

A Structural Equation Model of Psychological Adaptation in Caregivers of Children with Hematological Malignancies: The Role of Family Intimacy, Social Support, Cognitive Fusion and Coping

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Abstract

Background

Caregivers of children with hematological malignancies frequently face intense emotional and psychological challenges that impair their mental health, well-being, and caregiving ability. Understanding the interaction of factors influencing psychological adaptation is essential for designing targeted interventions. However, limited research has explored these dynamics in the contexts of pediatric cancer. The aim of this study is to investigate psychological adaptation in caregivers of children with hematological malignancies.

Methods

A cross-sectional design was used with 214 primary caregivers recruited from pediatric hematological oncology wards. Standardized scales measured psychological adaptation, family intimacy, social support, cognitive fusion and cognitive coping. Structural equation modeling (SEM) used to analyze the direct and indirect pathways among the variables.

Results

Family intimacy and social support were positively associated with psychological adaptation. Family intimacy was a significant negative predictor of cognitive fusion ($\beta = -0.167$, $p = 0.029$), which was inversely associated with psychological adaptation ($\beta = -0.239$, $p = 0.001$). Social support positively predicted the use of positive coping strategies ($\beta = 0.283$, $p < 0.001$), which in turn enhanced adaptation ($\beta = 0.387$, $p = 0.001$). Notably, indirect effects were observed for social support via positive coping ($\beta = 0.112$, $p = 0.001$), and family intimacy via cognitive fusion ($\beta = 0.035$, $p = 0.057$).

Conclusion

Family intimacy and social support promote psychological adaptation primarily through their impact on cognitive fusion and cognitive coping. Positive coping plays a key mediating role which underscoring the importance of interventions that enhance psychological adaptation and caregiving ability of caregivers.

1 Introduction

Pediatric cancer affects approximately 400,000 children annually, with hematological malignancies being the most common subtype (Chhikara & Parang, 2023; Alhajori et al., 2023). In China, about 22,000 new cases are reported each year among children aged 0–14, with incidence rising by 2.5% annually (Li et al., 2021). Despite survival rates exceeding 80% due to therapeutic advances (Erdmann et al., 2021), the intensive nature of treatment places substantial physical, emotional, and financial burdens on family

caregivers(Bekui et al., 2023;Liu et al., 2022). Studies indicate that 52–94% of caregivers experience significant emotional distress following diagnosis(Karimi Moghaddam et al., 2023), and in China, rates of anxiety and depression reach 87.8% and 45.9%, respectively(Y. Wang et al., 2021). Although 20–30% of caregivers successfully adjust over time, the majority continue to experience poor psychological adaptation even years after the diagnosis (Jones et al., 2018). Understanding factors associated with healthy psychological adaptation is therefore critical for developing effective support strategies.

Psychological adaptation refers to the cognitive and emotional adjustments individuals make to function effectively and alleviate distress in response to challenges(Rachmad, 2022;Avsec et al., 2022;Luo et al., 2021). For caregivers of children with cancer, such adaptation directly influences the child's quality of life and prognosis(Irwanto et al., 2020). Chinese caregivers of children with cancer report significantly lower psychological adaptability than those of healthy children(C. Wang et al., 2024), highlighting the need to identify key internal and external factors that shape adaptation outcomes(Katz et al., 2018;Teo et al., 2023).

Cognitive coping strategies are mental processes used to interpret, reframe, and manage stress by changing perceptions of difficult situations(Bondarchuk et al., 2024;Ismael et al., 2024). In contrast, cognitive fusion involves becoming entangled with negative thoughts, which increases avoidance, rumination, and psychological distress (Gillanders et al., 2014). Among caregivers of pediatric cancer patients, high fusion intensifies fear of uncertainty and perceived burden, hindering emotional regulation and problem-solving(Barrera-Caballero et al., 2022). Effective coping, both problem-focused and emotion-focused is consistently linked to reduced distress and improved resilience (Gurtovenko et al., 2021;Prates et al., 2024), whereas negative coping strategies impair adaptation (Molzon et al., 2018).

Family intimacy, characterized by strong emotional bonding, effective communication, and mutual support, helps maintain cohesion during pediatric cancer treatment(Deng et al., 2022;Oh et al., 2024). It promotes shared responsibility, emotional stability, and collaborative coping, thereby alleviating caregiving stress (Thomson et al., 2022). Beyond the family, social support from extended family, friends, and professional networks offers emotional relief and practical assistance(García-Carmona et al., 2021). Access to formal and informal resources reduces isolation, buffers chronic stress, and enhances caregiver well-being(Oshio & Kan, 2019;Tan et al., 2020;Smith et al., 2019)..

Despite extensive literature on individual effects of these factors, studies exploring their combined and interactive impacts remain limited, particularly among caregivers of children with hematological malignancies. To address this gap, the present study examines both risk and protective factors from personal and environmental perspectives.

1.2 Theoretical Framework

This study is grounded in social cognitive theory (SCT), developed by Albert Bandura (1986) which posits that human functioning emerges from the dynamic and reciprocal interaction of personal factors, environmental influences, and behaviors. Reciprocal determinism underscores how these three domains

continually influence and modify one another (Martin et al., 2018). Applied to caregiving for children with hematological malignancies, SCT provides a strong framework for understanding how caregivers' cognitive and emotional responses are shaped by internal thoughts, behaviors, and the surrounding family and social environment. Supportive environments encourage effective coping and positive psychological adjustment, whereas restrictive environments with weak communication and minimal support impede adaptation (Abuhammad et al., 2025).

Thus, using SCT as our conceptual model, we propose that personal factors (cognitive fusion, coping strategies) and environmental factors (family intimacy, social support) directly and indirectly influence caregivers' psychological adaptation. Specifically, personal factors are hypothesized to mediate the relationship between environmental influences and psychological adjustment (see Fig. 1). Using Structural Equation Modeling (SEM), this study aims to fill existing gaps by empirically testing a theory-based model of caregiver adaptation.

2 Method

2.1 Study Design

A cross-sectional study using a structural equation modeling (SEM) approach assessed the relationships among family intimacy, social support, cognitive fusion, cognitive coping and psychological adaptation. Participants were recruited by cluster sampling from pediatric cancer wards in five hospitals in Zhengzhou between November 2020 and January 2021. Caregivers who met the inclusion criteria were enrolled. A rough estimation method (Xiao, 2008) was used to estimate the sample size, with a target of 200–250 participants considered adequate for SEM based on the number of parameters to be estimated.

2.2 Participants

Caregivers of children with hematological malignancies undergoing regular chemotherapy were recruited from pediatric cancer wards based on specific inclusion criteria derived from a detailed literature review.

Inclusion criteria for children

(1) pathologically diagnosed with hematological malignancies e.g leukemia, lymphoma, or myeloma (2) aged ≤ 16 years (3) diagnosed for ≥ 1 month and receiving regular chemotherapy.

Inclusion criteria for caregivers

(1) an immediate family member of the child (2) aged ≥ 22 years (3) able to comprehend, cooperate, and provide informed consent.

Exclusion criteria included

(1) children with severe organic brain syndromes or mental illnesses e.g cognitive impairment (2) children in critical or unstable condition needing intensive parental care. Informed consent was obtained from all individual participants included in the study. Participation was voluntary, and participants were informed about their right to withdraw at any time without penalty.

2.3 Procedure

Investigators underwent standardized training prior to data collection to ensure consistency throughout across the study. Data were collected in coordination with hospital staff and study participants during the children's hospitalization for chemotherapy. Informed consent was obtained from each caregiver, and questionnaires were administered on-site in the pediatric hematology wards. To ensure data quality, all completed questionnaires were reviewed immediately, and any incomplete questionnaires were returned to participants for completion. Of the 252 eligible caregivers approached, all were living with and actively caring for a child with a hematological malignancy. A total of 214 participants consented and successfully completed the study within the specified timeframe.

2.4 Measures

2.4.1 General information questionnaire

Demographic data were self-reported and included the child's age, gender, type of health insurance, and caregiver characteristics such as age, gender, education, occupation, monthly household income, and medical insurance coverage. Clinical details including disease duration, type of onset and current treatment status were obtained from the child's medical records.

2.4.2 Psychological adaptation

The psychological adaptation scale (PAS) is a 20-item self-rating scale developed to measure caregivers' adaptation to a disease (Biesecker et al., 2013). It evaluates four domains of adaptation (coping efficacy, self-esteem, social integration, and spiritual well-being). Each item is scored from 1 to 5, with higher scores reflecting better adaptation. The original scale has a Cronbach's α coefficient of 0.96, while the Chinese version has a Cronbach's α coefficient of 0.90. In current study, Cronbach's α was 0.93.

2.4.3 Coping style

The Simplified Coping Style Questionnaire (SCSQ) was used to assess coping styles (Xie, 1998). This 20-item scale measures two dimensions: positive coping (12 items) and negative coping (8 items), with responses rated on a 4-point Likert scale from 0 ("do not use") to 3 ("often use"). In the original scale, Cronbach's α was 0.89 for positive coping and 0.78 for negative coping. In this study, the Cronbach's α was 0.83 for positive coping and 0.71 for negative coping.

2.4.4 Social support

The Perceived Social Support Scale (PSSS) is a 12-item instrument comprising three subscales: support from family, friends, and other sources (Zimet et al., 1990). Each item is rated on a 7-point scale, with total scores ranging from 12 to 84. Higher scores indicating greater perceived social support. The Chinese version, revised by Jiang Qianjin in 1999, has shown strong reliability and validity. Cronbach's α coefficient of the total score of the original scale and the three subscales of family support, friend support, and other support were 0.88 and 0.87, 0.85 and 0.91, respectively. In this study, the Cronbach's α coefficient for the total scale was 0.92.

2.4.5 Cognitive fusion

The cognitive fusion questionnaire (CFQ) was developed by Gillanders (Gillanders et al., 2014). The Chinese version, translated by (W.-C. Zhang et al., 2014) had good reliability and validity. The cognitive fusion scale has 9 items, using a 7-point scoring method, 1 = obviously inconsistent, 7 = obviously consistent. The higher the number, the higher the degree of cognitive fusion. The Cronbach's α coefficient of the Chinese version of the cognitive fusion scale was 0.92. The test-retest reliability was 0.67. The Cronbach's α coefficient of the scale in this study was 0.93.

2.4.6 Family relationship

The family intimacy and adaptability scale was used to evaluate the quality of family relationships (Olson et al., 1979). The original scale includes two subscales: intimacy and adaptability, rated on a 5-point scale (1 = "not", 5 = "always"). In this study, only the intimacy subscale was used, with higher scores reflecting greater family intimacy. The scale demonstrated good reliability, with a Cronbach's α of 0.85.

2.5 Statistical Analysis

Data analyses were conducted using SPSS and AMOS version 26.0 (IBM Corporation, Armonk, NY). Categorical data were presented as frequencies and percentages, while continuous data were described using means and standard deviations (SD). Bivariate analyses were performed to explore the relationships between all variables. The model was constructed and evaluated using AMOS 26.0 statistical software.

Structural Equation Modeling (SEM) was applied to explore both direct and indirect relationships among individual factors (positive coping, negative coping, cognitive fusion), family factors (family intimacy), social factors (social support), and psychological adaptation in caregivers of children with cancer. Mediation analysis was performed to examine whether positive coping strategies mediate the relationship between family intimacy and psychological adaptation, and whether cognitive fusion mediated the relationship between family intimacy and adaptation.

Model Specification and Modification

Statistical methods allowed the study to separate the complex interactions among the various factors that contribute to caregiver adaptation. The model was adjusted based on the initial parameter estimates, overall fit, and related model modification indices. The model fit was assessed using various

model-fit indices, including relative chi-square (χ^2/df) test < 2 ($p > 0.05$), the goodness of fit index (GFI) > 0.90, the adjusted goodness of fit index (AGFI) > 0.90, the comparative fit index (CFI) > 0.90, normed fit index (NFI) > 0.90, the incremental fit index (IFI) > 0.90, the Tucker-Lewis index (TLI) > 0.90, and root mean squared error of approximation (RMSEA) < 0.06. Mediation focused on pathways with strong theoretical grounding in SCT. Specifically, we hypothesized that environmental factors (family intimacy, social support) would be associated with adaptation through personal factors (cognitive fusion, coping). Thus, we tested the indirect effects of (1) family intimacy on adaptation via cognitive fusion, and (2) social support on adaptation via positive coping. The mediation effect was examined using the deviation correction and percentage bootstrap method, with a sample size set to 5000 (iteration times) and a confidence interval set to 95%. Quality control measures were strictly implemented to evaluate test–retest reliability.

3 Results

3.1 Sociodemographic and clinical characteristics of the study sample

The mean age of caregivers was 34.6 years, with 51 fathers (23.8%) and 163 mothers (76.2%) and the mean age of children with cancer was 6.91 ± 3.75 years, with 133 males (62.1%) and 81 females (37.9%) see Table 1.

Table 1
The sociodemographic and clinical characteristics of the participants(N = 214).

Gender	N (%)	
	Male	133(62.1)
	Female	81(37.9)
Type of cancer	ALL	124(57.9)
	AML	29(13.6)
	Lymphoma	20(9.3)
	Myelodysplastic disease	17(7.9)
	Others	24(11.2)
Age (year)	<6	85(39.7)
	6~	98(45.8)
	12~	31(14.5)
Duration of hematologic malignancies (month)	0–3	70(32.7)
	4–6	47(22.0)
	7–12	52(24.3)
	13~	45(21.0)
Caregiver characteristics		
Relationship with the child	Father	51(23.8)
	Mother	163(76.2)
Age (year)	≤ 30	60(28.0)
	31~	109(50.9)
	40~	45(21.0)
Location	Urban	55(25.7)
	Rural	159(74.3)
Education level of primary caregivers	Junior high school and less	103(48.1)
	High school/ technical secondary school	64(29.9)
	College education or more	47(22.0)
Note: ALL,Acute lymphoblastic leukemia; AML,Acute myeloid leukemia		

Gender	N (%)	
	Male	133(62.1)
	Female	81(37.9)
Monthly household income	<1000	56(26.2)
	1000~	97(45.3)
	3000~	40(18.7)
	>5000	21(9.8)
Note: ALL,Acute lymphoblastic leukemia; AML,Acute myeloid leukemia		

3.2 Descriptive Statistics and Bivariate Correlations Analyses of the Main Variables

In our sample, the mean score of psychological adaptation was 69.17 (SD = 12.27). The mean scores for other variables were: cognitive fusion was 40.47 (SD = 10.77), family intimacy was 64.37 (SD = 11.70), social support was 54.13 (SD = 12.45), positive coping was 19.81 (SD = 6.40), and negative coping was 9.43 (SD = 4.37).

Table 2 presents bivariate correlations. Psychological adaptation was positively associated with positive coping ($r = 0.444$, $p < 0.01$), negative coping ($r = 0.174$, $p < 0.05$), social support ($r = 0.141$, $p < 0.05$), and family intimacy ($r = 0.223$, $p < 0.01$). Psychological adaptation was negatively associated with cognitive fusion ($r = -0.154$, $p < 0.05$).

Table 2
Zero Order Correlations of the Study Variables

1. psychological adaptation	1	2	3	4	5	6
	1.00					
2. positive coping	0.444**	1.00				
3. negative coping	0.174*	0.174**	1.00			
4. family intimacy	0.223**	0.226**	-0.160*	1		
5. social support	0.141*	0.347**	-0.152*	0.492**	1	
6. cognitive fusion	-0.154*	-0.142*	0.393**	-0.208**	-0.159*	1
Note: * $P < 0.05$ ** $P < 0.01$						

3.3 Structural Equation Modeling

Structural equation modeling was used to explore the pathways of how variables of social support and family intimacy could influence psychological adaptation through positive coping, negative coping, and cognitive fusion. The data were fitted by the maximum likelihood method, which revealed a poor fit (CMIN) = 73.147, DF = 3, $p < 0.001$; root mean square error of approximation (RMSEA) = 0.331 (95% Confidence Interval (CI): 0.268, 0.399); comparative fit index (CFI) = 0.691; standardized root mean residual (SRMR) = 0.111). The path of the structural equation model that was not statistically significant has been eliminated. And then using standardized residuals to identify potential areas of model misfit, several model modifications were made using a stepwise approach. The final measurement model had substantially better fit (CMIN = 1.349 DF = 1, $p = 0.246$; RMSEA = 0.04 (95% CI: 0.000, 0.192); CFI = 0.998; SRMR = 0.020). see Fig. 2.

The coefficients (b) and standardized coefficients (β) of all the direct and indirect relationships in the final model can be found in Table 3, Social support was a positive predictor of positive coping ($\beta = 0.283$, $p < 0.001$). Social support also indirectly influenced psychological adaptation through positive coping ($\beta = 0.112$, $p = 0.001$). Family intimacy was a negative predictor of cognitive fusion ($\beta = -0.167$, $p = 0.029$). Family intimacy also indirectly influenced psychological adaptation through cognitive fusion ($\beta = 0.035$, $p = 0.057$), this effect was not statistically significant because the P value is slightly above the common threshold for significance (0.05) It *might* exist, but we can't be confident based on the data. Cognitive fusion ($\beta = -0.239$, $p = 0.001$), positive coping ($\beta = 0.387$, $p = 0.001$), and negative coping ($\beta = 0.245$, $p = 0.001$) had direct effects on psychological adaptation.

Table 3
Parameter estimates of the direct and indirect paths in the final model (N = 214).

Structural path	b	95% CI		β	P
		Lower	Upper		
Direct Paths					
Cognitive fusion					
Family intimacy →cognitive fusion	-0.154	-0.305	-0.013	-0.167	0.029
Positive coping					
Social support → positive coping	0.146	0.134	0.418	0.283	<0.001
Psychological adaptation					
Cognitive fusion →Psychological adaptation	-0.271	-0.352	-0.128	-0.239	0.001
Positive coping →Psychological adaptation	0.739	0.288	0.489	0.387	0.001
Negative coping →Psychological adaptation	0.669	0.120	0.357	0.245	0.001
Indirect paths					
family intimacy →cognitive fusion → psychological adaptation	0.036	-0.037	0.110	0.035	0.057
Social support →positive coping → psychological adaptation	0.110	0.039	0.202	0.112	0.001
Note: b regression coefficient; β . standardized regression coefficient; 95%CI, 95% confidence intervals					

4 Discussion

Recognizing and enhancing the factors associated to psychological adaptation are essential for improving the wellbeing and outcomes of caregivers of children with hematological malignancies. This study used structural equation modeling (SEM) to examine how personal factors (cognitive fusion, positive and negative coping) and environmental factors (family intimacy and social support) are collectively associated with psychological adaptation in caregivers of children with hematological malignancies. The analysis revealed key interrelationships, showing that family intimacy and social support impact psychological well-being both directly and indirectly through their relationships with cognitive fusion and positive coping. These insights can guide targeted interventions aimed at enhancing social support and family intimacy to promote positive coping, reduce cognitive fusion, and improve caregivers' psychological adaptation.

Perceived social support is an individual's belief that help and cooperation are available from others. Support from sources such as extended family, friends, and community networks plays a crucial role in facilitating caregiver adaptation. In our model, perceived social support emerged as an indirect rather than direct determinant of caregivers' psychological adaptation, highlighting its role as a resource-enabling factor rather than a symptom reliever. It facilitated positive coping, which in turn contributed to improve psychological adaptation, yielding a statistically reliable indirect effect. So after we considered proactive coping, support by itself no longer had any effect. However, support is helpful mostly because it gives caregivers the mental skills and coping strategies they need to deal with the stress of a child's cancer. This pattern is consistent with studies finding complete mediation by positive coping in caregivers of children with cancer (Chung et al., 2022), and with longitudinal research demonstrating that the prospective association between baseline support and later distress became non-significant after accounting for changes in coping self-efficacy (García-Torres et al., 2020). This significant indirect pathway from social support to psychological adaptation via positive coping aligns with prior findings that social networks can bolster caregivers' capacity for adaptive coping (Long et al., 2021). Social support, a well-documented variable has been shown to alleviate caregiver distress, enhance autonomy (Xu et al., 2024), and more effective coping. For caregivers of children with illnesses, support from family, friends, and the community is a vital resource associated with reduced negative emotions and greater resilience (Alon, 2019). A meta-analysis of pediatric oncology caregivers in China found that 60–75% of the overall effect of social support on mental health outcomes was mediated through coping mechanisms, resilience, and interpersonal factors (Mao et al., 2022). Another study has shown that caregivers of children with chronic illness often shift between adaptive and maladaptive strategies, depending on illness severity and perceived resources (Wong et al., 2020). These evidence syntheses align with the lens of social cognitive theory. The findings suggest that interventions should go beyond simply enhancing caregivers' sense of support, and should instead focus on teaching caregivers how to actively mobilize that support into adaptive coping strategies.

Coping strategies have been identified as key mediators in caregivers' psychological adaptation. They reflect a form of determination or capability including enhanced problem-solving confidence, reduced negative emotions, and improved management of stressful situations (Weigold et al., 2024). The study result highlighted the complex dual role of coping, such as positive coping strategies significantly associated with better psychological adaptation, consistent with prior research (Spaggiari et al., 2024; Rosenblatt & Li, 2021), while negative coping inconsistently showed a direct positive association with psychological adaptation in the SEM.

The positive association between negative coping and psychological adaptation initially appears counterintuitive, as maladaptive strategies are typically negatively associated with quality of life (Fairfax et al., 2019). However, our analysis clarified that this finding is a statistical artifact. When considered alongside positive coping, negative coping acted as a suppressor variable, removing noise from the positive coping-adaptation relationship. This interpretation is supported by the hierarchical regression, where the inclusion of negative coping increased the beta coefficient for positive coping. Therefore, the positive coefficient for negative coping in the SEM should not be interpreted as evidence that strategies

such as giving up or avoidance are beneficial. Rather, it underscores the importance of interpreting path coefficients within the full multivariate context. Clinically, this reinforces the need to focus on enhancing positive, approach-oriented coping strategies rather than assuming any form of coping is adaptive.

Consistent with prior research, Caregivers who engage in proactive coping strategies such as seeking information, emotional expression, and maintaining optimism are better equipped to manage caregiving demands (Marrakchi et al., 2024). In our model where social support and positive coping are controlled the residual component of negative coping (brief emotional venting or controlled denial) provide short-term relief, thereby explaining its positive association with psychological adaptation. From a theoretical perspective, these findings align with the core principles of Social Cognitive Theory (SCT), which emphasizes that adaptive cognitive behavioral responses are crucial for navigating stressful life situations (Bandura, 2001). The results highlight the significance and practical benefit of incorporating coping strategy training such as problem-solving and emotional regulation into interventions designed to enhance caregiver adaptation.

Beyond moderating cognitive fusion, family intimacy also directly benefits caregiver psychological adaptation by raising a supportive environment in which members offer emotional and practical assistance when difficulties arise (Lei & Kantor, 2022; W. Zhang et al., 2024) and helps caregivers cope with the strains of caring for an ill child (Aduful et al., 2023). In our study, higher levels of family intimacy were significantly associated with lower cognitive fusion, suggesting that caregivers from more cohesive families are less entangled with negative thoughts. In turn, lower cognitive fusion was linked to improved psychological adaptation. However, the indirect effect of family intimacy on adaptation through cognitive fusion was small and not statistically significant. Similarly, prior research showing that strong family functioning reduces parental distress (Kurz et al., 2025), while cognitive fusion hampers psychological flexibility and contributes to emotional distress (Bodenlos et al., 2020). Close family bonds provide direct support along with protecting caregivers from maladaptive cognitive processes and the tendency to get “stuck” in negative thoughts. This complements evidence from acceptance and commitment therapy (ACT) frameworks, which target cognitive fusion as a core barrier to well-being (Gayatri Devi, 2025; Van Hout et al., 2024). By buffering against cognitive fusion, family intimacy appears to help caregivers maintain healthier cognitive coping, thereby enhancing their ability to adjust as their child’s health status changes.

Our findings are consistent with global research highlighting the importance of family-centered interventions such as family counseling, communication skills training, and emotional support programs that reinforce family cohesion and promote caregivers’ psychological well-being. This study provides a new perspective on how the family environment affects psychological adjustment not only through direct support but also indirectly by shaping coping styles and cognitive fusion. The indirect pathway from family intimacy to psychological adaptation through reduced cognitive fusion provides a nuanced understanding of how family systems indirectly promote psychological adjustment. Cognitive fusion, a tendency to get stuck in negative thoughts and inversely related to family intimacy, had a significant negative impact on psychological adaptation. The model confirmed that caregivers with higher levels of

cognitive fusion exhibited poorer psychological adaptation, suggesting that strong family bonds safeguard against maladaptive cognitive processes. Our study bridges the gap between the family environment and caregivers' internal cognitive coping, showing that the closer and more supportive a family is, the less caregivers get stuck in negative thoughts. This finding links the family's influence with how caregivers manage their own thinking. Therefore, incorporating ACT principles into caregiver support programs could be beneficial in promoting adaptive psychological functioning.

Additionally, the results of this study showed a significant positive correlation between family intimacy and psychological adaptation as well as its various dimensions i.e the higher the family intimacy of caregivers lowers the cognitive fusion, which in turn improves the psychological adaptation of caregivers and vice versa. High family intimacy and lower cognitive fusion enhance the ability of caregivers to change their cognition according to the child's health condition. Regression analysis also indicated that family intimacy is an important predictor of caregivers' psychological adaptation.

4.1 Limitation

Several limitations should be considered when interpreting these findings. First, the cross-sectional design prevents causal inferences, limiting the ability to determine the temporal sequence of observed relationships. However, longitudinal studies are necessary to assess changes in coping, family dynamics, and psychological adaptation over time.

Second, the study was conducted in a specific geographic region using a cluster sampling approach, which limits the generalizability of the findings to other populations or healthcare settings. Although we identified significant associations and mediating pathways, prospective studies are needed to examine changes in coping, family dynamics and psychological adaptation over time.

Third, reliance on self-reported data introduces potential for recall and social desirability biases. Additionally, the psychometric tools used, although validated, were largely adapted from Western contexts and may not fully capture culturally specific caregiving experiences or emotional expressions.

Fourth, while we tested specific theoretically derived mediation pathways, we did not test all possible indirect effects. Although this approach reduces the risk of Type I error, it may have overlooked other meaningful relationships. Future research with larger samples should explore a more comprehensive set of mediators.

Finally, other potentially relevant variables, such as illness severity, caregiving duration, financial stress, and healthcare access, were not examined and should be included in future research to develop a more comprehensive model of caregiver adaptation.

4.2 Clinical implications

This study provides a conceptual framework that can inform the development of psychosocial interventions aimed at enhancing the psychological adaptation of caregivers of children with

hematological malignancies. For Oncology nurses and healthcare professionals, the findings underscore the importance of routinely assessing family intimacy and perceived social support as part of psychosocial screening. Early identification of caregivers with low family cohesion or inadequate social networks should prompt referral to structured interventions, such as family-based counseling, peer support groups, community linkage services and training on emotion regulation and problem solving strategies.

Incorporating coping skills training into routine caregiver support programs such as cognitive behavioral therapy, acceptance and commitment therapy, or mindfulness-based stress reduction promote adaptive coping and alleviate psychological distress. Nurses are ideally positioned to deliver brief, structured training on emotion regulation, cognitive de-fusion, and problem-solving strategies, either individually or in group settings. Strengthening the caregiving environment through targeted education and psychological support could ultimately improve caregiver well-being and the quality of care delivered to children undergoing cancer treatment.

5 Conclusion

This study contributes to the growing body of literature on psychosocial determinants of caregiver well-being by identifying key pathways through which family intimacy, social support, cognitive fusion and cognitive coping influence psychological adaptation in caregivers of children with hematological malignancies. Grounded in Social Cognitive Theory, the research employed a cross-sectional design and utilized SEM to extricate direct and indirect effects within this multifaceted framework. The findings demonstrate that supportive environmental factors enhance psychological adaptation by facilitating adaptive coping and reducing cognitive fusion.

Notably, social support indirectly promoted adaptation via positive coping, while family intimacy reduced maladaptive cognitive fusion, which was associated with better psychological outcomes. These findings highlight the importance of addressing both internal (cognitive strategies) and external (family and social) factors when designing interventions to support caregivers.

For oncology nursing practice, integrating family-focused and coping-enhancement strategies into standard care can play a pivotal role in improving caregiver mental health and sustaining quality care for pediatric oncology patients. Future research should employ longitudinal designs and culturally sensitive tools to further explore these dynamics and test the effectiveness of multi component interventions.

Declarations

Ethical approval

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Author Contribution

Author Contribution Statement: Imtiaz Alam: Conceptualization, methodology, formal analysis, investigation, writing – original draft, writing – review and editing, project administration. Wang Mengjia: Data curation, investigation, validation, writing – review and editing. Lei Jinjin: Software, formal analysis, visualization, writing – review and editing. Fath Ur Rahman: Investigation, data curation, resources, writing – review and editing. Lalit Dzifa Kodzo: Validation, formal analysis, writing – review and editing. Zhang Ruixing: Conceptualization, supervision, methodology, writing – review and editing, corresponding author. All authors reviewed and approved the final manuscript and agree to be accountable for all aspects of the work.

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Figures

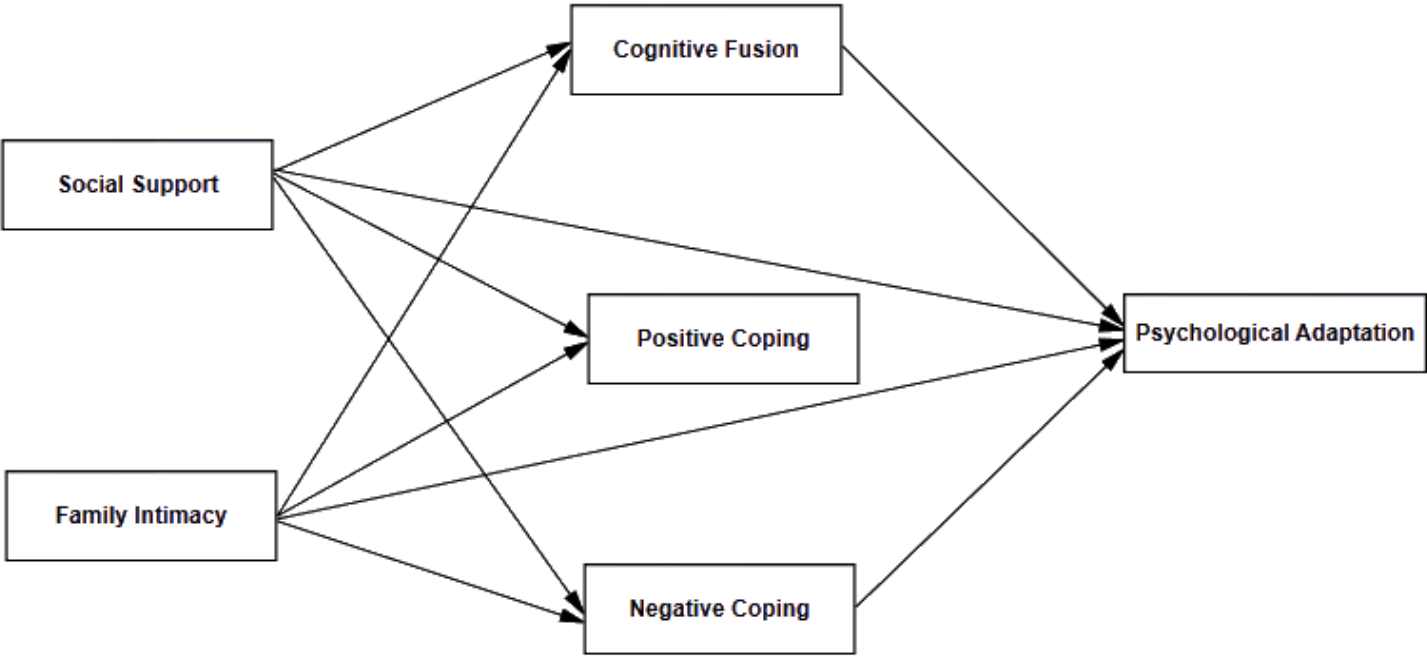


Figure 1

Conceptual model with hypotheses.

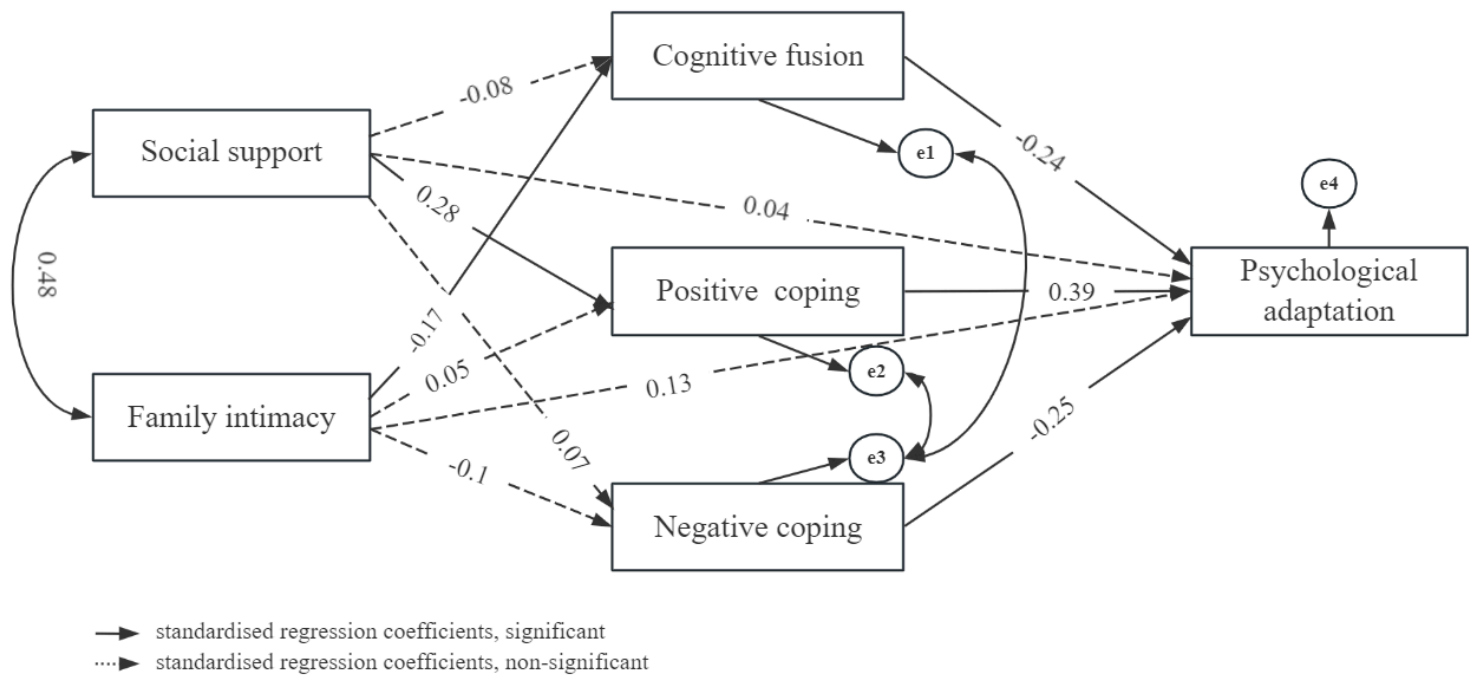


Figure 2

The final model of psychological adaptation among caregivers of children with cancer