Mediating Role of Coping Styles in Self-management Behaviors of School-aged Children with Asthma: A Cross-sectional Study

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ABSTRACT

Background: The self-management behaviors of children with asthma are influenced by multiple factors, but the underlying psychological mechanism remains unclear. Coping styles, as the core strategies for children to deal with the stress of illness, may play a key role between disease factors and behavioral outcomes.

Objective: To explore the mediating role of coping styles among the severity of asthma, asthma knowledge, and self-management behaviors.

Method: A cross-sectional study design was adopted, and 253 children aged 8-12 with asthma in Wenzhou area were included. Data were collected using questionnaires. The Hayes Process macro (Model 4) was used to test the mediating effect, and Bootstrap repeated sampling was conducted 5,000 times to calculate the 95% confidence interval.

Results: Coping styles play a partial mediating role between the severity of asthma and self-management behaviors (indirect effect accounts for 58.9%, 95% CI [-1.46, -0.75]), and play a complete mediating role between asthma knowledge and self-management behaviors (indirect effect accounts for 75.4%, 95% CI [0.78, 1.38]). For every additional 1 point in the score of positive coping, the total score of self-management behavior increased by 1.76-1.85 points ($p < 0.001$).

Conclusion: Coping style is the key psychological mechanism that connects disease cognition with management behavior. Clinical intervention should incorporate coping skills training into asthma education programs. By cultivating positive coping strategies such as problem-solving and emotion regulation, the self-management ability of children patients can be enhanced.

KEYWORDS: Asthma, Self-Management, Coping Style, Mediating Effect.

INTRODUCTION

Childhood asthma is the most common chronic respiratory disease worldwide, seriously affecting the physical and mental health and quality of life of children. According to research data from the Global Asthma Network, in 25 countries with different income levels, the prevalence of asthma among children aged 6-7 is 6.3%, and among adolescents aged 13-14, it is as high as 7.9%[1]. In China, the prevalence of childhood asthma continues to rise. Recent systematic review data show that the prevalence among children aged 6-14 years has reached 2.98% [2], and children aged 5-14 years show a prevalence rate of approximately 3.72% [3]. Although modern medicine has provided effective treatment methods for asthma, the symptom control effect of children with asthma is still not satisfactory. Research shows that the complete control rate of childhood asthma in China is only 33.86% [4], which is closely related to the level of self-management behavior among children.

Self-management behavior refers to the health maintenance actions that children take proactively under the guidance of medical staff based on their own conditions, including regular medication, symptom monitoring, and avoiding triggering factors, etc. [5] Good self-management behaviors can effectively prevent acute attacks, reduce medical expenses, and improve the quality of life [6,7]. However, at present, the self- management behaviors of children with asthma in China are generally at a moderate level [8], and it is urgent to explore its influencing mechanism to formulate targeted intervention strategies.

Coping styles, as cognitive and behavioral strategies adopted by individuals in the face of pressure, challenges or predicaments, can be classified into two categories: positive coping and negative coping [9]. Positive coping includes adaptive strategies such as seeking support, problem-solving, and cognitive reconstruction, while negative coping includes non-adaptive strategies such as avoidance, denial, and self-blame [10]. In the Modi pediatric self-management model, coping styles are regarded as the core psychological process at the individual level, connecting disease cognition, emotional experience and behavioral outcomes [5]. This model emphasizes the dynamic path of "cognition - emotion - behavior", that is, disease-related cognitive and emotional experiences are transformed into specific self-management behaviors through coping strategies.

In the field of chronic diseases, the mediating role of coping styles has been preliminarily verified. Chen et al. found that coping styles play a mediating role between disease perception and self-management behaviors [11]; Sa et al. 's research shows that positive coping is a strong predictor of self-management behavior in patients with diabetic retinopathy (β = 0.320, p < 0.05)[12]. Koster et al. confirmed in the Dutch study on childhood asthma that psychological coping strategies are the key mediating factors for the transformation of disease cognition into self-management behaviors [13]. Rhee et al. found in a longitudinal study of adolescent asthma patients in the United States that self-efficacy fully mediates the relationship between knowledge and self-management through problem-solving coping strategies [14]. However, in the field of childhood asthma in China, the mediating mechanism of coping styles has not yet been systematically explained.

The severity of asthma, as an objective disease indicator, not only directly affects the physical functions of children but more importantly, shapes their disease perception and psychological coping patterns. When serious symptoms like wheezing and breathing difficulties happen often to children, they may develop "learned helplessness" and will be inclined to have maladaptive coping styles like avoidance and denial [15]. But overall, home- and school-based educational programs have been found to have a significant impact in controlling asthma and decreasing asthma hospitalization for preschool children with asthma [16], proving that the proper systematic interventions are able to effectively help manage the disease. Knowledge about asthma is a useful asset of the cognitive level for child patients and includes understanding the causes of the disease, recognizing the symptoms, using drugs, and avoiding triggering factors. Appropriate disease knowledge will strengthen the feelings of control for children and instill self-efficacy in them and encourage their adaptation of problem-oriented adaptive coping styles [17]. But by itself, knowledge will not directly lead to behavior change; the knowledge has to be implemented by the child in the form of an adaptive coping style.

Based on the above theoretical analysis and empirical evidence, this study proposes the following hypothesis: Coping styles play a mediating role between the severity of asthma and self-management behaviors. Specifically, the more severe the asthma is, the more likely children are to adopt negative coping strategies, which in turn leads to a decrease in the level of self-management behaviors. Coping styles play a mediating role between asthma knowledge and self-management behaviors. Specifically, asthma knowledge indirectly improves the level of self-management behaviors by enhancing positive coping abilities. The innovation of this study lies in its first systematic exploration of the mediating mechanisms of coping styles among school-age children with asthma in China. It has deepened from predictive research to mechanism exploration. The research results will provide precise intervention targets for clinical practice and promote the transformation of asthma management from simple disease education to an integrated intervention model.

METHOD
2.1 Research Design and Subjects
This study adopted a cross-sectional correlation research design. The data were derived from the larger-scale "Research on Influencing Factors of Self-Management Behaviors in Children with Asthma" project, which has been approved by the Ethics Committee of the Second Affiliated Hospital of Wenzhou Medical University (Ethics Approval Number: MHESI 8100/00735; (2025-K-52-01)). The study strictly adhered to the ethical principles outlined, and all participants and their guardians signed informed consent forms.

The research subjects were children with asthma who visited the pediatric outpatient department of the Second Affiliated Hospital of Wenzhou Medical University from March to June 2025. The inclusion criteria include: age 8-12 years old; Conforms to the "Diagnostic Criteria for Bronchial Asthma in Children" of China; The disease course is ≥3 months, and the treatment received is ≥3 months. Recent studies have explored innovative educational approaches in pediatric asthma management, including immersive virtual reality-based environmental education [18], though traditional questionnaire-based methods were adopted in this study [19]; Understand the content of the questionnaire and be able to communicate in Chinese. The exclusion criteria include: being in the acute attack period of asthma at the time of investigation, combined with severe complications, and cognitive impairment or mental illness.

The sample size was calculated using G*Power 3.1 software. The effect size $f^2 = 0.1$, $\alpha = 0.05$, power of test = 0.95, and the number of predictor variables = 6 were set. The lowest sample size calculated came to 215 cases. With a 15% invalid questionnaire rate anticipated, the sample size required came to 245 cases, and a total of 253 cases were enrolled, fulfilling the statistical requirements. Consecutive sampling combined with random selection was adopted. Children fulfilling the inclusion and exclusion criteria were numbered day by day, and participants were selected using a random number table until the daily sample size requirement was met. Data itself was gathered by the investigators themselves in the outpatient consultation or a private room. There were two outpatient nurses involved in rendering auxiliary help but playing no role in scientific judgment-making or data entry. The time for the survey was from 8:30 to 17:00 from Monday to Friday, and each of the questionnaires itself took 20 to 25 minutes for its completion.

2.2 Measuring Tools
The general information was recorded including age, gender, disease duration, attack frequency, family income, and primary caregivers. Other four standardized scales were used for data collection in this study. All scales were evaluated for content validity by two pediatric nursing experts and one pediatric respiratory physician, and the content validity index was 1.00 for all.

The asthma severity assessment questionnaire [20] consists of 6 items. It evaluated symptom frequency, nocturnal attacks, activity limitations, etc. A 4-level score was used (1= asymptomatic,4= frequent symptoms), with higher the score, the more severe the condition. In this study, Cronbach's α = 0.926.

The asthma knowledge questionnaire [21] consists of 30 questions across 4 dimensions: disease nature, drug treatment, attack prevention, and self-monitoring. A yes or no answer was used, with higher the score, indicating higher knowledge.

The Simple Coping Style questionnaire is a children's version developed by Xie and verified [22,23], consisting of 20 items, including 12 questions on positive coping and 8 questions on negative coping. It is scored on a 4-level scale (1= not adopted,4= frequently adopted). This study mainly uses the dimension of positive coping, with higher the score, the stronger the tendency of positive coping. In the study, Cronbach's α = 0.905.

The Self-management Scale for Childhood Asthma [24,25] consists of 3 dimensions with a total of 34 questions: daily life management, disease medical management, and social psychological management. It uses a 5-level scoring system (1= never, 5 = always), with a score of ≥120 points indicates good management, while a score of <120 points indicates a need for improvement. In this study Cronbach's α=0.940.

2.3 Data Analysis

Statistical analysis was conducted using SPSS 27.0 software, and the test level α = 0.05. First, conduct descriptive statistics to calculate the mean, standard deviation, and actual range of each variable. Secondly, Pearson correlation analysis was used to test the correlation between variables. The mediating effect test uses the Hayes Process macro Model. The control variables included age, gender, disease duration, and family income. Bootstrap repeated sampling was conducted 5,000 times to calculate the 95% deviation-corrected confidence interval. If the confidence interval did not contain 0, the mediating effect was significant, and the proportion of the mediating effect = (indirect effect/total effect) ×100%. The diagnostic test showed that the variance inflation factor was less than 5, indicating no severe multicollinearity. The residual normal P-P plot and scatter plot showed that the data conformed to the normal distribution hypothesis.

RESULTS

3.1 Descriptive Statistics

A total of 253 children with asthma were included in the study, among whom 135 were boys (53.4%), with an average age of 10.12±1.41 years (ranging from 7.40 to 12.80 years). In terms of the disease course, there were 129 cases (51.0%) with a duration of ≤28 months and 124 cases (49.0%) with a duration of >28 months. There were 137 people (54.2%) with an attack frequency of no more than 3 times per month and 116 people (45.8%) with an attack frequency of more than 3 times per month. In terms of drug treatment,66.4% of the children were treated with bronchodilators, and 33.6% were treated with glucocorticoids. Family characteristics show that 45.5% of the families have the mother as the main caregiver, and 54.9% have a monthly family income of no more than 14,000 yuan. As shown in Table 1.

The total score of self-management behavior was 119.71±27.76, which was at an above-average level (passing line 120 points). Among them, the score of the daily life management dimension was 23.97±6.02, the score of the disease medical management dimension was 65.01±16.00, and the score of the social psychological management dimension was 30.73±7.31. The score rate in the dimension of disease medical management was the highest (72.2%), while that in the dimension of daily life management was the lowest (68.5%), suggesting that children patients still need to strengthen their environmental control and lifestyle adjustment.

The average score of asthma severity was 13.57±5.32, the average score of asthma knowledge was 12.00±7.97, and the average score of positive coping was 31.93±5.21. The descriptive statistics of each research variable are shown in Table 2, and the score distribution of each dimension of self-management behavior is shown in Figure 1. These descriptive data indicate that the research samples present a reasonable distribution range in all indicators, providing a solid data foundation for subsequent correlation analysis and mediating effect tests, as shown in Figure 1.

Table 1. Demographic and Clinical Characteristics of Children with Asthma (n=253)

Characteristics	n	%
Age (years) (M=10.12, SD=1.41, Range: 8.00-12.80)		
8	41	16.2
9	55	21.7
10	42	16.7
11	55	21.7
12	60	23.7
Gender		
Male	135	53.4
Female	118	46.6
Disease Course (months) (M=6.43, SD=3.13)		
≤28 months	129	51.0
>28 months	124	49.0
Attack Frequency		
≤3 times/month	137	54.2
>3 times/month	116	45.8

Drug Therapy			
Bronchodilators		168	66.4
Corticosteroids		85	33.6
Primary Caregiver			
Mother		115	45.5
Father		40	15.8
Grandfather		57	22.5
Grandmother		41	16.2
Monthly Family Income (RMB) (M=15355.73, SD=6325.08)			
≤14,000		139	54.9
>14,000		114	45.1

Table 2. Descriptive Statistics of Study Variables (n=253)

Variable	Possible Range	Actual Range	M ± SD
Asthma Severity	6-24	6-24	13.57 ± 5.32
Asthma Knowledge	0-30	0-30	12.00 ± 7.97
Coping Style (Positive)	12-48	24-48	31.93 ± 5.21
Self-Management Behavior			
Daily Life Management	7-35	7-35	23.97 ± 6.02
Disease Medical Management	18-90	18-90	65.01 ± 16.00
Social Psychological Management	9-45	11-40	30.73 ± 7.31
Total Self-Management	34-170	36-168	119.71 ± 27.76

(A) Distribution of Self-Management Scores
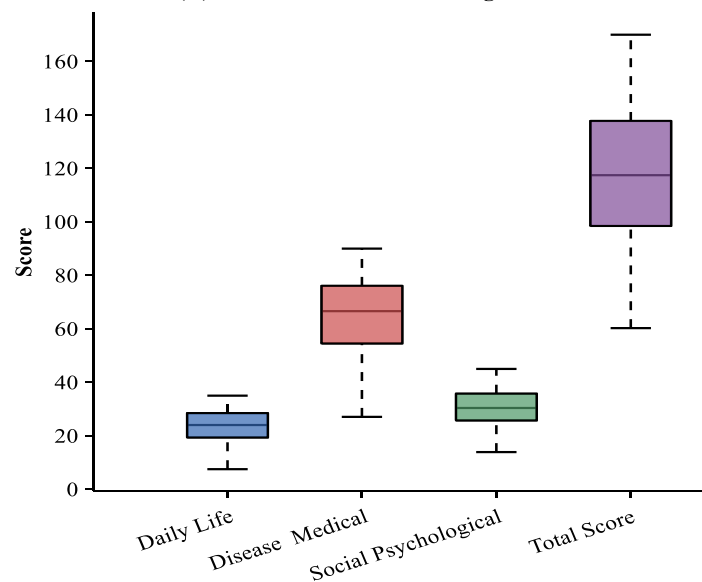
(B) Score Rate Radar Chart
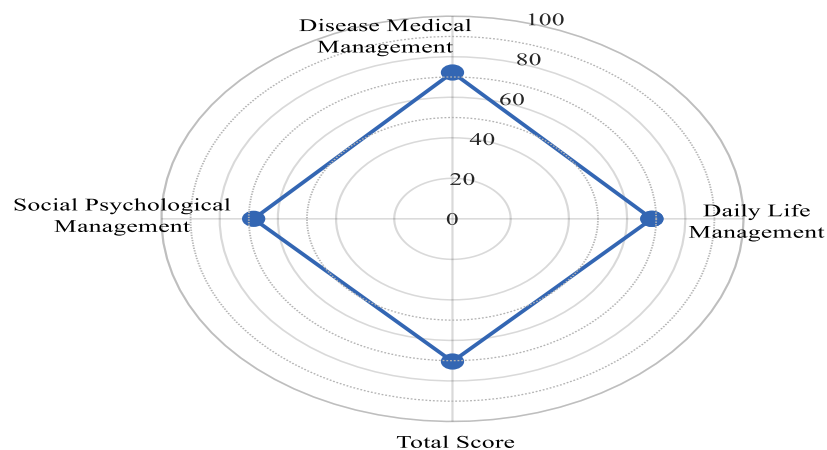
Figure 1. Self-Management Behavior Dimensions in Children with Asthma (n=253)

3.2 Relevant Analysis

As revealed by Table 3, the Pearson correlation analysis outcomes are that asthma severity is significantly negatively related to coping strategies (r = -0.38, p < 0.001) and self-management behavior (r = -0.42, p < 0.001) and that this indicates that the severer the asthma is, the greater the tendency is towards passive coping and lower self-management. Asthma knowledge has significant positive relationships with the same measures for coping strategies (r = 0.45, p < 0.001) and self-management behavior (r = 0.51, p < 0.001) but indicates that the higher the level of asthma knowledge is, the greater the level of proactive coping and self-management. Coping strategies have the strongest relationship with self-management behavior (r=0.68, p<0.001) and indicate the possibility that they represent a key mediating variable between the factors of disease and management behavior. The preliminary support for subsequent tests for a mediation effect that these relationships offer is consonant with the test criteria for mediation proposed by Baron and Kenny.

Table 3. Pearson Correlation Analysis Among Study Variables (n=253)

Variable	1	2	3	4	M ± SD
1. Asthma Severity	1				13.57 ± 5.32
2. Asthma Knowledge	-0.36***	1			12.00 ± 7.97
3. Coping Strategies	-0.38***	0.45***	1		31.93 ± 5.21
4. Self-Management Behaviors	-0.42***	0.51***	0.68***	1	119.71 ± 27.76

Note. ***p < .001

3.3 Mediating Effect Test

The Hayes Process Model 4 proved useful for the test of the mediating effect. It was first studied after controlling for demographic factors such as the duration of the disease, gender, age, and family income.

The analysis revealed that the overall impact was significant (c=-1.85, SE=0.28, 95% CI [-2.40, -1.30], p<0.001), meaning that for every 1-point increase in the severity of asthma, self-management behavior reduced by 1.85 points. Path a was significant (B=-0.62, SE=0.15, 95% CI [-0.92, -0.32], p<0.001), meaning that the greater the severity of asthma, the lower the score for positive coping. For every 1-point increase in the level of severity, the style of coping reduced by 0.62 points. Path b was significant (B=1.76, SE=0.18, 95% CI [1.41, 2.11], p<0.001), meaning that controlling the level of the severity in the equation, for every increase by.

As Table 4 indicates, the indirect impact was significant (a×b=-1.09, SE=0.18, 95% CI [-1.46, -0.75]). Because the confidence range did not include 0, it revealed that the mediating impact through the styles of coping was -1.09 points, explaining 58.9% of the total impact, further verifying that styles of coping provided a partial mediation. The direct impact also remained significant (c'=-0.76, SE=0.22, 95% CI [-1.19, -0.33], p<0.001), showing that excluding the role of mediation by styles of coping, the severity continued to directly impact self-management by explaining 41.1%.

Secondly, test the mediating role of coping styles between asthma knowledge and self-management behavior. The outcomes revealed that the total impact proved significant (c=1.42, SE=0.19, 95% CI [1.05, 1.79], p<0.001) to indicate that self-management behavior increased by 1.42 points for each 1 point increase in asthma knowledge. Path a was significant (B=0.58, SE=0.12, 95% CI [0.34, 0.82], p<0.001), indicating that for every 1 point increase in knowledge, positive coping improved by 0.58 points. Path b was significant (B=1.85, SE=0.16, 95% CI [1.54, 2.16], p<0.001), indicating that after controlling the knowledge level, for every 1 point increase in coping style, self-management improved by 1.85 points.

The indirect effect was significant (a×b=1.07, SE=0.15, 95% CI [0.78, 1.38]), and the mediating effect through coping styles was 1.07 points, accounting for 75.4% of the total effect. The direct effect was weak (c'=0.35, SE=0.17, 95% CI [0.02, 0.68], p=0.039). Although it was statistically significant, the effect size was only one-third of the indirect effect, suggesting that the coping style played a complete mediating role or was close to complete mediating.

Subgroup analysis showed that in the mild group (n=137), the mediating effect of coping styles in the severity → self-management pathway accounted for 68.2% (95% CI [-1.68, -0.85]), and in the knowledge → self-management pathway accounted for 79.3% (95% CI [0.82, 1.58]); In the moderate to severe group (n=116), the corresponding mediation effect accounted for 52.1% (95% CI [-1.35, -0.52]) and 70.1% (95% CI [0.56, 1.36]). This indicates that in the mild group, the mediating role of coping styles is more prominent; In the moderate to severe group, the direct effect was enhanced, indicating that severe children were more restricted by the disease itself.

Table 4. Summary of Mediation Analysis Results

Pathway	Effect Type	B	SE	95% CI	p	Mediation %
Model 1: Severity → Coping → Self-Management						
Severity → Coping	Path *a*	-0.62	0.15	[-0.92, -0.32]	<.001	—
Coping → Self-Management	Path *b*	1.76	0.18	[1.41, 2.11]	<.001	—
Severity → Self-Management	Total (*c*)	-1.85	0.28	[-2.40, -1.30]	<.001	—
Severity → Self-Management	Direct (*c'*)	-0.76	0.22	[-1.19, -0.33]	<.001	—

	Indirect ($a \times b$)	-1.09	0.18	[-1.46, -0.75]	—	**58.9%**
Model 2: Knowledge → Coping → Self-Management						
Knowledge → Coping	Path a	0.58	0.12	[0.34, 0.82]	<.001	—
Coping → Self-Management	Path b	1.85	0.16	[1.54, 2.16]	<.001	—
Knowledge → Self-Management	Total (c)	1.42	0.19	[1.05, 1.79]	<.001	—
Knowledge → Self-Management	Direct (c')	0.35	0.17	[0.02, 0.68]	.039	—
	Indirect ($a \times b$)	1.07	0.15	[0.78, 1.38]	—	**75.4%**

Note: n = 253. Bootstrap = 5,000 samples. Controlled variables: age, gender, disease duration, family income.

DISCUSSION

This study is the first to systematically verify the mediating mechanism of coping styles in school-age children with asthma in China, revealing that coping styles serve as a "psychological bridge" connecting disease factors with self-management behaviors. The research found that coping styles play a partial mediating role (58.9%) between the severity of asthma and self-management behaviors, and a complete mediating role (75.4%) between asthma knowledge and self-management behaviors, confirming two different mediating pathways: "disease stress → negative coping → behavioral inhibition "and" knowledge empowerment → positive coping → behavioral promotion".

The mechanism by which the severity of asthma affects self-management through coping styles can be understood from the perspective of cognitive evaluation theory. According to the stress-coping theoretical framework [9], critically ill children form an unbalanced evaluation of "threat greater than resources" when facing frequent attacks, and then adopt negative coping strategies such as avoidance and self-blame. The negative correlation (r=-0.38) between severity and positive coping in this study confirmed this mechanism. Frequent symptom exacerbations and treatment setbacks lead to learned helplessness, with children believing that their actions cannot change the outcome and thus giving up active management [15]. The negative emotions such as anxiety and depression that often accompany critically ill children [26] further deteriorate their emotional state through negative coping, forming a vicious cycle. Subgroup analysis showed that the mediating effect was stronger in children with mild symptoms (68.2% vs. 52.1%), indicating that psychological factors were more malleable when the condition was mild, while physiological limitations became the main obstacle when the condition was severe [26].

The complete mediating pathway (75.4%) by which asthma knowledge influences self-management through coping styles reveals the knowledge-skills-behavior transformation chain. Asthma knowledge provides a framework for disease understanding, but the knowledge itself is static and needs to be activated through coping strategies. According to social cognitive theory, knowledge promotes behavioral change by enhancing self-efficacy [17], and caregiver self-efficacy plays a multilevel facilitating role in pediatric asthma outcomes. Coping styles are the operational manifestations of self-efficacy. Rhee et al. 's longitudinal study among adolescent asthma patients in the United States supports this view, finding that self-efficacy fully mediates the relationship between knowledge and self-management through problem-solving coping strategies [14]. In this study, the fully mediating model (with a direct effect of only 0.35 and an indirect effect of 1.07) suggests that the health education effect of simple knowledge imparting is limited. Traditional lecture-style education may increase knowledge scores, but if positive coping skills are not cultivated simultaneously, behavioral change is difficult to sustain [27,28].

At the theoretical level, this study has for the first time empirically demonstrated the complete path of "cognition → emotion/coping → behavior" of the Modi pediatric self-management model in Chinese children with asthma [5], confirming that coping style is the most core psychological process at the individual level. Unlike adult studies, children's coping abilities are still developing and they rely more on external support to shape their coping patterns, which provides a golden window period for early intervention. Compas et al. pointed out in their systematic review on the management of chronic diseases in children that school-aged children (aged 8-12) are in a critical period when their coping strategies shift from relying on external guidance to internalizing autonomy, and the intervention effect of coping patterns during this period is the most significant [9]. Koster et al. 's qualitative interviews in the Dutch Childhood Asthma study found that adolescent patients generally believed that coping skills were more helpful for them to achieve effective self-management than disease knowledge [13].

At the clinical practice level, this study proposes a stratified intervention strategy: children with mild symptoms and high knowledge should strengthen positive coping training (goal setting, action planning); Children with mild symptoms but low knowledge need to combine knowledge education and skills training. For children with severe illness and negative coping, cognitive behavioral therapy should be adopted to break through learned helplessness. For critically ill children who are actively treated, drug therapy needs to be optimized to break through physiological limitations. Coping skills training should include five steps: assessment of coping styles, cognitive reconstruction, problem-solving training, mobilization of social support, and maintenance and generalization. Bruzzese et al. implemented an 8-week coping skills training in an asthma management program in American schools, which increased the self-management behavior score of children by 28% and reduced the rate of asthma-related emergency visits by 45% [29]. Family participation is indispensable. By demonstrating positive coping behaviors through parents and setting common goals between parents and children, continuous support can be provided for the child patients. Van de Ven et al. found that coping strategies played a significant role in improving quality of life among adolescents with asthma, highlighting the importance of psychological interventions in disease management [30].

This study has limitations. Cross-sectional design cannot infer causal relationships. In the future, longitudinal studies should be adopted to verify the causal direction. The samples were only from the Wenzhou area. The generalizability of the results needs to be cautious. It should be expanded to multi-center studies to compare the differences between urban and rural areas. Self-reported data may have social approval biases. In the future, triangulation verification should be conducted in combination with objective indicators. Unexplored moderating variables (such as family functions) may affect the effectiveness of coping styles, and the interaction needs to be further examined.

CONCLUSION

This study verified the mediating role of coping styles in the self-management of children with asthma: the severity of asthma reduced self-management through negative coping (mediating 58.9%), and asthma knowledge enhanced self-management through positive coping (mediating 75.4%). Clinical practice should shift from simple disease education to an integrated model of "knowledge - psychology - behavior", and incorporate coping skills training into the standard program. For children with mild symptoms, it is crucial to strengthen positive coping training. For those with severe symptoms, it is important to combine drug optimization and psychological support, and for families to participate in shaping coping patterns. In the future, longitudinal studies are needed to verify the causal mechanism, and randomized controlled trials should be conducted to test the intervention effect, ultimately improving disease control and quality of life.

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