An epidemiological study of enuresis among primary school children in Isfahan, Iran

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ABSTRACT

Objectives: To estimate the prevalence of enuresis in primary school children in Iran and to determine the factors associated with this disorder.

Methods: A cross-sectional time-ordered study was performed at the Faculty of Medicine, Isfahan Medical University, Isfahan, Iran from September 2005 to January 2006. A total of 4500 self-administered questionnaires were distributed to parents of children aged 6-12 years attending 30 primary schools.

Results: From an overall response rate of 69.9%, enuresis was reported in 216 children (7%), comprising 6.2% for nocturnal enuresis according to ICD10 and 3.3% according to DSM IV, 0.5% for diurnal enuresis and 0.8% for combined day and night wetting. Primary nocturnal enuresis was reported in 166 children (5.3%). Seventy-one (50.7%) of the 140 children with nocturnal enuresis had ≥3 wet nights per week. A positive family history in father and mother was seen in 51% and 39% of children with primary nocturnal enuresis respectively. Using logistic regression analysis, younger age ($p<0.002$), gender ($p<0.0001$) and low level of education of mother ($p<0.028$) were significant predictors of enuresis. Positive history of enuresis in father was a significant predictor of primary nocturnal enuresis ($p<0.012$).

Conclusion: The prevalence of nocturnal enuresis in Iran is lower than those reported in western countries, however, higher percentage demonstrated severe enuresis. The prevalence of diurnal enuresis is lower than previous studies. Age, gender and the educational level of the mother are the main risk determinants of enuresis and the prevalence of primary nocturnal enuresis appears to be significantly related to positive history of enuresis in father.

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The voluntary control of micturition is a social milestone as well as a developmental one.[1] Enuresis is defined as the involuntary voiding or discharge of urine beyond the age of anticipated control in the absence of congenital or acquired defect of the nervous system or urinary tract.[2] Enuresis can be categorized into primary nocturnal enuresis (PNE) or secondary nocturnal enuresis (SNE).[3,4] Enuresis is a common problem among children and adolescents, and can lead to important social and psychological disturbance.[5] Several epidemiological studies reported different frequencies of enuresis. The frequencies reported vary depending on the geographical areas involved, the composition of the population studied and on the definition used for enuresis.[6] Most studies have consistently found that the risk factors for PNE are male gender, age, and positive family history of PNE, divorced parents and deep sleep. There are conflicting results about whether low socio-economic status of the family, being a single child and a low birth weight

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are risk factors for PNE.[7] However, despite extensive studies on enuresis, its epidemiology and etiology remain obscure.[8] The aim of the present study was to establish the prevalence of enuresis among primary school children in Iran and determine the risk factors associated with this disorder.

Methods. The study was performed between September 2005 and January 2006 at the Faculty of Medicine, Isfahan Medical University, Isfahan, Iran. Permission was obtained from the Ministry of Education. A cross sectional population-based study was conducted in 4500 children aged between 6 and 12 years. Isfahan is a large city, thus, we used a random cluster-sampling scheme to obtain a representative sample of primary school children from various districts. There were 84951 students (41678 girls and 43273 boys) attending the primary school in Isfahan. When we took the estimated prevalence as 12% and marginal error as 1.5%, at 95% confidence interval, and the least number of children need to represent 84951 students was 3600. The sample was further increased by 25% to account for contingencies such as non- responder. Thirty primary schools were chosen from 5 main districts by means of systematic sampling. In each school, some classes were randomly chosen and 150 students were chosen from each school according to the students' grade distribution (30 students from each grade). Data were collected via a questionnaire filled out by the parents. Questionnaire comprising 2 sections that required boxes to be ticked. The first section determined the sociodemographic factors such as age, gender, birth weight, parental educational level and employment status, the number of family members and number of children. This was followed by a question on the presence of enuresis. The second section was then only completed if wetting was present. Items included were the presence of night-time wetting, daytime-wetting, day and night time wetting, determinants of primary and secondary wetting, frequency of wetting, soiling, family history of wetting in parents and spontaneous awaking at night. Questionnaires were distributed to all students and they were instructed to take them home to their parents. An information letter was attached to the questionnaires informing the parents of the voluntary nature of the study. Providing envelopes for the return of the questionnaires ensured confidentiality. All non-returns and blanks were considered non-responders. Incomplete responders were set aside. Two different definitions of nocturnal enuresis were used: the DSM IV and ICD10 criteria. Nocturnal enuresis (NE) is defined as: 1) Bed-wetting during sleep at least 2 times per week in a child aged 5 years or more for a duration of at least 3 months (DSM IV).[3] 2) Bed-wetting during sleep at least once a month in a child aged ≥5 years for a duration of at least 3 months (ICD10).[4] Diurnal enuresis is defined as wetting while awake after the age of 3 years. When the wetting occurs all the time, while asleep or awake, this condition is accepted as nocturnal and diurnal enuresis. Enuresis was also distinguished as primary and secondary. Primary nocturnal enuresis is bedwetting in a child aged ≥5 years who has never been dry for extended periods, while SNE is the onset of wetting after a continues dry period of more than 6-12 months. The frequency of NE was divided into 4 categories: more than 3 times per week, ≤3 times per week, one time per 2 weeks, one time per month. To evaluate factors associated with the severity of enuresis, the children with NE were divided into those with enuresis of >3 or ≤3 wet nights per week.

The data were compiled and analyzed using the Statistical Package for Social Sciences (SPSS 11.5) program. The significant risk factors between those with enuresis and those without (controls), and the risk factors for the severity of enuresis, were investigated by multiple logistic regression analysis, with $p<0.05$ considered to indicate significant associations.

Results. Of the 4500 questionnaires distributed, completed questionnaires were received from 3103 children, an overall response rate of 69.9%. The study group composed of students' aged 6-12 years (486 respondents were aged 6-7 years, 552 were aged 7-8, 603 were aged 8-9, 678 were aged >9-10, 567 were aged 10-11 and 188 were >11-12 years). There were 1524 males (49.1%) and 1578 females (50.9%). The overall prevalence of enuresis was 7%, comprising 6.2% for NE according to ICD10 and 3.3% according to DSM IV. The prevalence of diurnal enuresis and combined day and night wetting were 0.5% and 0.8%. Primary nocturnal enuresis was reported in 166 children (5.3%) (**Table 1**). Nocturnal enuresis was more frequent in boys 130 (67%) than in girls 62 (32%). (Odds ratio 3.59, 95% CI 1.34-9.57). Among the PNE children (n=166), 112 were boys and 54 were girls, giving a relative prevalence ratio of 2.07:1.0 while for SNE the prevalence ratio was 2.0:1.0. At the age of 6-7 years 8.8%, 7-8 years 8.1%, 8-9 years 5.4%, 9-10 years 5.7%, 10-11 years 4.4% and >11-12 years 3.7% of children had PNE. The prevalence decreased with increasing age. A positive family history in father and mother was seen in 51% and 39% of children with PNE. The severity of NE for the 4 categories of frequency >3 wet nights/week, ≤3 wet nights/week, 2 wet nights/2 weeks and one wet night/month were 50.7%, 11.4%, 17.8%, 20.0%.

Seventy-one (50.7%) of the 140 with NE children had >3 wet nights per week. The percentage of boys with secondary enuresis tended to be slightly lower than with primary enuresis (65% versus 67%), while the percentage of girls with secondary enuresis was slightly higher than those with primary enuresis (34% versus 32.5%). Overall, the group of enuretic children woke to void only 44.7% of the time; there was no significant difference between the nocturnal arousal rates and enuresis (odd ratio: 0.809, CI 95% 0.050-13.104). There was no significant difference (p=0.34, p=0.91) between the proportion of enuretic boys and girls who had a positive or negative family history of enuresis in father and mother, although there was a trend for boys to show a greater incidence of positive family history. There was a significant difference (p=0.025.odd ratio: 6.067, CI 95% 1.026-35.872) among children with daytime enuresis with or without positive history for soiling. The logistic regression analysis was used to identify predictor variable of enuresis. The 9 factors (age, gender, children's number, family member, level of education of mother and father, birth weight, mother and father's job) shown in **Table 2** were entered as independent variables to create the regression model. Enuresis was significantly associated with male gender, young age and mother's low level of education. However, children's number, family size, birth weight, father's level of education and father and mother's employment status were not significantly predictor of enuresis. When the (chi-square) x^2 test was used, a significant relationship was found between the prevalence of enuresis and age, gender, educational level of the father and mother. (**Table 3**). Among the enuretic children, a second logistic regression model was created to determine significant risk factors for PNE (**Table 4**). Significance was detected for positive history in father, but not for gender, age, family size, first child, father and mother's level of education, father and mother's employment status.

Table 1 - Prevalence rate of enuresis in Iranian children.

Variable	Enuresis n=216 (%)	PNE n=166 (%)	Total n=3103 (%)
Age			
6-9	137 (8.3)	105 (6.3)	1641 (52.9)
>9-12	77 (5.3)	61 (4.2)	1433 (46.2)
Gender			
Male	142 (9.3)	111 (7.2)	1524 (49.1)
Female	73 (4.6)	54 (3.4)	1578 (50.9)
Level of education (father)			
Unlettered & primary and secondary school	123 (8.6)	93 (6.5)	1424 (45.9)
Diploma and university degree	91 (5.8)	72 (4.6)	1549 (53.1)
Level of education (mother)			
Unlettered & primary and secondary school	134 (8.7)	101 (6.5)	1538 (49.6)
Diploma and university degree	82 (5.2)	65 (4.1)	1549 (49.9)
Family member			
3-4	184 (7.0)	140 (5.3)	2619 (84.4)
≥5	31 (6.8)	25 (5.5)	454 (14.6)
Mother's job			
Yes	18 (4.9)	14 (3.8)	362 (11.7)
No	193 (7.2)	151 (5.6)	2680 (86.4)
Father's job			
Yes	190 (6.9)	145 (5.3)	2730 (88.0)
No	21 (6.8)	19 (6.2)	306 (9.9)

PNE - primary nocturnal enuresis

Table 2 - Logistic regression of predictor factors of enuresis

Variable	Enuresis/ normal %	*P*-value	Odds ratio	CI 95%
Gender		0.000	2.247	1.643-3.074
Male	4.6			
Female	2.3			
Age (years)		0.002	1.619	1.189-2.204
6-9	4.5			
>9-12	2.5			
Children's number		0.970	0.982	0.388-2.489
1-2	4.5			
≥3	2.5			
Family member		0.837	1.103	0.433-2.811
3-4	4.6			
≥5	2.4			
Level of education mother		0.028	1.515	1.047-2.191
Unlettered and primary and secondary school	4.3			
Diploma and university degree	2.7			
Level of education father		0.089	1.360	0. 954-1.937
Unlettered and primary and secondary school	4			
Diploma and university degree	2.9			
Birth weight				
<2500	0.8	0.484	1.401	0.545-3.605
2500-4000	6	0.578	1.274	0.547-2.991
>4000	0.2			
Mother's job		0.749	0.916	0.537-1.565
Yes	0.6			
No	6.3			
Father's job		0.649	1.123	0.681-1.851
Yes	6.3			
No	0.7			

Table 3 - Pearson correlation between gender, age, educational level of mother and father and enuresis.

Variables	Enuresis n (%)	Non-enuresis n (%)	*P*-value
Gender			
Male	142 (9.4)	1382 (90.6)	0.001
Female	73 (4.6)	1505 (95.4)	
Age (years)			
6-7	47 (9.6)	439 (90.4)	0.003
7-8	53 (9.6)	499 (90.4)	
8-9	37 (6.1)	566 (93.9)	
9-10	40 (5.9)	638 (94.1)	
10-11	29 (5.1)	538 (94.9)	
>11-12	8 (4.2)	180 (95.8)	
Educational level of father			
Unlettered	13 (12)	95 (88)	0.003
Primary school	50 (8.9)	519 (91.1)	
Secondary school	60 (8)	687 (92)	
Diploma	69 (6.1)	1057 (93.9)	
University degree	22 (4.2)	501 (95.8)	
Educational level of mother			
Unlettered	14 (9.6)	131 (90.4)	0.001
Primary school	63 (9.5)	602 (90.5)	
Secondary school	57 (7.8)	670 (92.2)	
Diploma	71 (5.8)	1142 (94.2)	
University degree	11 (3.3)	325 (96.7)	

Discussion. Enuresis is one of the most common developmental disorders among children and often leads to considerable worry and distress in affected children and their parents; it may cause secondary emotional and social problems in children who continue to wet their bed.[8] Studies on the epidemiology of enuresis often have a selection bias and sample sizes have frequently been too small to allow any definite conclusion. Another reports indicated that prevalence rates differ in different cultural groups, perhaps reflecting variations in attitudes and expectation towards the problem.[6] The present study used a random cluster sampling method, with sample sizes large enough to estimate prevalence with acceptable accuracy. The overall prevalence of enuresis was lower (7% in children aged 6-12 years) in our study compared to the studies in France[9] (12.95% in children aged 5-16 years), Saudi Arabia[10] (15% in children aged 6-11 years) and Turkey (13%).[11] Trombetta et al[12] reported that the prevalence of enuresis was 7.2% in 6-year-old children, and 2.8% in 9-year-old children. In this

Table 4 - Logistic regression of predictor factors of primary nocturnal enuresis (PNE).

Variable	Total	PNE (%)	*P*-value	Odds ratio	Confidence interval 95%
Gender			0.093	0.559	0.283 - 1.106
Male	143	111 (77)			
Female	73	54 (74)			
Age			0.901	1.046	0.516 - 2.118
6-9 years	137	105 (76)			
>9-12 years	77	61 (79)			
Children's number			0.469	1.306	0.633 - 2.694
1-2	139	106 (76)			
3 and more	77	60 (78)			
Family member			0.334	1.438	0.677 - 3.009
3-4	141	106 (75)			
5 and more	74	59 (79)			
Level of education mother			0.815	1.086	0.543 - 2.171
Unlettered and primary and secondary school	134	101 (75)			
Diploma and university degree	82	65 (79)			
Level of education father			0.834	1.075	0.545 - 2.121
Unlettered and primary and secondary school	123	93 (75)			
Diploma and university degree	91	72 (79)			
Family history (father)			0.012	0.390	0.184 - 0.829
Yes	98	84 (85)			
No	98	71 (72)			
Family history (mother)			0.109	0.527	0.239 - 1.163
Yes	76	66 (86)			
No	124	94 (75)			
Father's job			0.205	2.555	0.571 - 11.443
Yes	190	145 (76)			
No	21	19 (90)			
Birth order			0.399	0.749	0.383 - 1.467
First child	96	73 (76)			
Other	114	93 (81)			
Mother's job			0.761	1.198	0.372 - 3.858
Yes	18	14 (77)			
No	193	151 (78)			

study prevalence of enuresis declined with age from 9.1% in the 6 to 9-year-old groups to 5.6% in 9 to 12-year-old groups. Gur et al[5] found that the prevalence of enuresis was significantly higher among children of larger families but we did not find any correlation between them. Our study revealed that enuresis was significantly associated with male gender, younger age and low level of mother's education. Using the ICD-10 definition, the overall prevalence of NE in this study was 6.2%, while using DSM IV this was much lower at 3.3%. Similar differences have been shown by the Italian and Malaysian studies.[2,6] The prevalence of NE in our study was lower than reported from Taiwan[7] (8%), Korea[8] (9.2 %), Turkey[13] (13.7%) and France (9.2%).[14] We found higher percentage of severe enuresis (50.7%) in Iranian children with NE compared to the studies in Taiwan[7] (10%), France[14] (22%), Hong Kong[15] (28%), Sweden (41%).[16] In contrast, in a study conducted in Turkey[13] 59% of enuretic children had severe enuresis. Whether differences in genetic predisposition or cultural background can explain the difference in severity of enuresis between Iranian children and other ethnic children needs further investigation. A wide variety of factors, such as gender, age, a positive family history of PNE, divorced parents and deep sleep, have been reported to be associated with PNE in Western countries, Turkey and Hong Kong.[6,11,17,18,19] While a low socio-economic status of the family, single children and a low birth weight were also found to be risk factors for PNE in the USA; these were not supported by studies from Italy and Turkey.[6,11] Bedwetting was more frequent in boys than girls. However, researchers speculate on the reasons for this finding. Since general continence is clearly linked with developmental maturity, perhaps females mature faster on average than males.[5] We did not find any significant relation between gender and PNE. Gumus et al[11] showed that the low educational level of parents was associated with NE. In contrast with our study, which is similar to Netherlands study,[20] the educational level of parents was not significantly related to the prevalence of PNE. Enuresis history of the child's mother, father, brother and sisters has frequently been reported as an accompanying finding in the literature.[13,15] In the present study, enuresis history of the child's father was an important factor associated with PNE. There was no significant correlation between age, frequency of bedwetting, birth order, low birth weight, larger family, working status of parents and PNE. Watanabe and Kawauchi[21] showed that the arousal center was activated to turn deep sleep into light sleep when the bladder was distended. They found that a disturbance in this arousal system might result in sustained deep sleep and hence cause enuresis. Dissimilar to their findings, there was no significant difference between the nocturnal arousal rates and PNE. The prevalence of day wetting ranged from 2-10% in literature,[22] the prevalence of 0.5% found in our study was lower than reported previously. Combined day and night wetting has been reported to occur in 0.7-17% of 6- or 7-year-old children.[16] The present results showed a prevalence rate of 0.8% that fits in this wide range. Lee et al[8] showed that the prevalence rates for nocturnal, diurnal and combined enuresis were higher among boys than girls. The prevalence rates of nocturnal and day and night enuresis in Iranian children were higher in boys than girls. Diurnal enuresis was more prevalent in girls similar to Swedish children.[16]

This is the first large survey on enuresis in Iranian children. The overall prevalence of enuresis is 7%. Younger age, male gender and the educational level of the mother are the main risk determinants of enuresis. Using the ICD-10 definition, the overall prevalence of NE is 6.2% and more than half of them have severe enuresis. The prevalence of PNE is 5.3% and a significant relationship is found between PNE and enuresis history of the child's father. The prevalence of diurnal enuresis (0.05%) is lower than previous studies.

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