

Prevalence and Effects of Primary Nocturnal Enuresis in Children in Two Districts of Shanghai City

YB ZHENG, H XU, YN GONG, KL WANG, ZH NI, DD HE

Abstract

Purpose: To determine the prevalence rate of primary nocturnal enuresis (PNE) in Shanghai; evaluate the impact of PNE and the effects of PNE treatments. **Methods:** Anonymous questionnaires containing close-ended questions were completed by the children's parents. The impact of enuresis and effect of treatment were quantitatively analysed using numerical rating scales (NRSs). **Findings:** PNE prevalence was 4.0%, decreasing with age. "Annoyance" with PNE was reported by 70.6% parents and 55% children (51.3% children aged 7-9.9 years; 75% children aged 10-12 years). 32.6% patients had visited a hospital, of whom, 62% were advised lifestyle modification to promote self-healing. In all, 87% parents thought the treatments effective (NRS score, ≥ 2). **Conclusions:** PNE prevalence among children in Shanghai City is not low, especially, in the low-income group. PNE had a greater impact on parents than on children. Few children had visited a hospital, and the treatments prescribed generally produced small improvements.

Key words

Child; Epidemiology; Nocturnal enuresis; Psychology; Questionnaires

Introduction

Nocturnal enuresis (NE) refers to unconscious urination during sleep at night in children aged over 5 years. NE not only has a great impact on children's mental health and

social adaptability but is also associated with other stresses, such as the mental impact on the whole family. Numerous studies all over the world have evaluated the prevalence rate, risk factors, diagnosis, and treatment of enuresis.¹⁻¹² In China as well, much research on enuresis has been conducted in the last decade, and the prevalence rate, risk factors, impact on quality of life, and other factors related to enuresis have been investigated in various provinces and cities.^{13,14} In the present study, we focused on children in Shanghai City who were aged 7-12 years and were at a high risk for enuresis, especially, primary nocturnal enuresis (PNE). We assessed the impact of PNE on the children and their parents, and the attitudes of the parents towards treatment measures for PNE.

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Methods

The prevalence rate of NE has been reported to be 1.4%-28% in children aged 6-12 years.¹⁻¹⁵ We therefore estimated a prevalence rate of 7%, and calculated that the total sample size required was 7600 persons. We selected a downtown area, namely, Xuhui District, and a remote

area, namely, Minhang District, which has a large migrant population. We randomly selected four primary schools from each of these two areas, and surveyed all the students in the selected schools. Of the 45 primary schools in Xuhui District, we selected Xiangyang Primary School, The First Central Primary School, Longnan Primary School, and The First Affiliated Primary School of Shanghai Normal University. Of the 47 primary schools in Minhang District, we selected The Primary School of Shenzhuang Town, Huacao Primary School, The Central Primary School of Minhang District, and Jiwang School.

Anonymous questionnaires consisting of close-ended questions were used, and were filled in by the parents. The self-designed questionnaires included the following main items: sex; age; presence or absence of enuresis; frequency of enuresis; family history of enuresis; daytime urinary symptoms; night time drinking; whether have constipation or not; effects of enuresis on parents and children; and whether the treatment prescribed was successful. The impact of enuresis and the effects of its treatment were quantitatively analysed using numerical rating scales (NRSs) classified into grades from 1 to 5. In the case of the impact of enuresis, "1" on the NRS represented no impact, and "5" represented severe impact. In the case of the effects of enuresis treatment, "1" on the NRS represented no effect, and "5" represented a marked effect. The impact of enuresis for parents refers mainly to the burden of family life, such as "extra burden of household chores", "dared to bring the child to travel" and so on, the impact of enuresis for children mainly refers to the effect on personality, such as "anxiety", "inferior" and "loner" and so on. In terms of "effects of treatment", it refers to the reduction in frequency of bed-wetting.

Selection Criteria

PNE was diagnosed according to the criteria issued by the International Children Continence Society (ICCS)¹⁶ and the paper published by the team of Prof. Yeung of Hong Kong.¹⁴ The selection criteria were as follows: (1) children aged 7-12 years, (2) at least one episode of bed-wetting in the last 3 months, and (3) history of bed-wetting since infancy without being dry for 6 consecutive months. The exclusion criteria were anatomical or functional abnormalities of the urinary system or nervous system. We divided the selected patients into groups based on the frequency of enuresis: ≤ 2 times/week, 3-5 times/week, and 6-7 times/week.

Statistical Analysis

The data were recorded using Excel and analysed using the Stata7 software package. Count data were expressed as the mean \pm standard deviation, and differences among groups were examined using the t-test. Ratios were compared using the chi-square test. A statistical difference was established at $p < 0.05$.

Results

Of a total of 8056 questionnaires sent, 7939 were returned (response rate, 98.5%), of which 7057 (88.9%) were valid. The prevalence of PNE was 4.0% (282/7057). The average age of the patients was 8.4 ± 1.3 years, and the male-to-female ratio was 1.2:1. The PNE prevalence was 4.3% (145/3395) in Minhang District and 3.7% (137/3662) in Xuhui District; no statistical differences were found between the two prevalence rates ($\chi^2 = 1.2893$, $p = 0.256$). The PNE prevalence rate decreased with age; it was 7.6% (130/1719) among children aged 7-7.9 years and 1.2% (15/1221) among children aged 11-12 years. No statistical differences in the prevalence rate were found between boys and girls of different age groups (Table 1).

Among the PNE patients, 43.6% had a family history of enuresis. Enuresis had been present in the parents of 61.8% (76/123) of the patients, the siblings of 13.8% (17/123) of the patients, the grandparents of 4.9% (6/123) of the patients, and in other relatives of 12.2% (15/123) of the patients. Bed-wetting occurred ≤ 2 times/week in 47.8% of patients, 3-5 times/week in 39.4% of patients, and 6-7 times/week in 12.8% of patients. With increasing age, the prevalence rate of bed-wetting that occurred over 3 times/week also increased (Figure 1). Monosymptomatic enuresis was present in 79.8% of patients, and non-monosymptomatic enuresis was present in 20.2% of patients. Bed-wetting occurred over 6-7 times/week in 9.3% (21/225) of the patients with monosymptomatic enuresis and 26.3% (15/57) of the patients with non-monosymptomatic enuresis. The rate of frequent bed-wetting showed a statistical difference between these two groups ($\chi^2 = 11.7780$, $p = 0.001$). Finally, 64.5% of PNE patients had the habit of drinking at night, and 11.3% had constipation.

We had analysed the impact of PNE on the parents and children (Table 2), and found that 70.6% of parents and 55% of children reported "annoyance" with PNE (NRS score, ≥ 2). A comparison of the rates of reported annoyance

showed a statistical difference between the two groups ($\chi^2=14.6880$, $p<0.001$). Furthermore, 51.3% of 7- to 9.9-year-old and 75% of 10- to 12-year-old reported being annoyed with enuresis. The rates of reported annoyance a statistical difference between these two age groups ($\chi^2=8.4545$, $p=0.004$). NRS scores of over 2 were present in 49.8% of children with monosymptomatic enuresis and 75.4% of children with non-monosymptomatic enuresis. A comparison between the two groups showed a statistical difference ($\chi^2=12.0980$, $p=0.001$).

Of the children with PNE, 32.6% (92/282) had visited a hospital. Among these children, 62% had been advised to adopt a regular lifestyle to promote self-healing, 17.4% were prescribed medications along with advice regarding a regular lifestyle, 6.5% had been advised to use alerters or alarms and 4.3% bladder training. In all, 87% (80/92) of

parents thought that the treatments were effective (NRS scores, ≥ 2), and 19.6% (18/92) believed that the treatments were very effective (NRS scores, 4-5). The greatest improvements were attributed to the use of alerters or alarms for bed-wetting and to urinary bladder training (average NRS scores, 3.3 and 3.0, respectively) (Table 3).

Discussion

Many recent studies have investigated PNE in children, and considerable progress has been made in evaluating the prevalence rate, risk factors, and diagnostic and treatment methods of PNE.¹⁻¹⁰ However, the reported prevalence rates vary, mainly due to the use of different diagnostic criteria in different study groups. In 2000, our department conducted

Table 1 PNE prevalence of different age and sex

Age	Prevalence n/N(%)			95% CI	χ^2 (P)
	Boy	Girl	Total		
7-7.9	71/927 (7.7)	59/792 (7.4)	130/1719 (7.6)	6.4-8.9	0.0268 (0.870)
8-8.9	36/744 (4.8)	31/671 (4.6)	67/1415 (4.7)	3.7-6.0	0.0374 (0.847)
9-9.9	27/648 (4.2)	14/662 (2.1)	41/1311 (3.1)	2.3-4.2	4.5473 (0.033)
10-10.9	13/694 (1.9)	16/699 (2.3)	29/1391 (2.1)	1.4-3.0	0.2953 (0.587)
11-12	7/611 (1.1)	8/609 (1.3)	15/1221 (1.2)	0.7-2.0	0.0709 (0.790)
Total	154/3624 (4.2)	128/3433 (3.7)	282/7057 (4.0)	3.6-4.5	1.2470 (0.264)

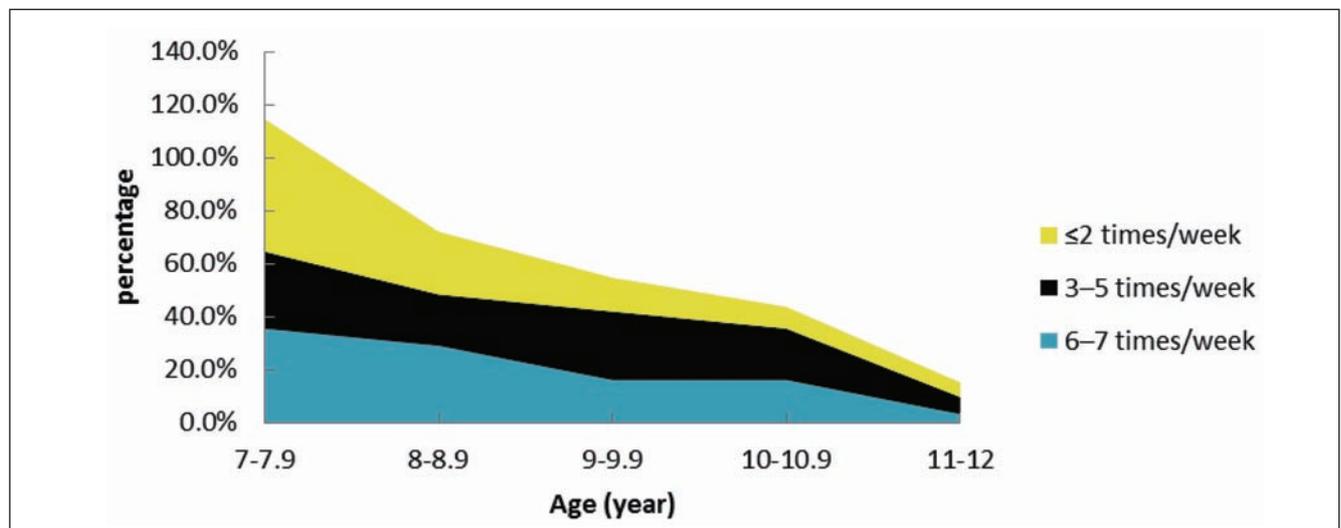


Figure 1 Frequency of bed-wetting in different age groups. With increasing enuresis frequency, the prevalence rate of older children also increased. In children with enuresis frequency less than 2 times per week, 50% was 7-7.9 years old, 13.7% was over 10 years old. While in children with enuresis frequency 3-5 times per week and 6-7 times per week, 29% and 35.5% were 7-7.9 years old, 25.9% and 19.3% were over 10 years old.

a survey to determine the prevalence of enuresis in 6- to 11-year-old. The survey showed that based on the criterion of bed-wetting at least 2 times/week, the prevalence rate of enuresis among children in Shanghai was 2.4%. Over 10 years after the above study, we have now conducted another questionnaire survey on PNE in children living in two areas of Shanghai City. Our questionnaire was designed to quantitatively analyse subjective parameters such as the impact of enuresis and the effect of enuresis treatment, via the use of NRSs. The privacy of all the children was well protected, since the questionnaires were filled in anonymously by the parents and were unsealed by members of our research group.

PNE Prevalence in Children is Not Low in China

According to the available literature, PNE affects approximately 15%-20% of children aged 5 years and 1.4%-28% of those aged 6-12 years.¹⁻¹⁵ The large variation in PNE prevalence rates may be mainly attributable to the different diagnostic criteria adopted in different studies. Diagnostic criteria have been developed by the ICCS, the American Psychiatric Association (DSM-III and DSM-IV),

and the World Health Organization (ICD-10), and the definitions recommended by these organisations differ in terms of the frequency of bed-wetting. The DSM-III¹⁷ and ICD-10.¹⁸ define PNE as at least two episodes of bed-wetting in a month for 3 consecutive months among children aged 6 years or more, or at least one episode of bed-wetting in a month for at least 3 consecutive months among children aged 7 years. The DSM-IV,¹⁹ however, defines PNE as bed-wetting episodes that occur at a frequency of ≥ 2 times/week for at least 3 consecutive months. We analysed the available studies on the prevalence rate of enuresis (Table 3). We found that the prevalence rate of enuresis that occurred >2 times/week was 1.46%-1.87% in China and 2.6%-4.45% in other countries. Furthermore, the prevalence rate of enuresis that occurred at least once a month was 4%-4.6% in China and 4.8%-18.4% in other countries. In our study, bed-wetting at a frequency of at least once in 3 months was present in 4.0% of patients and that at a frequency of 3-7 times/week was present in 2.4% of patients. When compared with other regions in China, Shanghai City had a slightly higher prevalence rate of enuresis. Moreover, the PNE prevalence among children in China was not lower than that in other

Table 2 The impact of PNE on the parents and children

	NRS score (parents) n (%)				NRS score (children) n (%)			
	1	2-3	4-5	Average score	1	2-3	4-5	Average score
Total	83 (29.4)	167 (59.2)	32 (11.3)	2.29	127 (45)	132 (46.8)	23 (8.2)	1.99
Age								
7-7.9	39 (30)	74 (56.9)	17 (13.1)	2.31	62 (47.7)	60 (46.2)	8 (6.2)	1.23
8-8.9	23 (34.3)	38 (56.7)	6 (9.0)	2.16	33 (49.3)	31 (46.3)	3 (4.5)	1.85
9-9.9	13 (17.1)	22 (53.7)	6 (14.6)	2.32	21 (51.2)	16 (39)	4 (9.8)	1.93
10-10.9	7 (24.1)	19 (65.5)	3 (10.3)	2.34	8 (27.6)	17 (58.6)	4 (13.8)	2.36
11-12	1 (6.7)	14 (93.3)	0	2.4	3 (20)	8 (53.3)	4 (26.7)	2.73
Sex								
Boy	49 (31.8)	84 (54.5)	21 (13.6)	2.3	70 (45.5)	71 (46.1)	13 (8.4)	1.99
Girl	34 (26.6)	83 (64.8)	11 (8.6)	2.27	57 (44.5)	61 (47.7)	10 (7.8)	1.99
MPNE								
Yes	75 (33.3)	133 (59.1)	17 (7.6)	2.15	113 (50.2)	96 (42.7)	16 (7.1)	1.88
No	8 (14)	34 (59.6)	15 (26.3)	2.82	14 (24.6)	36 (63.2)	7 (12.3)	2.38
Frequency								
≤ 2 times/week	43 (31.9)	79 (58.5)	13 (9.6)	2.21	62 (45.9)	58 (43)	15 (11.1)	2.03
3-5 times/week	48 (43.2)	52 (46.8)	11 (9.9)	1.9	29 (26.1)	67 (60.4)	15 (13.5)	2.29
6-7 times/week	9 (25)	16 (44.4)	11 (30.6)	2.74	12 (33.3)	19 (52.8)	5 (13.9)	2.28

MPNE: monosymptomatic primary nocturnal enuresis

countries. However, most studies in foreign countries have focused on NE rather than PNE and used different age groups.

In our study, the PNE prevalence rate in Minhang District (4.3%) was higher than that in Xuhui District and the overall prevalence rate. Minhang District has a larger floating population with a lower income, and many researchers consider that the higher prevalence rate of PNE in low-income families might be due to irregular lifestyles and an unwillingness to seek medical treatment.^{7,13} Minhang District may be having higher prevalence, but not shown to have statistical difference in the study; either, the number not large enough or the social or income difference not significant enough. But whatever, more attention should be paid to this special group.

PNE Has a Greater Impact on Parents Than on Children

In recent years, an increasing number of studies have focused on the quality of life of children with PNE and their

families.²³⁻²⁹ PNE can lead to mental disorders, such as unstable emotions, low self-evaluation, social phobia, and decreased learning abilities, in children.²³⁻²⁸ PNE also affects the parents, who need to provide their children with extra care; some parents may suffer from emotional disorders and punish their children, even with violence.²⁹⁻³¹ In our study, we found that over half of the children and parents reported

Table 3 The effects of PNE treatments

Treatments	n (%)	NRS score (Average score)
Wait for self-healing	57 (62)	2.96
Medications	16 (17.4)	2.56
Bladder training	4 (4.3)	3.0
Bladder training + medications	6 (6.5)	2.5
Alerters or alarms	6 (6.5)	3.33
Alerters or alarms + medications	3 (3.3)	1.67
Total	92 (100)	2.84

Table 4 The available studies on the prevalence rate of enuresis

Country/region	Author	Year	Subjects	Age (year)	Frequency	Prevalence
China ²⁰	Ma et al	2014	PNE	6-12	At least 2 times/week	4.6%
Taiwan ¹⁵	Tai et al	2007	NE	6-12	At least 1 time/month	4.54%
Henan ¹³	Wen et al	2006	PNE	5-18	At least 1 time/month	4.07%
			Marked PNE		At least 2 times/week	1.46%
Hong Kong ¹⁴	Yeung et al	2006	PNE	5-19	1 time/3 months >3 times/week	3.1% 1.87%
Turkey ¹	Yazici et al	2012	NE	7-14	5-6 years at least 2 times/month >7 years at least 1 time/month	7.5%
United Kingdom ²¹	von Gontard et al	2011	NE	7	At least 2 times/week	2.6%
Australia ³	Sureshkumar et al	2009	NE	6-12	At least 1 time/month	18.4%
the United States ⁴	Shreeram et al	2009	NE	8-11	At least 2 times/week	4.45%
Iran ⁷	Safarinejad	2007	NE	5-18	5-6 years at least 2 times/month	4.8%
					>7 years at least 1 time/month	
India ⁸	De Sousa et al	2007	NE	6-10	At least 2 times/week	7.61%
Japan ⁹	Kajiwara et al	2006	NE	7-12	At least 1 time/month	5.9%
					At least 1 time/week	3.7%
Malaysia ²²	Kanhawari	2003	NE	7,9,12	5-6 years at least 2 times/month	8%
			PNE		>7 years at least 1 time/month	6.2%
Korea ¹⁰	Lee et al	2000	NE	7-12	At least 1 time/month	9.4%
					At least 1 time/week	1.3%
Italy ¹²	Chiozza et al	1998	NE	6-14	At least 2 times/week	3.88%
Netherlands ¹¹	Spee-van der Wekke et al	1998	NE	5-15	5-6 years at least 2 times/month	6%
					>7 years at least 1 time/month	4%

being emotionally affected by PNE, with the latter group reporting more severe effects. Foxman et al reported that two-thirds of parents in the USA worry about their child's enuresis, while only one-half of the children worry about themselves.³² Semolic et al also reported that in Slovenia, the effects of enuresis were twice as severe in parents as in their children, probably due to the much larger amount of time and energy taken up by the disease in the case of the parents.⁵ In China, the one-child policy leads parents to worry more about the PNE of their children, worsening their anxiety.

With increasing age, the impact of PNE increases in children, especially, in those aged over 10 years, since children begin to care about their social appearance at this age and participate in social activities such as summer camps.⁵ In addition, the prevalence rate of severe PNE increases with age. Yeung et al reported that in Hong Kong, among children aged 5 years, 14.3% experienced enuresis 7 times/week; this rate increased to 48.3% among 19-year-old.¹⁴ In addition, we discovered that non-monosymptomatic enuresis had a larger impact on children than on their parents, owing to the high proportion of complications and the severity of PNE in this group.

Effects of PNE Treatment Are Poor and Individualised Treatments Are Needed

We briefly evaluated the effects of PNE treatments. We found that only 39% of PNE patients had visited a hospital for treatment, and that this rate was positively related to the child's age. Most children adopted lifestyle-modification strategies and awaited self-healing; the second treatment choice was using medications. As in other studies,^{2,4,8,10,13} the low rates of hospital visits might be related not only to factors such as regional cultural differences, but also to the beliefs of most parents that their children would recover with age.⁴ According to ICCS recommendations, PNE treatments refer to interventions used to relieve enuretic symptoms, and include measures such as keeping a bladder diary rather than simply using medications.¹⁶ The earlier the interventions for enuresis, especially, non-monosymptomatic enuresis, are started, the better are the outcomes obtained. Detailed urinary records, history taking, and physical examination may help to detect latent abnormalities, and in all patients with signs of bladder irritation, further examinations should be performed. Most parents thought that the current treatment methods were effective, but that the improvements they produced were not great. Since the effects of enuresis treatments

should be examined after at least 6 weeks, the effectiveness of any anti-enuretic treatment plans should be investigated in long-term follow-up studies.

In conclusion, the prevalence rate of PNE in children aged 7-12 years was 4.0% in the two selected areas of Shanghai. When compared with the results of other studies, this rate was not low, especially, in the low-income population. PNE had a greater impact on the parents than on the children, but with increasing age, the impact on the children tended to increase. Currently, only about a third visit a hospital for enuresis treatment, and the treatments recommended generally produce only small improvements (by using score 4-5 being satisfactory improvement, the % was rather low). Therefore, more attention should be paid to enuretic children, and individualised treatments should be developed to treat PNE.

Our study has some limitations. First, we selected only the areas of Minhang District and Xuhui District for this study, which may be subject to selection bias. Second, we used a general method (NRS) to evaluate the effects of enuresis on the children and their parents, and did not use any specific tool; prospective studies may be needed to confirm our findings. Finally, the evaluation of the effects of enuresis treatments is limited by the characteristics of a cross-sectional study; we were unable to obtain long-term follow-up data, and so the evaluation of the treatment effects might be incomplete.

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Declaration of Interest

None

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