Original Article
Logistic regression analysis of risk factors influencing childhood enuresis: a comprehensive survey study

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Abstract: Objective: To identify risk factors associated with childhood enuresis. Methods: We conducted a retrospective analysis of 146 children aged 6 to 13 years diagnosed with enuresis at Anhui Province Children's Hospital between June 2020 and June 2023. Children were categorized based on bedwetting frequency: those with less frequent episodes (once a week to twice a month) were placed in the mild group (60 cases), and those with frequent episodes (two or more times per week) were placed in the severe group (86 cases). We compared demographic data, family histories, and personal characteristics between the groups and performed logistic regression to determine significant risk factors. Results: The analysis revealed that a stubborn personality, nocturnal polyuria, sleep-wake disorders, and bladder dysfunction significantly increased the risk of enuresis (P < 0.05). These findings underscore the importance of a holistic approach in evaluating psychological aspects, nocturnal urination patterns, sleep quality, and bladder health in managing enuresis. Conclusion: The study identifies stubborn personality, nocturnal polyuria, sleep-wake disorders, and bladder dysfunction as independent risk factors for childhood enuresis. Understanding these factors is crucial for developing targeted interventions that can enhance the management and outcomes of enuresis. Future research should explore the interrelationships among these factors to refine preventive and therapeutic strategies for early childhood enuresis.

Keywords: Childhood enuresis, risk factors, bladder dysfunction, sleep-wake disorders, nocturnal polyuria

Introduction

Enuresis is a prevalent pediatric urinary disorder, defined by an inability to control urination past the age typically expected for bladder control [1, 2]. This condition not only results in physical discomfort but also adversely impacts the social and psychological well-being of affected children [3, 4]. Globally, enuresis affects approximately 5% to 10% of children over the age of five, with prevalence rates declining as children age [5]. While most children outgrow this condition, it can persist into adolescence and adulthood for some [6].

The etiology of childhood enuresis is multifaceted and not fully understood, involving a combination of physiological and psychosocial factors. Physiological contributors include abnormalities in urinary system development and the maturation of the neural mechanisms that control urination [7, 8]. Psychosocial influences, such as familial stress, emotional challenges, sleep disturbances, and coping abilities, also play significant roles [9]. Additionally, genetic predispositions are evident, with a higher incidence of enuresis in children who have a family history of the condition [10].

Despite previous studies identifying potential risk factors like family history and gender [11, 12], comprehensive analyses of enuresis risk factors remain limited. This study aims to thoroughly investigate and identify the risk factors affecting childhood enuresis through a comprehensive survey and logistic regression analysis. By elucidating these factors, this research seeks to enhance our understanding of enuresis mechanisms, thereby improving prevention, diagnosis, and treatment strategies, and ultimately enhancing the quality of life for these children.

Materials and methods

Study design and patient selection

This study targeted children diagnosed with enuresis at Anhui Province Children's Hospital from June 2020 to June 2023. The study included children aged 6 to 13 years whose complete medical records were available. Data were collected from the electronic health records of the hospital. This included demographic and physiological parameters such as age, gender, height, and weight of the children, that were analyzed to investigate potential correlations with the incidence and severity of enuresis.

We employed specific inclusion and exclusion criteria to ensure a consistent study cohort. Inclusion criteria: (1) Diagnosis of enuresis confirmed through clinical examination [13]; (2) Age between 6 and 13 years. Exclusion criteria: (1) Non-compliance with the diagnostic and inclusion parameters; (2) Presence of conditions such as urinary tract infections, spina bifida, urogenital malformations, diabetes insipidus, or other related disorders; (3) Severe cardiac, hepatic, or renal dysfunction; (4) Significant mental impairments. Ultimately, 146 children were selected for the analysis. This study utilizes logistic regression to identify risk factors for childhood enuresis, aiming to provide insights for disease prevention and management, thereby enhancing affected children's quality of life. *This study has obtained approval from both the research committee and the ethics committee of the Anhui Province Children's Hospital.*

Groups

Diagnostic criteria for enuresis were set as an inability to control urination occurring at least twice a month in children older than five years. Primary enuresis is defined as never achieving bladder control by the expected developmental age. Secondary enuresis describes children who have previously attained control over urination but subsequently relapse into bedwetting.

Children were divided into two groups. The severe group consists of 86 children with severe enuresis, characterized by a bedwetting frequency of at least two times per week.

The mild group included 60 children experiencing enuresis with a lower frequency, ranging from once a week to twice a month.

Questionnaire survey records

Family information: The survey collected detailed information regarding the children's family backgrounds. This included a family history of medical conditions, educational levels of both parents, marital status, and smoking habits during pregnancy (both maternal and paternal). Analysis of family history helps elucidate potential genetic contributions to enuresis. Parental education might reflect the family's socio-economic status and educational environment, potentially influencing enuresis. Marital status and prenatal exposure to smoking are also explored as possible risk factors for enuresis.

Child information: Information was also collected on various personal aspects of the children, including personality traits, constipation, psychological stress, nocturnal urination frequency, sleep-wake patterns, and bladder function. These factors are investigated for their potential roles in the onset and severity of enuresis, considering how traits such as stubbornness might influence the condition.

Statistical analysis

Quantitative data were represented as means ± standard deviations (Means ± SD). Differences between groups were analyzed using independent samples t-tests. GraphPad Prism 8 and SPSS 20.0 were utilized for data visualization and analysis. Count data were expressed as percentages and analyzed with the Chi-square test to identify significant differences in categorized data between groups, expressed as χ^2. Logistic regression was employed to examine risk factors for enuresis, with statistical significance set at $P < 0.05$.

Results

Proportion of bedwetting frequency

The analysis included 146 children diagnosed with enuresis, categorized by bedwetting frequency within one month: 21 children (14.38%) wet the bed twice a month, 39 children (26.71%) wet the bed once a week, and 86 children
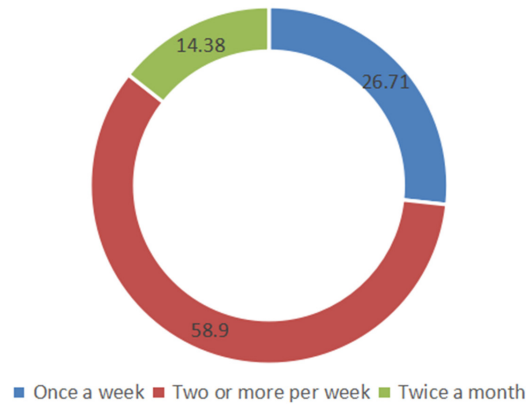
Figure 1. Proportion of bedwetting frequency. This donut chart visually represents the distribution of bedwetting frequency among 146 children diagnosed with enuresis. It highlights that the majority of cases involve bedwetting more than twice a week, with a smaller proportion experiencing bedwetting twice a month. The percentages are clearly displayed, facilitating an easy comparison of the various frequencies of enuresis. This chart serves as a valuable tool for further research and informs the development of targeted treatment strategies.

(58.90%) had instances of bed wetting more than twice a week (**Figure 1**).

Comparison of general data

Table 1 presents a comparison of general characteristics such as age, gender, height, and weight between the groups, showing no statistically significant differences (all P > 0.05).

Univariate analysis

Family information: Comparative analysis of family information between the groups indicated no significant differences in parents' educational levels, marital status, or smoking during pregnancy (both maternal and paternal) (all P > 0.05). However, a significant difference was observed in family history of enuresis, identifying it as a risk factor for the development of enuresis in children (P < 0.05) (**Table 2**).

Child characteristics: The analysis of personal characteristics among the children revealed no significant differences in constipation or psychentonia between the groups (P > 0.05). However, statistically significant differences were observed in traits and conditions such as stubborn nature, frequent nocturnal urination, sleep-wake disorders, and bladder dysfunction,

all identified as risk factors for the development of enuresis (all P < 0.05). See **Table 3**.

Multivariate analysis

A logistic regression analysis was performed to identify independent risk factors for childhood enuresis, using the variables that showed significant differences in **Tables 2** and **3**. The results, detailed in **Table 4**, confirmed that a stubborn nature, frequent nocturnal urination, sleep-wake disorders, and bladder dysfunction are independent risk factors for enuresis in children (all P < 0.05), as presented in **Table 5**.

Discussion

Enuresis, defined as involuntary urination at night in children over the age of 5, results in wet beds or clothes and represents a prevalent childhood health concern with multifaceted causes. This condition can adversely affect the psychological well-being and social lives of affected children and their families [14, 15]. Therefore, identifying the risk factors associated with enuresis is crucial for developing effective prevention and treatment strategies, thereby mitigating its negative impact [16, 17]. This study collected clinical and lifestyle data related to enuresis, including family history, bedwetting frequency, and psychological and social influences. Logistic regression analysis was employed to examine the relationships between these factors and childhood enuresis, revealing that stubborn nature, frequent nocturnal urination, sleep-wake disorders, and bladder dysfunction are independent risk factors.

Children who exhibit stubbornness often show traits of being opinionated and resistant to change, which may stem from a deep-seated fear of failure or making errors [18]. In the context of enuresis, such personality traits could exacerbate the difficulty of coping with involuntary urination, heightening anxiety and tension. For example, stubborn children might struggle more with accepting urination training or altering routines, potentially delaying the development of urinary control. Research by Pandey et al. [19] supports this view, indicating that parents often perceive children with enuresis as more stubborn compared to their non-enuretic peers. These insights align with the findings of

Table 1. Comparison of general data

	Number of cases	Age		Gender		Height (cm)	Weight (kg)
		6-9	9-13	Male	Female		
Severe group	86	48 (55.81)	38 (44.19)	49 (56.98)	37 (43.02)	132.55±12.35	31.06±5.16
Mild group	60	36 (60.00)	24 (40.00)	38 (63.33)	22 (36.67)	131.25±10.33	31.43±5.03
P		0.615		0.441		0.508	0.660

Table 2. Univariate analysis of family information

	Number of cases	Severe group (86)	Mild group (60)	x^2	P
Family history					
Yes	24	20	4	7.081	0.008
No	122	66	56		
Paternal background					
Junior college and above	101	60	41	0.034	0.853
Below junior college	45	26	19		
Maternal background					
Junior college and above	92	56	36	0.397	0.529
Below junior college	54	30	24		
Divorced					
Yes	19	12	7	0.163	0.686
No	127	74	53		
Maternal smoking during pregnancy					
Yes	2	2	0	1.415	0.234
No	144	84	60		
Paternal smoking during mother's pregnancy					
Yes	92	54	38	0.004	0.947
No	54	32	22		

Table 3. Univariate analysis of child characteristics

	Number of cases	Severe group (86)	Mild group (60)	x^2	P
Stubborn nature					
Yes	59	45	14	12.34	< 0.001
No	87	41	46		
Constipation					
Yes	18	14	4	3.021	0.082
No	128	72	56		
Psychentonia					
Yes	10	8	2	1.974	0.160
No	136	78	58		
Frequent urination at night					
Yes	18	15	3	5.062	0.025
No	128	71	57		
Sleep-wake disorder					
Yes	29	25	4	11.14	0.001
No	117	61	56		
Bladder dysfunction					
Yes	20	16	4	4.261	0.039
No	126	70	56		

Table 4. Assignment table

	Assignment	
Family history	No = 0	Yes = 1
Stubborn nature	No = 0	Yes = 1
Frequent urination at night	No = 0	Yes = 1
Sleep-wake disorder	No = 0	Yes = 1
Bladder dysfunction	No = 0	Yes = 1
Enuresis	No = 0	Yes = 1

our study, suggesting that stubborn personality traits may significantly contribute to the challenges of urinary control in children, thereby increasing the risk of enuresis.

Excessive nighttime urination can contribute to enuresis by undermining urine control in children [20]. Various factors, including reduced bladder capacity, increased nocturnal urine production, and poor sleep quality, may impair a child's ability to control urination at night, thus fostering the development of enuresis [21]. Frequent nocturnal urination disrupts normal sleep patterns, leading to poor urine control and exacerbating anxiety and tension, which in turn perpetuates a cycle detrimental to the development and improvement of urinary control. To mitigate these issues, parents can support their children by adjusting drinking schedules, establishing regular toileting routines, and engaging in bladder training. Additionally, fostering a sleep-conducive environment may help address excessive nighttime urination.

Sleep-wake disorder, characterized by difficulties in awakening from sleep during the night, can prevent children from responding to bladder fullness, thereby increasing the risk of enuresis [22]. Children with this disorder often struggle to wake in response to external stimuli, even when their bladder is full. The inability to awaken not only hampers nighttime urine control but may also affect overall sleep quality and mental health. The disorder's link to developmental aspects of the central nervous system and sleep regulation suggests significant implications for enuresis [23]. A study by Azevedo et al. [24] highlights the prevalence of comorbid sleep disorders in children with enuresis, indicating that bedwetting is often accompanied by other sleep-related issues. This finding corroborates the associations observed in our study.

Bladder dysfunction, which impairs urine control in children, can present as bladder overactivity or underactivity [25, 26]. Overactivity is characterized by excessive bladder muscle contractions, leading to urgent and frequent urination [27]. Underactivity, on the other hand, is marked by reduced bladder capacity and insufficient urine storage, often resulting in urinary incontinence and bedwetting [28]. These dysfunctions may stem from immature bladder muscle control or neurological development issues [29]. Both forms of bladder dysfunction significantly disrupt children's ability to control urination, thereby increasing the likelihood of bedwetting [30]. Early identification and appropriate treatment of bladder dysfunction are crucial for improving urine control and reducing bedwetting incidence.

The findings of this study are limited to certain identified independent risk factors for childhood enuresis; additional factors may also play a role. As each child's condition is unique, the significance of these risk factors may vary across individuals. Future research should aim to incorporate a more comprehensive assessment of various factors to better understand the complexities of childhood enuresis and enhance prevention and treatment strategies.

In conclusion, this retrospective analysis identified stubborn nature, frequent nocturnal urination, sleep-wake disorders, and bladder dysfunction as significant independent risk factors for childhood enuresis. These findings underscore the importance of a holistic approach to managing enuresis, which considers these risk factors collectively. Continued research in this area could further elucidate the interrelations among these factors and enuresis, leading to more effective early intervention strategies and improved outcomes for children affected by this condition.

Disclosure of conflict of interest

None.

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Table 5. Multivariate analysis

	B	S.E,	Wals	Sig.	Exp (B)	95% C.I. of the EXP (B)	
						Lower limit	Upper limit
Family history	1.176	0.631	3.471	0.062	3.242	0.941	11.175
Stubborn nature	1.387	0.418	11.034	0.001	4.002	1.766	9.072
Frequent urination at night	1.592	0.708	5.053	0.025	4.914	1.226	19.691
Sleep-wake disorder	2.068	0.605	11.689	0.001	7.909	2.417	25.882
Bladder dysfunction	1.366	0.648	4.447	0.035	3.921	1.101	13.963

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