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ORIGINAL RESEARCH

The Association and Mediators Between Sleep Problems in Autistic Children and Parenting Stress

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Purpose: To investigate the association among sleep problems in autistic children, emotional symptom in autistic children and parenting stress.

Methods: This study recruited a total of 292 children with autism in two special education schools in Hunan province, China. The average age of the autistic children in this study was 6.5 ± 2.8 years. Sleep problems in autistic and parenting stress were measured by Youth Self-Rating Insomnia Scale (YSIS), Sleep Disturbance Scale for Children (SDSC), and The Parenting Stress Index-Short Form (PSI-SF-15). The main analysis included latent profile analysis, multivariate logistic regression analysis, and mediation analysis.

Results: The prevalence for sleep disturbance and insomnia symptoms in autistic children were 38.7% and 13.0%, respectively. Parenting stress was divided into three groups: low-risk group (81 participants, 28%), middle-risk group (134 participants, 46%), and high-risk group (77 participants, 26%). Sleep problems (insomnia and sleep disturbance) and emotional symptoms (anxiety and depression) in children with autism were risk factors for parental stress. Depressive symptom in autistic children was significant in mediating the relationship between insomnia symptoms and parenting stress.

Conclusion: There is a significant effect of sleep problems in autistic children, as these sleep issues can substantially increase parental stress, with depressive symptoms in autistic children serving as a positive mediator.

Keywords: sleep problems, sleep disturbance, parenting stress, emotional symptom, autistic children

Introduction

Globally, Autism Spectrum Disorder (ASD) has become the biggest cause of mental disability in children, with incidence increasing year by year.[1–3] Many children begin to show signs of autism as early as 12 to 18 months of age. However, most children with autism are not diagnosed until after the age of three.[2,3] Autistic children or related disorders often struggle with sleep problems, which rank among the most frequently reported challenges by parents.[4–7] Across all age groups (0–18 years), the prevalence of sleep-related symptoms in autistic children ranges from 40% to 80%, which is significantly higher than the 25% to 50% prevalence observed in typically developing children.[8,9] Data from large-scale survey and clinical diagnoses show that the overall prevalence of sleep disturbances in autistic children is 13% (95% CI: 9–17%), still notably higher than in the general child population.[4,10,11] Evidence suggests that sleep problems can exacerbate some of the core symptoms of autism,[6,12,13] such as stereotyped behavior, social dysfunction, emotional and behavioral problems, increasing the difficulty of treatment for autistic children.[8,10] Therefore, it is crucial to pay close attention to the sleep patterns of children with autism, and such evidence underscores the necessity of prioritizing sleep monitoring in ASD clinical care.

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Of note, sleep problems not only affect the health and quality of life of autistic children, but also have a profound impact on family function. Caring for autistic children itself presents significant challenges for parents.[14] On the one hand, children's social impairments can affect how parents interact with them.[15,16] On the other hand, the sleep, emotional, and behavioral problems associated with ASD can heighten parental anxiety and increase parenting stress.[16–18] There may be a bidirectional relationship between parental stress and autistic children's sleep problems.[19,20] Some studies have shown that high levels of parental stress may exacerbate sleep problems of autistic children.[21,22] Other evidence suggested that sleep problems of autistic children may also increase parental stress or mental health difficulties.[23,24] It is important to note that previous studies have primarily estimated parental stress levels using overall means, assuming homogeneity among participants.[21–23] Consequently, their conclusions reflect average trends rather than individual psychological characteristics. In reality, parenting stress can be heterogeneous, some parents of children with autism may experience significantly higher stress levels, while others may report only mild stress. Therefore, this study will examine the different levels of parental stress in children with autism to objectively understand the heterogeneity subgroups of their stress.

The stress on parents of children with autism is a global concern, impacting families in both Eastern and Western cultures.[25] Within the context of Chinese culture, where the family unit holds paramount importance, parents of children with autism often face heightened expectations and pressures from within the family.[25] There may be concerns about how the child's condition could affect the family's reputation. Influenced by traditional values, Chinese parents might be more inclined to silently bear this pressure and less likely to seek external support. Moreover, shaped by Confucian ideals, these parents often have high aspirations for their children's development. In today's rapidly evolving society, the cumulative pressures of work and life can exacerbate parenting anxiety. Therefore, examining the parental stress experienced by parents of children with autism within the framework of Chinese culture is profoundly significant.

Furthermore, numerous studies have shown that sleep problems in autistic children are associated with symptoms of anxiety and depression.[13,20] The anxiety and depression symptoms, as component of mood disorder of children, may significantly increase parental stress.[26] These pieces of evidence suggest that anxiety and depression symptoms may mediate the relationship between sleep problems of autistic children and parental stress. However, direct empirical evidence is still sparse. Thus, this study focused on children with autism aged 3–12 years as the research subjects, aiming to (1) show the prevalence of sleep problems in autistic children, (2) differentiate heterogeneous groups of parenting stress in parents with autistic children, (3) examine the impact of sleep problems in autistic children on parenting stress, (4) test the mediating effect of anxiety and depression symptoms in autistic children. This study uses latent profile analysis to explore more comprehensively the potential impact of autistic children's sleep problems on different types of parental stress. The current research could strengthen the understanding the impact of sleep problems on the long-term development of autistic children and family health, as it can help raise awareness and promote the development of comprehensive interventions.

Method

Participant and Procedure

Taking children with autism aged 3–12 years as the sample, the research participants were children with autism and their parents, forming child-parent dyad. Participants in this study were recruited through convenience sampling from in two special education schools, both located in Hunan Province. All participants were undergoing rehabilitation training between June and August 2024. We used Wenjuanxing, a widely adopted online survey platform in China, to design and distribute the questionnaire. This platform supports multi-format question types (eg, Likert scales, multiple-choice) and real-time data encryption, ensuring compliance with China's data security laws. To recruit participants, QR codes linking to the survey were disseminated via WeChat, a multifunctional social media app with over 1.3 billion active users in China. WeChat enables group messaging, file sharing, and mini-program integration, making it a standard tool for academic recruitment in Chinese contexts. Parents accessed the survey by scanning the QR code within the app, which redirected them to the Wenjuanxing platform. These tools were selected for their ubiquity and ease of use in China, though they may be less familiar to international readers.

Prior to participation, all parents or legal guardians received a written informed consent form outlining the study's purpose, voluntary nature, data confidentiality measures, and the right to withdraw at any stage. Signed consent was obtained exclusively from parents/guardians, as the children (aged 3–12 years) were minors with ASD, many of whom lacked the cognitive capacity to provide meaningful assent. This approach aligns with the ethical guidelines of the National Health Commission of China and the Declaration of Helsinki for research involving cognitively impaired minors, which waives child assent when parental consent is secured and the study poses minimal risk. This study received ethical approval from our hospital.

In total, we collected 68 electronic responses and 283 paper responses, resulting in 351 initial cases. We then cleaned the data according to a set of inclusion and exclusion criteria. The inclusion criteria were as follows: (1) parents of autistic children who were fully informed about the study and volunteered to participate; (2) children with an "Autism Behavior Checklist" score greater than the screening threshold of 31; and (3) children with one or more prior diagnoses of ASD. The exclusion criteria included: (1) non-parental respondents; (2) excessive repetition or deletion in responses; (3) the presence of a serious physical or neurological disorder in either the child or the parent; and (4) the child's use of medications that interfere with sleep, such as psychotropic drugs or antiepileptic drugs. These pieces of information were gathered through questionnaires. During the data cleaning process, any cases where parents reported these situations were excluded from the sample.

After applying these criteria, 59 samples were excluded, leaving 292 valid responses, resulting in an effective rate of 83.2%. A post-hoc power analysis using G*Power 3.1 (f^2= 0.15, α = 0.05, power = 80%) indicated that N = 200 was sufficient. The sample size of this study (N = 292) exceeded this threshold, ensuring adequate power. According to Table 1, the average age of the autistic children in this study was 6.5 ± 2.8 years. Among sex in autistic children, 224 were male (76.7%) and 68

Table 1 The Demographic Characteristics of Autistic Children and Their Parents

Autistic Children			**Autistic Children' Parent**		
Age (M, SD)	6.47	2.77	Parental age (M, SD)	37.06	6.50
ABC total score (M, SD)	60.29	33.60			
			Parental sex (n, %)		
ABC cut-off (n, %)			Female	204	69.9
Subclinical (31–61)	192	65.8	Male	88	30.1
Clinical (≥62)	100	34.2	Father's educational level (n, %)		
Sex in autistic children (n, %)			Under middle school	77	26.4
Female	224	76.7	High school	86	29.5
Male	68	23.3	Bachelor degree	109	37.3
Only-one child (n, %)			Graduate degree	20	6.8
Yes	94	32.2	Mother's educational level (n, %)		
No	198	67.8	Under middle school	87	29.8
Diagnosis (n, %)			High school	84	28.8
Autism spectrum disorder	123	42.1	Bachelor degree	104	35.6
Developmental delay	134	45.9	Graduate degree	17	5.8
Speech disorder	53	18.2	Parental marital status (n, %)		
Others [a]	42	14.4	In marriage	276	94.5
Family's monthly income (n, %)			Divorce	12	4.1
>10000¥	57	19.5	Others	4	1.4
6000–10000¥	106	36.3			
3000–6000¥	88	30.1			
< 3000¥	41	14			

Notes: %, percent, [a] cerebral palsy, intellectual disability, etc.
Abbreviations: M, mean; N, frequency; SD, standard deviation.

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were female (23.3%). The average total score on the ABC was 60.3 ± 33.6. One hundred and ninety-two autistic children (65.8%) reached subclinical level, while 100 autistic children (34.2%) had clinical level. For the parents, the average age was 37.1 ± 6.5 years. Among sex in parent who finished survey, 204 were mothers (69.9%) and 88 were fathers (30.1%).

Measurement

Youth Self-Rating Insomnia Scale (YSIS)

Insomnia symptoms of autistic children were evaluated by three items of difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), and early morning awaking (EMA), which adopted from Youth Self-Rating Insomnia Scale (YSIS).[27,28] YSIS is applicable to Chinese children under the age of 15[27]. The three items are consistent with the common sleep problems reported in previous research on children with autism.[29] Parents were required to fill in the form based on their child's past month's situation. Each item was scored with 5 grades, including 1 = never, 2 = less than once a week, 3 = 1–2 times a week, 4 = 3–5 times a week, 5 = 6–7 times a week. Whoever suffered one symptom at least three times had clinical-level insomnia symptoms.

Sleep Disturbance Scale for Children (SDSC)

The Sleep Disturbance Scale for Children (SDSC) includes 26 items covering various sleep issues, such as difficulty falling asleep, maintaining sleep, sleep-disordered breathing, arousal disorders, nightmares, sleep–wake transition disorders, hypersomnia, and night sweats (hyperhidrosis).[30,31] SDSC was designed for children under 16 years old[30] and has been adapted specifically for use with autistic children.[31] This scale asked parents to report on their child's sleep status over the past six months. Parents or guardians rate the child's symptoms on a 5-point Likert scale, ranging from 1 ("never") to 5 ("always, daily"). Higher scores indicate more severe sleep disturbances, with a total score of 39 or higher indicating a sleep disturbance.

Anxiety and Depressive Symptoms

Anxiety symptoms were assessed using the Generalized Anxiety Disorder scale (GAD-2),[32] while depressive symptoms were evaluated with the Patient Health Questionnaire (PHQ-2).[33] GAD-2 and PHQ-2 are both suitable for children under 18 years old.[32,33] Parents were asked to complete the questionnaire based on their child's experiences over the past two weeks. Both scales are 4-point Likert scales ranging from 0 ("not at all") to 3 ("almost every day"). Scores range from 0 to 6, with higher scores indicating more severe anxiety or depression symptoms over the past two weeks.

The Parenting Stress Index-Short Form (PSI-SF-15)

The Parenting Stress Index-Short Form (PSI-SF-15), as revised by Luo et al (2019),[34] was also utilized in this study. It assesses personal stress, parent–child interaction stress, family system stress, and social support stress. Parents were asked to respond based on the stress they experienced over the past month. The scoring is based on a 5-point Likert scale, where parents rate their feelings about each item from 1 ("strongly disagree") to 5 ("strongly agree"). Higher scores reflect greater parenting stress.

Autism Behavior Checklist (ABC)

Autism Behavior Checklist[35–37] is commonly used to screen autistic children, assessing areas such as physical movement, language, self-care, sensory perception, and communication. Parents needed respond based on their child's typical behavior and circumstances. This study adopted Chinese version, a total score of 31 or higher suggests the possibility of autism, while a score of 62 or higher is indicative of a definitive diagnosis.[37]

Demographic Characteristics

Demographic information for autistic children included age, sex, only-child status, and psychotherapy experience. Demographic information for parents included gender, age, marital status, father's level of education, mother's level of education, and monthly family income. To complement the diagnosis from the ABC scale, this study also asked parents to report their child's diagnosis as part of the demographic survey. Parents were able to select their child's diagnosis using a multiple-choice format, choosing from the following options: 1) autism spectrum disorder, 2) developmental delay, 3) speech disorder, 4) other (eg, cerebral palsy, intellectual disability, etc).

Data Analysis

Statistical analysis was conducted using SPSS 27.0 software, and MPLUS 8.0. SPSS was used to calculate *t* test, Chi-square test and logistic regression analysis, while MPLUS was used for potential profile analysis and mediation effect test. Latent Profile Analysis (LPA) were a statistical method used to identify hidden class or subgroups in data.[38,39] In order to find the best parameter values, Maximum Likelihood Estimation (MLE, the model parameters were estimated using the expectation maximization algorithm) was used to conduct iterative optimization.[29,39] Common information criteria are as follows: Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and Adjusted BIC (aBIC)are all used to measure the goodness-of-fit and complexity of a model.[39,40]

Result

Reliability and Validity Testing

The internal consistency reliability of the questionnaire was determined using Cronbach's α, where a higher alpha value indicates higher reliability of the data. The convergent validity was test by construct reliability (above 0.7) and average variance extracted (above 0.5).[41] The psychometric properties of all scales demonstrated acceptable reliability and validity: YSIS (Cronbach's α = 0.81, CR = 0.84, AVE = 0.64), SDSC (Cronbach's α = 0.91, CR = 0.86, AVE = 0.55), GAD-2 (Cronbach's α = 0.80, CR = 0.91, AVE = 0.84), PHQ-2 (Cronbach's α = 0.76, CR = 0.89, AVE = 0.82), PSI-SF -15 (Cronbach's α = 0.91, CR = 0.92, AVE = 0.62), ABC (Cronbach's α = 0.91, CR = 0.87, AVE = 0.54).

The Prevalence of Sleep Problems in Autistic Children

Table 2 show that the prevalence of insomnia symptoms in the full sample of autistic children was 13.0% (n = 38) and the prevalence of sleep disturbances was 38.7% (n = 113). The results of chi-square test indicated that the prevalence of insomnia symptoms (t = −3.34, $p < 0.001$) and sleep disturbances (t = −4.23, $p < 0.001$) in autistic children meeting the clinical level was significantly higher than that in autistic children meeting the screening level.

The Heterogeneous Groups of Parenting Stress

When the latent profile of parenting pressure was divided into 1 to 5 classes from small to large, Table 3 presents 5 classes of the model fitting index and class probability in turn. Combining the theoretical and practical implications of the model fit index and various subgroups, we choose *Class 3* models were selected as the final latent profile model, that is there may be 3 subgroups of parenting stress in autistic children. The model fitting index is as follows: AIC = 12,099.96, BIC = 12,327.92, aBIC = 12,131.30, Entropy = 0.931, pLMR = 0.000, pBLRT = 0.000. According to Figure 1, subgroup 1 consisted of 81 people (28%), and was named as the low-risk group. Subgroup 2, comprising 134 participants (46%), was named as the middle-risk group. Subgroup 3, including 77 participants (26%) was named as the high-risk group.

Table 2 Characteristics of Sleep Problems in Autistic Children and Analysis of Differences Based on Autism Severity for the Full Sample

	Full Sample (n = 292)	Subclinical Level [a] (n = 192)	Clinical Level [b] (n = 100)	t/χ^2	*p*
YSIS cut-off (n, %)				1.20	0.274
Non clinical < 4	254 (87.0)	170 (58.2)	84 (28.8)		
Clinical ≥4	38 (13.0)	22 (7.5)	16 (5.5)		
SDSC cut-off (n, %)				19.19	0.000
Non clinical < 39	179 (61.3)	135 (46.2)	44 (15.1)		
Clinical ≥39	113 (38.7)	57 (19.5)	56 (19.2)		
YSIS total score (M, SD)	6.93 (3.02)	6.51 (2.72)	7.74 (3.39)	−3.34	0.000
SDSC total score (M, SD)	38.68 (11.45)	36.69 (9.18)	42.5 (14.17)	−4.23	0.000

Notes: [a:] The Autism Behavior Checklist scores in the range of 31 to 61, [b:] Autism Behavior Checklist score of 62 or higher, $p<0.05$ means statistically significant, t/χ^2 = *t* test or Chi-square test.

Abbreviations: DIMS, Disorders of Initiating and Maintaining Sleep; SBD, Sleep Breathing Disorders; DA, Disorders of Arousal; SWTD, Sleep–Wake Transition Disorders; DES, Disorders of Excessive Somnolence; SH, Sleep Hyperhidrosis.

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Table 3 Latent Profile Analysis of Parenting Stress in Parents of Autistic Children

Model	k	G2 /LL	AIC	BIC	aBIC	Entropy	pLMR	pBLRT	Probability
1 class	30	−7002.034	14,064.07	14,174.37	14,079.23	–	–	–	
2 class	46	−6284.774	12,661.55	12,830.68	12,684.80	0.909	0.018	0.019	0.51/0.49
3 class	**62**	**−5987.978**	**12,099.96**	**12,327.92**	**12,131.30**	**0.931**	**0.000**	**0.000**	**0.28/0.46/0.26**
4 class	78	−5870.271	11,896.54	12,183.33	11,935.97	0.942	0.000	0.000	0.10/0.44/0.28/0.18
5 class	94	−5778.894	11,745.79	12,091.40	11,793.31	0.953	0.363	0.367	0.26/0.21/0.10/0.25/0.18

Notes: Each column represents model fit information, Bold represents the best fit of the model.
Abbreviations: k, number of free parameters; G2 /LL, log likelihood; AIC, Akaike information criterion; BIC, Bayesian Information Criterion; aBIC, Sample-Size Adjusted BIC; Entropy, classification quality; pLMR, Lo-Mendell-Rubin adjusted lrt test; pBLRT, parametric bootstrapped likelihood ratio test.

The Impact of Sleep Problems in Autistic Children on Parenting Stress

Table 4 presents the effects of behavioral, sleep, and emotional problems in autistic children on the subgroup of parenting stress. In the unadjusted model, the results showed that when autistic children had clinical symptoms of insomnia, the probability of having middle risk of parenting stress was 4.56 times higher than that of having low risk ($p < 0.05$, 95% CI: 1.31–15.88), and the probability of having high risk was 6.29 times higher than that of low risk ($p < 0.01$, 95% CI: 1.74–22.71). For children with clinical levels of sleep disturbance, the likelihood of experiencing middle risk was 3.64 times higher than that of low risk ($p < 0.001$, 95% CI: 1.83–7.23), and the likelihood of experiencing high risk was 7.36 times higher than that of low risk ($p < 0.001$, 95% CI: 3.49–15.52).

When the demographic characteristics were included as control variables, the significance of all predicted relationships was similar to that of the unadjusted model, suggesting that the effects of sleep problems in autistic children on parenting stress were stable.

The Mediating Effect of Anxiety and Depression Symptoms

According to Table 5, Figures 2 and 3, this study only found a significant mediating effect of depressive symptoms on the relationship between insomnia symptoms and parenting stress ($\beta = 0.054$, $p = 0.045$, 95% CI: 0.007–0.116). Other path coefficients and model fit (R^2) are illustrated in Figures 2 and 3.

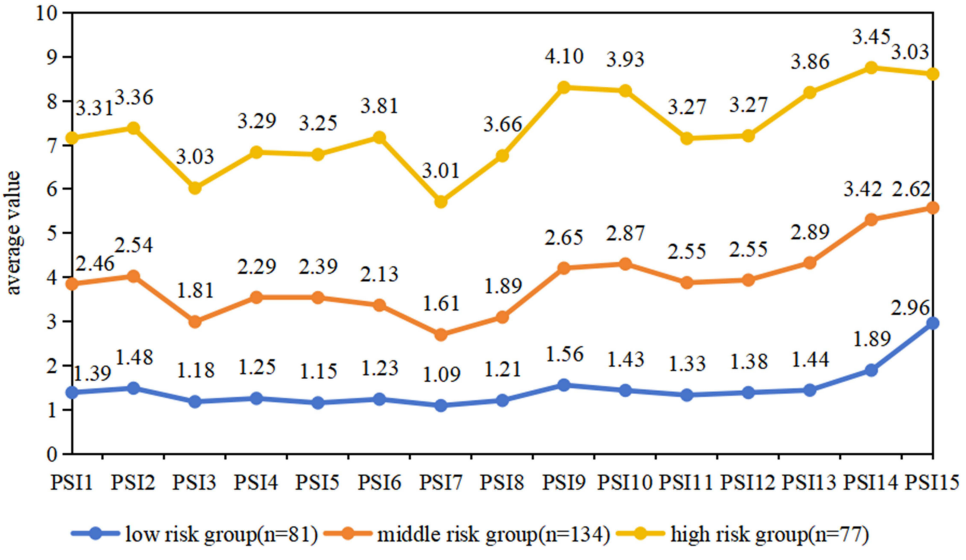

Figure 1 Probability of the three latent profiles of parenting stress on 15 items of Parenting Stress Index. The "low risk group" indicates that parents of children with autism experience low levels of stress. The "middle risk group" signifies moderate levels of parental stress, while the "high risk group", as expected, represents high levels of stress for parents of children with autism.

Table 4 The Impact of Behavioral, Sleep, and Emotional Problems in Autistic Children on Parenting Stress

		PSI Subgroups (Unadjusted Model)				PSI Subgroups (Adjusted Model)			
		Middle Risk vs Low Risk (Ref.)		High Risk vs Middle Risk (Ref.)		Middle Risk vs Low Risk (Ref.)		High Risk vs Middle Risk (Ref.)	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
YSIS	Nonclinical	Ref.		Ref.		Ref.		Ref.	
	Clinical	4.56*	(1.31, 15.88)	6.29**	(1.74, 22.71)	3.62*	(1.01,12.98)	5.42*	(1.45, 20.26)
SDSC	Nonclinical	Ref.		Ref.		Ref.		Ref.	
	Clinical	3.64***	(1.83, 7.23)	7.36***	(3.49, 15.52)	3.54***	(1.74, 7.22)	7.98***	(3.67, 17.37)

Note: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$. The adjusted model includes demographic characteristics such as parental gender, parental age, father's level of education, mother's level of education, parental marital status, family monthly income, child's gender, child's age, and only-child status.
Abbreviations: PSI, Parenting Stress Index; ABC, Autism Behavior Checklist; YSIS, Insomnia Symptoms in Autistic children; SDSC, Sleep Disturbance Scale for Children; OR, odds ratio; 95% CI, 95% confidence interval.

Table 5 The Impact of Sleep Problems in Autistic Children on Parenting Stress: Mediation by Anxiety and Depression Symptoms

Insomnia Symptoms	*β /Coef*	S.E.	*p*	95% CI	Sleep Disturbance	*β /Coef*	S.E.	*p*	95% CI
YSIS→AS	0.390	0.066	0.000	(0.284, 0.497)	SDSC→AS	0.446	0.054	0.000	(0.406, 0.594)
YSIS→DS	0.328	0.066	0.000	(0.219, 0.437)	SDSC→DS	0.5	0.057	0.000	(0.358, 0.535)
YSIS→PSI	0.280	0.060	0.000	(0.161, 0.399)	SDSC→PSI	0.333	0.064	0.000	(0.228, 0.438)
AS→PSI	−0.042	0.072	0.558	(−0.188, 0.103)	AS→PSI	−0.077	0.067	0.248	(−0.188, 0.033)
DS→PSI	0.166	0.071	0.020	(0.024, 0.308)	DS→PSI	0.132	0.069	0.056	(0.018, 0.245)
Total effect	0.318	0.056	0.000	(0.428, 0.318)	Total effect	0.353	0.055	0.000	(0.245, 0.461)
Direct effect	0.280	0.060	0.000	(0.399, 0.280)	Direct effect	0.333	0.065	0.000	(0.206, 0.460)
Total indirect effect(s)	0.038	0.030	0.197	(−0.015, 0.104)	Total indirect effect(s)	0.020	0.035	0.569	(−0.038, 0.078)
ind1: YSIS→AS→PSI	−0.016	0.029	0.567	(−0.073, 0.039)	ind1: SDSC→AS→PSI	−0.039	0.034	0.249	(−0.094, 0.017)
ind2: YSIS→DS→PSI	0.054	0.027	0.045	(0.007, 0.116)	ind2: SDSC→DS→PSI	0.059	0.032	0.065	(0.006, 0.111)

Note: $p<0.05$ means statistically significant.
Abbreviations: YSIS, Insomnia Symptoms in Autistic children; SDSC, Sleep Disturbance Scale for Children; AS, Anxiety Symptoms in Autistic children; DS, Depressive Symptoms in Autistic children; PIS, Parenting Stress Index; ind1 means the first indirect path, while ind2 means the second indirect path, *β /Coef*, coefficient; S.E, standard error; 95% CI= 95% confidence interval.

Discussion

In this study, the prevalence for sleep disturbance and insomnia symptoms in autistic children were 38.7% and 13.0%, respectively. Previous literature reported that the prevalence of sleep-related symptoms in autistic children ranged between 40% and 80%.[8,9] Although the prevalence for sleep disturbances in this study is close to that range, it is lower than the 67.4% combined prevalence of sleep problems reported in prior studies on Chinese autistic children.[5] The prevalence for insomnia in this study aligns with the 13% combined prevalence for sleep disturbances reported in studies based on scale screening and clinical diagnosis.[4,10,11] Nevertheless, the inconsistency between the prevalence in this study and previous findings is undeniable. As noted in earlier studies,[4,6,42] such discrepancies in prevalence are often related to the choice of reporting instruments (eg, questionnaires, activity recorders, polysomnography), the scoring criteria for each measurement tool, reporting biases (eg, parental reports, caregiver reports, medical records), and other factors such as comorbidities.

While most previous studies suggest that parenting styles or stress can induce sleep problems in autistic children,[19–22,25] this study inversely confirms that sleep problems in these children significantly affect parental stress. This finding echoes previous studies showing that sleep problems of autistic children may also increase parental stress or mental health difficulties.[23,24] According to *Family Stress Model*,[43–45] sleep issues in children with autism, such as difficulty falling asleep and frequent nighttime awakenings, may serve as a persistent source of stress. These sleep disturbances can have a direct impact on parents, imposing additional caregiving responsibilities. For instance, parents might need to devote several hours each night to soothing their children, which disrupts their normal rest and daily routines, becoming a significant source of stress.

More importantly, this study found that insomnia symptoms in autistic children can significantly affect parental stress through the depressive symptoms in these children. This internal mechanism can be analyzed using the *Family Stress Model*

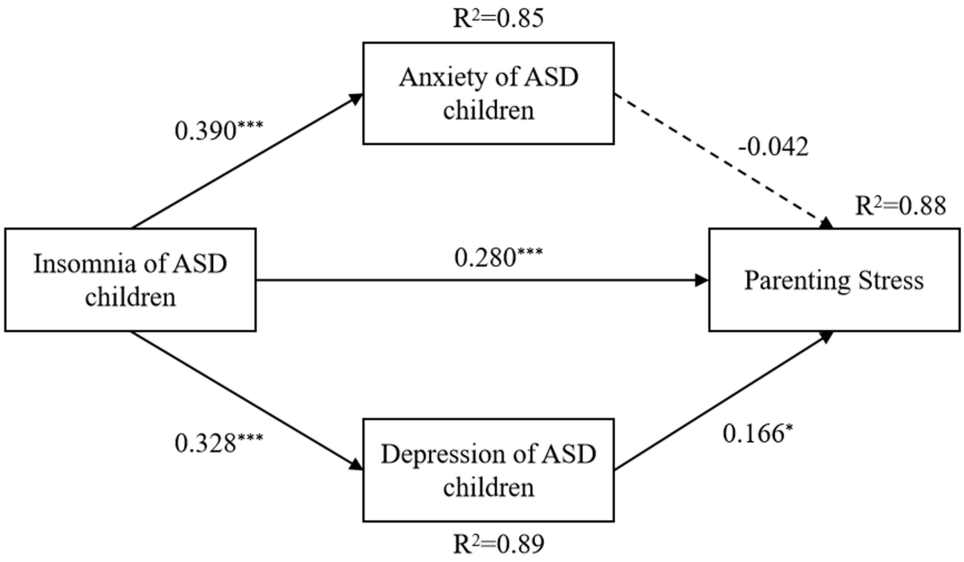

Figure 2 Mediation Analysis of Insomnia Symptoms in Autistic children and Parenting Stress. Insomnia in children with autism can significantly impact parental stress. Notably, anxiety symptoms in these children do not mediate this relationship, whereas depressive symptoms play a substantial mediating role. *** $p<0.001$,*$p<0.05$.
Abbreviation: ASD, Autism Spectrum Disorder.

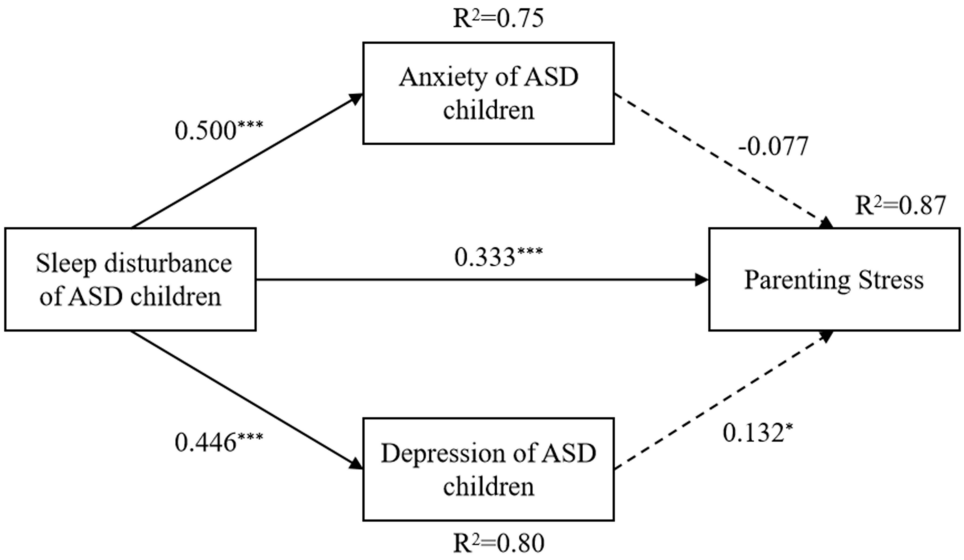

Figure 3 Mediation Analysis of Sleep Disturbance in Autistic children and Parenting Stress. Sleep disturbance in children with autism significantly impact parental stress, with the children's anxiety symptoms not serving as a mediator. However, depression symptoms in these children play a significant mediating role. *** $p<0.001$,*$p<0.05$.
Abbreviation: ASD, Autism Spectrum Disorder.

and the *Double ABC-X Model*. According to the *Family Stress Model*, the health and behavioral problems of family members increase family stress, which in turn affects parents' mental health and parenting behavior.[43–45] Due to the need to address their children's sleep problems, parents' sleep time may be reduced, leading to decreased sleep quality, and prolonged sleep deprivation can result in emotional instability in parents, which in turn increases parenting stress. Additionally, the *Double ABC-X Model* suggests that when facing stressors (such as sleep problems in autistic children), families undergo a series of resource mobilizations, cognitive assessments, and coping strategies, if these processes fail, stress will increase further.[46,47] In this study, sleep problems in autistic children became a source of stress for parents. When parents' resilience to cope with these stressors is insufficient, their perception and understanding of their children's sleep issues may become skewed, especially

when they believe that sleep problems are causing their children's depressive symptoms. This situation can become uncontrollable, significantly increasing the stress experienced by the parents.

In the context of Chinese culture, epidemiological and multicenter studies have examined sleep problems in children with autism.[5,48,49] Evidence suggested that Chinese children with autism experience more frequent sleep issues compared to their Western counterparts.[5] These cross-cultural differences primarily arise from variations in social, cultural, environmental, and psychological factors between Western countries and China.[42] In China, unique influences may include common sleeping arrangements (such as bed-sharing or living in the same room), family structure characteristics (like multigenerational households shaped by the one-child policy), higher academic pressure and expectations, and relatively crowded, noisy living environments.[42] These factors may collectively influence the sleep environment for children with autism as well as the psychological stress of their parents.

The theoretical implications of sleep problems in autistic children highlight the critical role of sleep within family systems and its impact on parental stress. Sleep disturbances in these children affect not only their well-being but also intensify the challenges parents face. This understanding can enhance research on family dynamics and stress transmission mechanisms, particularly across diverse cultural and social contexts. Clinically, this study encourages attention to the sleep problems in autistic children. Through education and family counseling, parents can gain a better understanding of the relationship between their children's sleep problems and their own stress. Additionally, supporting parents in improving their emotional well-being can help create a more stable and positive family environment for their children. Moreover, this study advocates for the promotion and education of sleep knowledge among Chinese parents of children with autism, enabling them to address their children's sleep problem in a more scientific manner. For instance, schools could organize lectures or online courses that teach parents how to recognize insomnia and sleep disorders in children and how to prevent these conditions. By implementing various intervention measures, the sleep problems of children with autism can be alleviated, thereby easing the burden on parents.

Limitation

Despite these significant findings, this study has several limitations. First, the sample size is relatively small, and the study's findings are based on parent-reported data, which may introduce potential response biases. Future research should delve deeper into different age groups, cultural backgrounds, and types of autism spectrum disorders to enhance the generalizability of the findings. Second, this study is cross-sectional and lacks long-term longitudinal follow-up. Future studies should consider long-term follow-up to gain a more comprehensive understanding of how sleep problems evolve at different developmental stages and their long-term effects. Third, this study did not explore the biological mechanisms underlying sleep problems in autistic children. Future research could delve into the neurobiological basis to investigate differences across ASD subtypes and the biological mechanisms involved. Fourth, the factors considered in this study are relatively simple. This study lacks inclusion of comorbidities in the sample, such as cerebral palsy and developmental delays, and also omits other significant contributors to parental stress, like the parents' own income income level or sleep patterns. Future studies should explore the comprehensive impact of environmental, genetic, social, psychological, and other factors on sleep problems in autistic children.

Conclusions

In terms of prevalences, the prevalence for sleep disturbances in autistic children was 38.7%, and the prevalence for insomnia symptoms was 13.0%. There is a significant effect of sleep problems in autistic children, as these sleep issues can substantially increase parental stress, with depressive symptoms in autistic children serving as a positive mediator.

Ethics Approval

This study was approved by the research ethics committee of The Affiliated Nanhua Hospital, under the code 2024-ky -094 and has, therefore, been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent to Participate

Informed consent was obtained from all individual participants included in the study.

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Disclosure

The authors declare no competing interests in this work.

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