]. Lymphoma caregiving entails unique challenges that arise from its clinical trajectory, including prolonged treatment protocols (e.g., multi-agent chemotherapy, stem cell transplantation), frequent hospitalizations, and the need for lifelong relapse surveillance, all of which impose significant psychosocial and logistical demands on families [42, 43]. Unlike cancers with more defined treatment courses, lymphoma caregivers navigate persistent uncertainties related to disease recurrence and complex treatment-related complications [6, 8]. These prolonged nature of caregiving—encompassing symptom management, emotional support, and shared decision-making—can exacerbate psychological, physical, and social stressors, ultimately impairing family functioning [44]. Given these challenges, it is essential for healthcare providers to systematically monitor caregiver-family

Table 5 Testing the mediating effects of the sub-dimensions of family functioning

Model pathways	Effect value	Total effect ratio	Boot 95% CI	Significance
Direct effect				
Resourcefulness→PS	−0.039	57.35%	(−0.063, −0.015)	√
Resourcefulness→CM	−0.030	41.10%	(−0.060, −0.001)	√
Resourcefulness→RL	−0.018	27.69%	(−0.055, 0.020)	-
Resourcefulness→AR	−0.023	47.92%	(−0.045, −0.002)	√
Resourcefulness→AI	0.003	-	(−0.023, 0.029)	-
Resourcefulness→BC	−0.006	25.00%	(−0.034, 0.023)	-
Resourcefulness→GF	−0.055	47.83%	(−0.093, −0.018)	√
Indirect effect				
Resourcefulness→Family coping→PS	−0.020	29.41%	(−0.036, −0.007)	√
Resourcefulness→Perceived social support→PS	−0.009	13.24%	(−0.022, 0.005)	-
Resourcefulness→Family coping→CM	−0.021	28.77%	(−0.039, −0.003)	√
Resourcefulness→Perceived social support→CM	−0.022	30.13%	(−0.040, −0.007)	√
Resourcefulness→Family coping→RL	−0.033	50.77%	(−0.058, −0.012)	√
Resourcefulness→Perceived social support→RL	−0.014	21.54%	(−0.032, 0.005)	-
Resourcefulness→Family coping→AR	−0.015	31.25%	(−0.026, −0.004)	√
Resourcefulness→Perceived social support→AR	−0.010	20.83%	(−0.022, 0.002)	-
Resourcefulness→Family coping→AI	−0.019	73.08%	(−0.034, −0.006)	√
Resourcefulness→Perceived social support→AI	−0.007	26.92%	(−0.022, 0.007)	-
Resourcefulness→Family coping→BC	−0.007	29.17%	(−0.023, 0.009)	-
Resourcefulness→Perceived social support→BC	−0.011	45.83%	(−0.025, 0.004)	-
Resourcefulness→Family coping→GF	−0.024	20.87%	(−0.043, −0.005)	√
Resourcefulness→Perceived social support→GF	−0.036	31.30%	(−0.059, −0.017)	√
Total indirect effect				
Resourcefulness→PS	−0.029	42.65%	(−0.047, −0.012)	√
Resourcefulness→CM	−0.043	58.90%	(−0.064, −0.025)	√
Resourcefulness→RL	−0.047	72.31%	(−0.070, −0.024)	√
Resourcefulness→AR	−0.025	52.08%	(−0.037, −0.012)	√
Resourcefulness→AI	−0.026	100.00%	(−0.044, −0.009)	√
Resourcefulness→BC	−0.018	75.00%	(−0.035, 0.000)	-
Resourcefulness→GF	−0.060	52.17%	(−0.083, −0.037)	√
Total effect				
Resourcefulness→PS	−0.068	100.00%	(−0.089, −0.048)	√
Resourcefulness→CM	−0.073	100.00%	(−0.099, −0.048)	√
Resourcefulness→RL	−0.065	100.00%	(−0.096, −0.033)	√
Resourcefulness→AR	−0.048	100.00%	(−0.067, −0.029)	√
Resourcefulness→AI	−0.023	100.00%	(−0.044, −0.001)	√
Resourcefulness→BC	−0.024	100.00%	(−0.047, 0.000)	-
Resourcefulness→GF	−0.115	100.00%	(−0.148, −0.082)	√

AI: Affective involvement; AR: Affective responsiveness; BC: Behavior control; CI: Confidence interval; CM: Communication; GF: General functioning; PS: Problem-solving; RL: Roles. All models were adjusted for whether the patient received their first diagnosis and the presence of chronic diseases in the caregiver. Additional adjustment variables for sub-dimensions of family functioning included: PS—patient cancer stage; RL—patient average monthly family income per capita; AR—caregiver age, marital status, relationship to the patient, and caregiving experience; AI—patient age, caregiver marital status, and relationship to the patient; BC—patient average monthly family income per capita, caregiver sex, and caregiving experience; GF—patient average monthly family income per capita, caregiver age, and relationship to the patient

dynamics and implement targeted interventions that address lymphoma-specific psychosocial needs.

After adjusting for confounding factors, our analysis demonstrated that higher caregiver resourcefulness directly improved family functioning, particularly within the domains of problem-solving, communication, affective responsiveness, and general functioning. However, no significant direct associations emerged for the roles, affective involvement, or behavior control dimensions.

The problem-solving dimension exhibited the strongest association with resourcefulness, likely reflecting caregivers' capacity to implement practical solutions to caregiving challenges. This pattern may be contextualized within the lymphoma care trajectory, where the disease's high symptom burden and recurrence risk necessitate intense patient focus on medical management, potentially displacing attention from familial role obligations [45]. Caregivers in this context assume primary

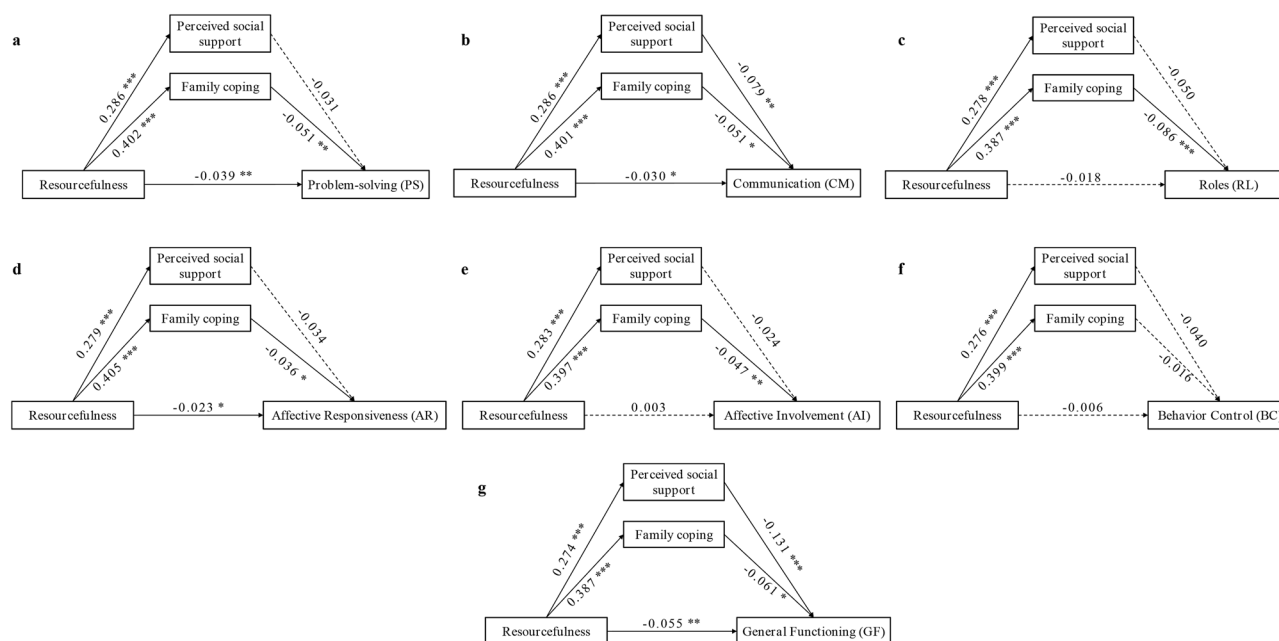


Fig. 3 The mediation model illustrating the relationship between resourcefulness and sub-dimensions of family functioning. All models were adjusted for whether the patient received their first diagnosis and the presence of chronic diseases in the caregiver. Additional adjustment variables included: Model A—patient cancer stage; Model C—patient average monthly family income per capita; Model D—caregiver age, marital status, relationship to the patient, and caregiving experience; Model E—patient age, caregiver marital status, and relationship to the patient; Model F—patient average monthly family income per capita, caregiver sex, and caregiving experience; Model G—patient average monthly family income per capita, caregiver age, and relationship to the patient. Estimates were unstandardized. Significant parameter estimates were depicted by solid lines, while non-significant parameter estimates were shown with dashed lines. A lower score in a sub-dimension of family functioning indicates better functioning in that sub-dimension. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

responsibility for symptom monitoring and treatment coordination, resulting in disproportionate assumption of household responsibilities and emotional labor [6, 43, 46]. Caregivers' resourcefulness, often involving problem-solving skills, facilitates effective coping with caregiving challenges. Resourceful caregivers resolve issues promptly, reducing family tension and conflict, thereby enhancing the family's problem-solving capacity. Thus, highly resourceful caregivers are more self-reliant in daily tasks, reducing dependence on others and improving overall family functioning [47]. They can leverage external resources and support networks to alleviate caregiving stress [48]. Resourceful caregivers' enhanced problem-solving and communication skills mitigate family conflicts and promote overall family cohesion [47, 49]. Additionally, resourceful caregivers adeptly manage emotional responses to the patients' condition, providing stable emotional support and strengthening family bonds [48]. Our findings align with evidence from cancer populations demonstrating a significant correlation between resourcefulness and improved family functioning [50]. This underscores the critical role of cultivating caregivers' resourcefulness in enhancing family functioning.

This study further examined the mediating roles of family coping and social support. Parallel mediation analysis revealed that family coping partially mediated

the association between resourcefulness and family functioning. Caregivers with elevated resourcefulness generally exhibit stronger family coping abilities, which in turn predicted improved family functioning. This finding is consistent with prior research showing that family-focused dyadic psychoeducation, including family coping strategies, enhances family functioning [51]. Further analysis, as depicted in Fig. 3, revealed that family coping partially mediates the impact of resourcefulness on six out of seven family functioning dimensions (models a–e, model g). This is likely due to caregivers with higher resourcefulness possessing superior problem-solving and stress management skills [47, 49, 51], aiding the family in coping with lymphoma challenges. Specifically, in managing lymphoma patients' complex caregiving needs, these caregivers efficiently solve problems, diminish internal family conflicts, and promote family harmony and stability, directly influencing the "problem-solving" dimension of family functioning (model a). Furthermore, resourceful caregivers typically possess strong communication skills, facilitating clear information and need transmission among family members, fostering understanding, cooperation, and improving the "communication" dimension of family functioning (model b) [52]. Additionally, they excel in assigning family roles [53], ensuring each member fulfills their crucial responsibilities, thereby

improving the “roles” dimension of family functioning (model c). Moreover, these caregivers frequently exhibit superior emotional management skills, enabling better understanding and response to family members’ emotional needs (model d) [54]. This affective involvement not only alleviates patient emotional stress but also enriches emotional bonds among family members. The affective involvement dimension (model e) demonstrated the largest proportion of indirect effect. This may be because resourceful caregivers frequently employ effective family coping strategies, like positive communication and emotional support, enhancing family members’ emotional involvement and interaction. Finally, by effectively utilizing coping strategies and promoting shared family responsibility [55], resourceful caregivers contribute to the overall functioning of the family (model g).

However, the situation is different for the behavior control dimension. It pertains to family members’ adherence to norms, discipline, and rules, influenced significantly by family cultural background, long-term habits, and family structure, rather than solely relying on the caregiver’s resourcefulness and coping skills [56]. Caregivers, even those with high resourcefulness, may struggle to promptly alter family behavior norms and discipline. Thus, targeted strategies are essential, including training in establishing and enforcing these norms, educational initiatives on rule enforcement, and implementing multi-level support systems alongside long-term behavioral adjustments to address the challenges in family coping abilities within this dimension [14].

The mediation analysis showed that social support mediated the relationship between resourcefulness and the overall family functioning score, as well as the communication and general functioning dimensions, but not the other five dimensions of family functioning (as shown in Fig. 3). This finding aligns with previous research indicating that social support is a predictor of family functioning in other populations [57, 58]. Communication, a critical dimension of family functioning, directly influences understanding and cooperation among family members. Social support can enhance communication and problem-solving by providing information and resources [59], thereby mediating the relationship between resourcefulness and communication (model b). Additionally, general functioning assesses the overall operation of the family, and social support enhances family adaptability and coping strategies, thus improving general functioning (model g). However, the study did not find a significant mediating effect of social support between resourcefulness and the other dimensions of family functioning. This could be due to these dimensions being more influenced by internal family interaction patterns and structural factors rather than external social support [60, 61]. Affective responsiveness and affective

involvement depend largely on emotional exchanges and interactions among family members, shaped by internal family dynamics rather than external social support.

The study further reveals that both social support and family coping mediate the relationship between resourcefulness and communication, as well as general functioning, without significant differences in their mediating effects. This similarity likely arises from their shared role in fostering understanding and cooperation among family members. Social support and family coping complement each other in distinct ways: social support facilitates communication and problem-solving through external resources and information [61, 62], while family coping emphasizes internal problem-solving skills and coping strategies [22]. Resourceful caregivers adeptly solve problems, manage stress, and leverage social support resources, thereby enhancing family communication and overall functioning. This integrated approach may explain the comparable mediating roles of social support and family coping.

Implications

This study examines the resourcefulness of caregivers of young and middle-aged lymphoma patients, their family functioning, and the influencing factors, particularly the mediating roles of family coping and social support. The findings reveal that family coping solely mediates the relationship between resourcefulness and multiple dimensions of family functioning, including problem-solving, role allocation, affective responsiveness, and affective involvement. These results suggest that clinical interventions should prioritize enhancing caregivers’ abilities in problem-solving, role distribution, and emotional management to foster understanding and cooperation among family members, thereby enhancing various aspects of family functioning.

Both social support and family coping serve as mediators between resourcefulness and the dimensions of communication and general functioning, indicating potential complementarity in promoting understanding and collaboration within families. Therefore, supporting caregivers should encompass not only the provision of external resources and information but also the development of strategies to enhance internal family communication and overall functional capacity. However, neither family coping nor social support mediates the relationship between resourcefulness and behavior control, a dimension involving adherence to family norms and disciplinary practices. Addressing this dimension may necessitate specific intervention strategies such as family education and training on rule enforcement to bolster internal behavior control, thereby further enhancing overall family functioning.

Strengths and limitations

This study examined the relationship between caregivers' resourcefulness and family functioning, alongside the mediating roles of family coping and social support, after adjusting for covariates. While it contributes incrementally to existing literature, our study faces several limitations. Firstly, the cross-sectional design constrains statistical inference and limits the strength of conclusions drawn. Secondly, while the study centered on resourcefulness, family coping, and social support, it did not consider other potential contributors to family functioning, such as family resilience. Additionally, we examined resourcefulness and social support as broad constructs rather than exploring how specific sub-dimensions (e.g., personal vs. social resourcefulness, internal vs. external support) influence family dynamics. Thirdly, although we contextualized our findings within the unique caregiving challenges faced by lymphoma caregivers, we did not compare caregivers across different cancer types. Furthermore, while the FAD is a well-established and widely used tool, we recognize that self-report measures may introduce inherent subjectivity. Notably, family coping and social support did not mediate the relationship between resourcefulness and the behavior control dimension of family functioning, suggesting that there may be unique challenges unaddressed by the current framework, possibly influenced by cultural or structural factors. Thus, future research could benefit from adopting a longitudinal design, integrating additional potential factors, and exploring the specific personal and social dimensions of resourcefulness, as well as the distinct facets of social support. Furthermore, incorporating more objective assessments of family functioning, such as direct behavioral observations (e.g., family members' interaction patterns) and family structure, could provide a more holistic understanding of family functioning, particularly in relation to behavior control.

Conclusion

The study investigated the relationship between resourcefulness and family functioning among caregivers of young and middle-aged lymphoma patients. After adjusting for covariates, caregivers with higher resourcefulness exhibited improved family functioning across various dimensions, except for roles, affective involvement, and behavior control. Parallel mediation analysis indicated that both family coping and perceived social support mediated the association between resourcefulness and family functioning, particularly in the communication and general functioning dimensions. However, only family coping mediated the relationship between resourcefulness and the dimensions of problem-solving, roles, affective responsiveness, and affective involvement. These findings underscore the need for diverse

intervention strategies to support family functioning in the context of lymphoma caregiving. Enhancing caregivers' resourcefulness is crucial. Additionally, it is essential to provide external resources and informational support while also developing strategies that promote effective internal communication within families, thereby enhancing overall family functioning.

Abbreviations

AI	Affective Involvement
AR	Affective Responsiveness
BC	Behavior Control
CM	Communication
FAD	Family Assessment Device
F-COPES	Family Crisis-Oriented Personal Evaluation Scales
GF	General Functioning
PS	Problem-solving
PSSS	Perceived Social Support Scale
RL	Roles
RS	Resourcefulness Scale
SD	Standard deviations

Supplementary information

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Supplementary Material 1

Supplementary Material 2

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Author contributions

CPP contributed to the conceptualization, methodology, and the original draft preparation. WRB actively engaged in data curation and original draft preparation. HHY made contributions to the investigation and methodology. GSJ, LT, and MXH participated in data curation and investigation. CCY supervised the study and contributed to the conceptualization. All authors have read and approved the final manuscript.

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Data availability

Data and analytical methods in this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study conformed to the Declaration of Helsinki and received ethical approval from the Institutional Review Board of Zhengzhou University (approval number: ZZUIRB 2021-151). All participants provided informed consent prior to completing the questionnaire. The surveys were anonymous, using participants' initials for documentation and coding purposes.

Consent for publication

Not applicable.

Competing interests

The authors report there are no competing interests to declare.

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