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Prevalence and factors associated with nocturnal enuresis and social anxiety among Palestinian primary school children: a cross-sectional study

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Abstract

Background Nocturnal enuresis (NE) is a prevalent pediatric condition with significant physical, psychological, and social impacts. This study aimed to determine the prevalence of NE among primary school children in Palestine and investigate its demographic and biopsychosocial associates.

Methods A cross-sectional study was conducted from October 2023 to January 2024 in primary schools across the West Bank, Palestine. A sample of 1003 children from grades one to six were recruited using convenient sampling. Data were collected through an online questionnaire administered to parents, covering sociodemographic variables, NE, social anxiety and separational anxiety. Statistical analyses including Chi-square tests and binary logistic regression were performed.

Results The study reports a 27.9% prevalence of NE among 1,003 primary school children in the West Bank. The sample included 42.6% males and 57.4% females, with most attending public schools (65.3%) and 70.9% achieving excellent academic performance. Most fathers (79.3%) and mothers (94.9%) had higher education, and 37% of families reported a monthly income between 1,000 and 1,600 USD. NE was more prevalent in males (32.8%), children with lower academic performance (40.5%), and those from lower-income families. Significant factors associated with NE include being male (aOR: 1.6; 95% CI: 1.1–2.2), family history of NE (aOR: 6.1; 95% CI: 4.3–8.5), high fluid intake before bedtime (aOR: 1.6; 95% CI: 1.2–2.2), lower academic performance (aOR: 1.5; 95% CI: 1.1–2.1), daytime incontinence (aOR: 3.5; 95% CI: 1.4–8.5), and severe to extreme social anxiety (aOR: 7.4; 95% CI: 1.2–49.0).

Conclusions Considering the high prevalence of NE in the current study and its strong link with social anxiety, it underscores the need for integrated psychological support alongside medical management. Therefore, cooperation between health policymakers, healthcare providers, school staff, and families is essential to develop targeted

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interventions addressing both the physical and psychological impacts of NE, ultimately improving the quality of life for affected children and their families.

Keywords Nocturnal enuresis, Prevalence, West bank, Children, Risk factors, Social anxiety

Background

Nocturnal Enuresis (NE) is involuntary urination during sleep that occurs beyond the age when bladder control is usually developed, typically after the age of five [1]. This prevalent pediatric condition affects millions of children worldwide and can sometimes persist into adolescence and adulthood [2]. NE impacts not only the physical health of those affected but also presents significant psychological and social challenges. It often leads to embarrassment, low self-esteem, and disrupted sleep patterns for children and their family [3, 4].

According to the diagnostic standards of the International Children's Continence Society, NE can be identified when no other symptoms are affecting the lower urinary tract or a history of bladder dysfunction [5]. A disturbing and prevalent developmental disorder, NE affects between 15 and 20% of children aged five and around 2% of young adults [6]. And among school-aged children (6 to 13 years old), the prevalence of NE is 6.5% for girls and 12.4% for boys [7]. However, its prevalence varies across different regions due to genetic, environmental, and socioeconomic factors. Yet, studies conducted in regional countries highlight these differences, with reported prevalence rates of 10.2% in Iran [5], 18% in Egypt [6], 23.8% in Jordan [7], and 30.5% in Abu Dhabi [8]. However, research on NE remains scarce in Palestine, where cultural stigmas and healthcare access may contribute to underreporting, explaining the lack of data on NE prevalence and its psychosocial impact. In addition, NE remains a complex condition influenced by various risk factors, including sex, age, family history, constipation, obstructive sleep apnea, socioeconomic level, anxiety, exposure to violence, and history of COVID-19 infection [8–10]. Understanding global trends and regional variations is essential for addressing this condition effectively and developing targeted strategies for intervention.

Research exploring the link between psychiatric disorders and NE has found that approximately 20% of children with NE experience at least one mental health disorder, with the prevalence of psychiatric conditions being 1.3 to 4.5 times higher compared to children without NE [9]. Social anxiety disorder (SAD) and Separation anxiety disorder (SepAD) are prevalent psychiatric conditions in children and adolescents [10]. They are particularly relevant in the context of NE. In fact, NE may heighten SAD, as sufferers fear being discovered or derided by peers [11]. To further emphasize this, the mean social anxiety score among affected children was

54.58 ± 8.84 , as measured by the Social Anxiety Scale for Children-Revised (SASC-R) [11]. Therefore, NE in children can trigger avoidance behaviors, like avoidance of overnight activities and sleepovers, leading to social isolation and increased embarrassment [12]. On the contrary, NE episodes can be exacerbated by the stress and anxiety that are customary in social settings; thus, a detrimental cycle of anxiety and NE can be established [13]. SepAD sufferers may find separation from loved ones distressing, manifesting in nighttime worries and sleep disturbances. NE can worsen SepAD by raising the fear of wetting the bed away from the safety and security of home or parental supervision. Furthermore, the stress associated with SepAD might disrupt sleep patterns, worsening NE episodes [14].

A significant knowledge gap exists regarding NE as there is a lack of official data concerning its prevalence among children in the West Bank, Palestine. Additionally, understanding the link between SAD and SepAD and NE is essential for providing comprehensive management to affected children and effectively satisfying their emotional needs. The primary objectives of this study are to assess the prevalence of NE in primary school children in the West Bank, Palestine, and investigate the association between demographic factors (such as sex, grade, occupational and educational level of parents, family's income) and NE, and examine the relationship between biopsychosocial factors (including family history, constipation, COVID-19 history, snoring, psychological effect on the child and the family, behavioral problems in the child, school performance during last year, SepAD and SAD, and socio-environmental stressors) and NE. We believe that the results of this study are crucial for health policymakers to develop strategies for the early detection of NE and the prevention of related complications and comorbidities. This will ultimately enhance the well-being of affected children and society. Furthermore, we anticipate that our research will serve as a foundation for future studies on NE in Palestine.

Methodology

Study design and population

A cross-sectional study was conducted in primary schools across the West Bank, Palestine, from October 2023 to January 2024, targeting children in grades one through six. We included public and private schools in the sampling process to ensure diverse demographic participation. Children younger than first grade, older than

sixth grade, or those receiving their primary education outside the West Bank were excluded from the study.

We used the Epi-Info online sample size calculator to determine the necessary sample size. Based on a population size of 400,000, as reported by the Palestinian Central Bureau of Statistics in 2021, with an anticipated prevalence of 25%, a 3% margin of error, and a 95% confidence interval, the initial sample size was calculated to be 800. To account for potential incomplete questionnaires and expected low compliance among respondents, we increased the sample size by 25%, resulting in a final minimum required sample size of 1,000 children. Initially, we intended to collect a random sample using a multistage cluster sampling technique. However, we decided to use a convenient sampling method instead due to challenges, especially the inability to obtain official access to schools. We divided the West Bank into three regions, the south, middle, and north, and included schools from both urban and rural areas to guarantee wide geographic coverage. We disseminated the Google Forms created online survey to parents of first through sixth graders in confidential WhatsApp groups. This distribution was facilitated through personal outreach and collaboration with school administrators. To maximize the response rate, we regularly reminded supervisors and teachers of the study's significance and urged them to promote parental involvement. Additionally, we encouraged the participation of both enuretic and non-enuretic children to ensure a balanced sample. Regarding ethical considerations, the questionnaire's first page included an informed consent form in Arabic clearly outlining the voluntary nature of participation. Before starting the survey, respondents were obligated to acknowledge and accept the consent statement before proceeding. To maintain confidentiality, no personally identifiable information was collected in the dataset. All information remained confidential and was used solely for research purposes.

The study obtained ethical approval from the Institutional Review Board at An-Najah National University (Reference No: Med.August.2023/20). Following ethical guidelines, data were gathered from the parents of participating children rather than the children themselves. Informed consent was obtained from parents, acting as legal guardians, to ensure adherence to ethical standards for participants under 16 years of age. The consent form outlined the study's purpose and importance and assured voluntary participation.

Measurement tool and variables

Data collection was facilitated through a parental-administered online questionnaire designed with Google Forms. The research team developed the questionnaire, selecting items after reviewing relevant literature about the subject [5, 14]. The questionnaire contained five

sections (Supplementary File 1). The first section covering personal information included ten questions about the sociodemographic variables: sex, grade, region, public/private school, child's school performance during last year, father's and mother's educational level and employment status, and family's income. The second section was about NE, with a total of 12 questions, including the presence or absence of primary NE, which is defined as children who never achieved control over urinary continence for at least six consecutive months; secondary NE is defined as children who initially achieved control over bed wetting for six consecutive months but eventually failed to maintain it (failure of control is defined as bed-wetting that occurs at least twice a week for at least three consecutive months) [15], enuresis during the first few hours of the night, amount of enuresis, achieving control, amount of urination in the following day, the effect of enuresis on the child and the family, difficulty in waking up the child, ability to wake up alone, family's reaction to enuresis, and if NE present, how do families tend to manage NE, managements include medications, waking the child throughout the night, awakening devices, fluid restriction and no used management.

The third section included ten questions about possible risk factors like family history, developmental delay, COVID-19 history, snoring, constipation, consuming large amounts of fluids before sleep, history of psychological traumas, history of urinary tract infection (UTI), daytime incontinence and behavioral problems defined as asking parents whether the child has patterns of actions like; arguing, being aggressive, or defiant around others, that deviate from what is considered typical or socially acceptable [8].

The fourth and fifth sections were about SAD and SepAD using the Dimensional Anxiety Scales [16]. The part concerning SAD comprised nine questions addressing various aspects of SAD, such as interactions in public settings, family gatherings, and similar social contexts. The part regarding SepAD consists of ten questions that explore the symptoms, thoughts, and behaviors a child may exhibit when separated from their family [17]. Participants responded using a five-point Likert scale, with "always" receiving '4' and "never" receiving '0'. The prorated total score ranged from 0 to 36 for SAD and 0–40 for SepAD [18]. The severity was described in a manner of 0–4 levels, with zero as "none" and four as "extreme" [17].

The original English version of the Dimensional Anxiety Scales demonstrated strong internal consistency, validity, and test-retest reliability in its psychometric assessment [16]. After the English questionnaire was translated into Arabic, three field experts reviewed and revised it. A pilot study with 50 participants was conducted to evaluate the questionnaire's clarity, relevance

Table 1 Sociodemographic variables and their relationships with nocturnal enuresis (n = 1003)

Variable	Total N (%)	Nocturnal enuresis		P value
		Yes n (%)	No n (%)	
Sex				
Male	427 (42.6%)	140 (32.8%)	287 (67.2%)	0.003
Female	576 (57.4%)	140 (24.3%)	436 (57.7%)	
Grade				
One	330 (32.9%)	85 (25.8%)	245 (74.2%)	0.240
Two	206 (20.5%)	59 (28.6%)	147 (71.4%)	
Three	174 (17.3%)	42 (24.1%)	132 (75.9%)	
Four	132 (13.2%)	47 (35.6%)	85 (64.4%)	
Five	97 (9.7%)	26 (26.8%)	71 (73.2%)	
Six	64 (6.4%)	21 (32.8%)	43 (67.2%)	
Regions				
North West Bank	460 (45.9%)	132 (28.7%)	328 (71.3%)	0.874
Middle West Bank	226 (22.5%)	61 (27.0%)	165 (73.0%)	
South West Bank	317 (31.6%)	87 (27.4%)	230 (72.6%)	
School type				
Public	655 (65.3%)	185 (28.2%)	470 (71.8%)	0.751
Private	348 (34.7%)	95 (27.3%)	253 (72.7%)	
School performance				
Excellent	711 (70.9%)	171 (24.1%)	540 (75.9%)	<0.001
Good	218 (21.7%)	79 (36.2%)	139 (63.8%)	
Satisfactory or passing	74 (7.4%)	30 (40.5%)	40 (59.5%)	
Father's educational level				
Below High school	208 (20.7%)	64 (30.8%)	144 (69.2%)	0.303
High school and university	795 (79.3%)	216 (27.2%)	579 (72.8%)	
Mother's educational level				
Below High school	51 (5.1%)	18 (35.3%)	33 (64.7%)	0.228
High school and university	952 (94.9%)	262 (27.5%)	690 (72.5%)	
Father's employment status				
Employed	922 (92.4%)	257 (27.9%)	665 (72.1%)	0.841
Unemployed	76 (7.6%)	22 (28.9%)	54 (71.1%)	
Mother's employment status				
Employed	321 (32%)	91 (28.3%)	230 (71.7%)	0.807
Unemployed	681 (68.0%)	188 (27.6%)	493 (72.4%)	
Financial income				
<600 USD	151 (15.1%)	40 (26.5%)	111 (73.5%)	0.135
600–999 USD	326 (32.5%)	96 (29.4%)	230 (70.6%)	
1000–1600 USD	371 (37.0%)	122 (30.2%)	259 (69.8%)	
> 1600 USD	155 (15.5%)	32 (20.6%)	123 (79.4%)	

to its objectives, and ease of interpretation. The initially calculated prevalence of NE was 29%. Based on participant feedback, participants contacted us to clarify some questions, so we simplified the language for better clarity. Additionally, a few instances of repetition were identified and removed. Participants also reported that the estimated completion time was too long, so we refined the questionnaire and reduced the time required to approximately five minutes. The reliability of the Arabic version was confirmed with a Cronbach's alpha of 0.837 for the SAD section and 0.869 for the SepAD section, indicating strong internal consistency.

Statistical analysis

The collected data were initially exported into an Excel spreadsheet, where they underwent a thorough filtering and coding process to ensure accuracy and consistency. For statistical analysis, we utilized IBM SPSS version 23 (IBM Corp., Armonk, NY). Descriptive statistics, including frequencies and percentages, were calculated for categorical variables to provide an overview of the data distribution. Univariate analysis using the Chi-square test was conducted to assess associations between NE and the study variables. To account for potential confounding factors and examine the independent effects of each variable, a multivariate binary logistic regression analysis was performed, as the study outcome (NE) was binary (Yes vs. No). Variables that demonstrated significance in the univariate analysis or were identified as significant in the literature were incorporated into the model. The logistic regression results, including the strength and direction of the associations, were reported as adjusted odds ratios (aOR) with their corresponding 95% confidence intervals (95% CI). A significance level of 0.05 was used to determine statistical significance.

Results

Initially, we collected 1,042 responses, all of whom agreed to participate. After applying the eligibility criteria, the final sample size was 1,003 participants. Table 1 details the sociodemographic characteristics of the children in the study. The sample consisted of 57.4% females, with 32.9% of participants in grade one. Additionally, 65.3% were enrolled in public schools, and 70.9% exhibited excellent academic performance. Regarding parental education, 79.3% of fathers and 94.9% of mothers had pursued higher education. Furthermore, 37.0% of families reported an average household income between 1000 and 1600 USD.

NE was identified in 280 participants, accounting for 27.9% of the study sample (95% CI: 25.1–30.8). Among those with NE, 57% had primary NE (Fig. 1). The frequency of enuretic episodes varied, with 31.1% experiencing NE every night. Parents reported difficulty in

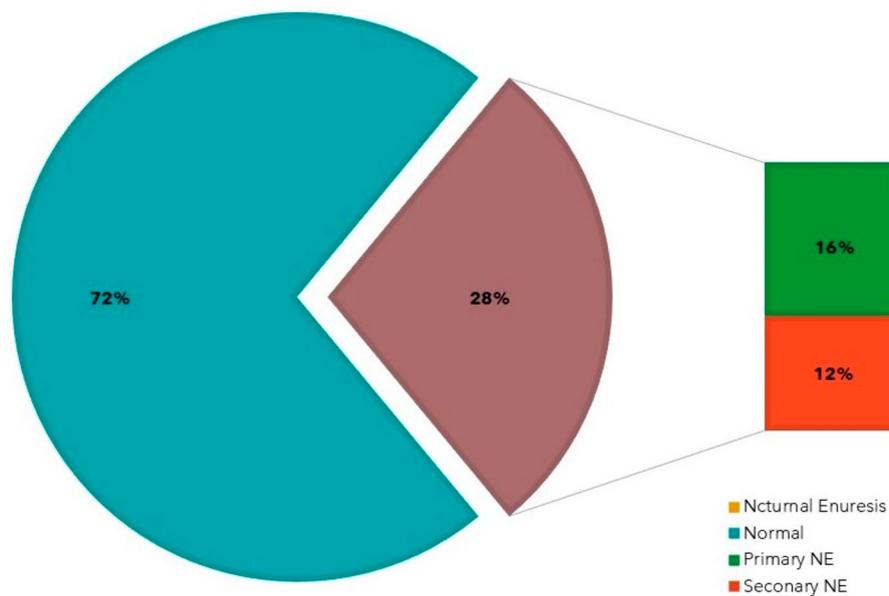


Fig. 1 The prevalence of Nocturnal enuresis among the Palestinian children

Table 2 Nocturnal enuresis and its characteristics in terms of frequency, timing, amount, control, bothersome, and ability to wake up (n = 280)

Variable	Frequency (%)
Frequency of NE	
Every night	78 (31.1%)
2–3 times per week	86 (34.3%)
Once a week	74 (29.5%)
2–3 times per month	13 (5.2%)
NE during 1st few hours of night (Yes)	270 (98.5%)
Large urine amount (Yes)	182 (70.0%)
Urinary bladder control for >6 consecutive months	
Primary	143 (56.7%)
Secondary	109 (43.3%)
Large amount of urination in the following day (Yes)	75 (29.5%)
Child bothered by NE (Yes)	188 (75.8%)
Family bothered by their Child's NE (Yes)	182 (71.4%)
Difficulty in waking the child up (Yes)	146 (52.1%)
Wakes up alone (Yes)	99 (35.4%)

waking up their children in 52.1% of cases. Additionally, 98.5% reported NE occurring during the first few hours of the night, and 70% reported a large amount of enuresis. Enuresis bothered 75.8% of the children, and 71.4% of families found their children's enuresis to be bothersome (Table 2).

Parents of children with enuresis use a variety of management strategies. The most frequent approach, used by 45.7% of respondents, is waking the child during the night, while only 1.1% use waking devices (bedwetting alarm) devices. Notably, 39% of families reported no specific management method for their child's enuresis.

Table 3 Family-reported reactions, management approaches, and types of traumas associated with nocturnal enuresis in children (n = 280)

	Frequency (%)
Type of management the child received for bedwetting	
Waking the child throughout the night	45.7%
Fluid restriction	43.6%
Medications	17.1%
Herbal treatment	6.1%
Bedwetting alarm (wakening device)	1.1%
None	37.9%
Family's reaction to enuresis	
Ignore the behavior	30.7%
Talk about it with the child	29.6%
Expressing anger	17.1%
Take no specific action	9.6%
Stay calm	7.1%
Use punishment	1.4%

Regarding reactions to enuresis, ignoring the behavior was most common (30.7%), while using punishment was rare (1.4%), typically involving assigning the child responsibility for cleaning their bed and clothes (Table 3).

Based on the findings presented in supplementary Table 1, approximately 16.3% of respondents reported that they sometimes, often, or always experience feelings of panic, fear, or distress in social settings. Additionally, 36.8% of participants indicated varying degrees of experiencing thoughts related to rejection, being made fun of, or ashamed by others in social contexts. Regarding SepAD, supplementary Table 2 indicates that 31.3% of respondents reported feeling anxious, worried, or

nervous to some degree when being away from home or family, while 29.3% experienced occasional to frequent episodes of sudden panic, fear, or fright in similar situations. The severity of SAD and SepAD were recoded mild, moderate, and severe or extreme. Within the entire sample, 28.3% exhibited mild SAD, while 40.6% experienced mild SepAD.

The univariate analysis identified several factors significantly associated with NE. Males exhibited a higher prevalence of NE at 32.8%. Lower academic performance correlated with increased NE, with a prevalence of 40.5% among students with satisfactory or passing grades (Table 1). A strong association emerged between NE and family history, affecting 59.1% of participants with a familial history of enuresis. Behavioral problems were also significantly linked to NE, impacting 43.2% of children with such problems. Furthermore, 38.7% of children who snored experienced NE. Consuming large amounts of fluid before sleep was associated with NE in 35.5% of cases. History of psychological trauma was another significant factor, with 39.6% of affected participants reporting NE. A history of UTI was linked to a 32.8% prevalence of NE. There was a strong association between daytime incontinence and NE, with 71.9% of those affected by daytime incontinence also experiencing NE. Social anxiety and separation anxiety were significant contributors, with NE reported in 54% of moderate social anxiety cases and 43.7% of moderate separation anxiety cases (Table 4). No significant associations were found between NE and region, grade, parental occupational and educational levels, family's income, developmental delays, history of COVID-19 infection, or constipation (Tables 1 and 4).

Furthermore, multivariable analysis was conducted to control for confounders, revealing several significant associations with NE (Table 5). Males exhibited a 1.6-fold higher likelihood of experiencing NE than females (aP-value: 0.014; aOR: 1.6; 95%CI: 1.1–2.2). Children with a family history of NE were six times more likely to develop NE themselves (aP-value: < 0.001; aOR: 6.1; 95%CI: 4.3–8.5). Furthermore, children achieving satisfactory or passing grades in school were 1.5 times more likely to have NE (aP-value: 0.035; aOR: 1.5; 95%CI: 1.1–2.1). Consuming large amount of fluid before sleep was linked to a 1.6 times higher likelihood of NE (aP-value: 0.007; aOR: 1.6; 95%CI: 1.2–2.2), and daytime incontinence associated with a 3.5-fold increased likelihood of NE (aP-value: 0.006; aOR: 3.5; 95%CI: 1.4–8.5). Additionally, severe to extreme social anxiety was identified as another predictor of NE (aP-value: 0.037; aOR: 7.4; 95%CI: 1.2–49.0).

Discussion

The prevalence of NE among primary school children in the West Bank was 27.9%, remarkably higher than in neighboring countries. Studies conducted across the

Middle East have reported different prevalence rates, including 10.2% in Iran [5], 18% in Egypt [6], 23.8% in Jordan [7], and 30.5% in Abu Dhabi [8]. This high prevalence could be linked to the unique situation of residing in an area of armed conflict, which was apparent in the number of responses from enuretic children who reported that they had been a direct or indirect victim of any violent acts of the Israeli occupation in forms of chasing, shooting, arresting, or house break-in. This parallels other studies confirming the effects of armed conflict on child's health and development, including NE [19]. Although the sociocultural stigma surrounding bed-wetting can delay medical help-seeking, it may not prevent families from reporting NE in anonymous surveys, potentially contributing to the high prevalence observed. Moreover, systemic barriers, including restricted access to pediatric urology services, limited mental health support in schools, and poor transportation infrastructure, may reduce opportunities for early intervention, leading to persistent, untreated cases that elevate prevalence rates. In addition, the financial constraints faced by many Palestinian families limit their ability to afford specialized care, further contributing to the chronic nature of NE. Despite factors that might suggest underreporting, the cumulative effect of these stressors and barriers likely explains the notably high prevalence in our study. Another contributing factor could be the elevated prevalence of SAD, with 16.7% of cases exhibiting severe to extreme levels of SAD. This finding is consistent with earlier research demonstrating a significant correlation between NE and SAD [13]. Psychological problems are common among enuretic children. A survey in KSA showed that 8% of these children suffered psychological problems [20]. Given the considerable prevalence of NE and its close correlation with the previous factors, it is crucial to explore the possibility of hidden NE in such cases.

Males had a substantially higher prevalence of NE than females. The finding is consistent with various studies in the literature [7, 21, 22]. This discrepancy is linked to the faster development of bladder control in girls, which leads to girls achieving bladder control milestones earlier than boys [23]. Besides, children who attained satisfactory or passing grades were more likely to have NE, with a prevalence of 40.5%. The correlation between NE and children's academic performance is documented [24], implicating the necessity of encouraging teachers, particularly those instructing male students, to prioritize academic education thoroughly, working closely with psychological counselors to reach out to families of individuals with poor academic performance, and facilitating referrals to specialists to investigate any potential underlying NE. Such efforts aim to enhance academic outcomes by addressing any related concerns comprehensively.

Table 4 Risk factors of nocturnal enuresis among the studied children (n = 1003)

Risk factors	Total N (%)	Nocturnal enuresis		P value
		Yes	No	
Family history				
Yes	254 (25.3%)	150 (59.1%)	104 (40.9%)	< 0.001
No	749 (74.7%)	130 (17.4%)	619 (82.6%)	
Developmental delay				
Yes	43 (4.3%)	15 (34.9%)	28 (65.1%)	0.298
No	960 (95.7%)	265 (27.6%)	695 (72.4%)	
Behavioral problems				
Yes	81 (8.1%)	35 (43.2%)	46 (56.8%)	0.001
No	922 (91.9%)	245 (26.6%)	677 (73.4%)	
COVID-19 history				
Yes	96 (6.9%)	19 (27.5%)	50 (72.5%)	0.942
No	934 (93.1%)	261 (27.9%)	673 (72.1%)	
Snoring				
Yes	119 (11.9%)	46 (38.7%)	73 (61.3%)	0.005
No	884 (88.1%)	234 (26.5%)	650 (73.5%)	
Constipation				
Yes	54 (5.4%)	17 (31.5%)	37 (68.5%)	0.548
No	949 (94.6%)	263 (27.7%)	686 (72.3%)	
Consuming large amount of fluid before sleep				
Yes	499 (52.3%)	176 (35.3%)	323 (64.7%)	< 0.001
No	455 (47.7%)	104 (22.9%)	351 (77.1%)	
History of psychological trauma				
Yes	139 (14.0%)	55 (39.6%)	84 (60.4%)	0.001
No	864 (86.0%)	225 (26.0%)	639 (74.0%)	
History of UTI				
Yes	265 (26.4%)	87 (32.8%)	178 (67.2%)	0.035
No	738 (73.6%)	193 (26.2%)	545 (73.8%)	
Daytime incontinence				
Yes	32 (3.2%)	23 (71.9%)	9 (28.1%)	< 0.001
No	967 (96.8%)	257 (26.6%)	710 (73.4%)	
Social anxiety				
None	657 (65.5%)	172 (26.2%)	485 (73.8%)	< 0.001
Mild	284 (28.3%)	79 (27.8%)	205 (72.2%)	
Moderate	50 (5.0%)	27 (54.0%)	23 (46.0%)	
Severe/extreme	12 (1.2%)	2 (16.7%)	10 (83.3%)	
Separational anxiety				
None	494 (49.3%)	128 (25.9%)	366 (74.1%)	0.007
Mild	407 (40.6%)	109 (26.8%)	298 (73.2%)	
Moderate	87 (8.7%)	38 (43.7%)	49 (56.3%)	
Severe/extreme	15 (1.5%)	5 (33.3%)	10 (66.7%)	

A positive family history in 59.1% of NE students is aligned with the literature [5, 20, 25]. Daytime incontinence exhibited a 3.5-fold increased likelihood of NE. Research conducted in China and Australia documented a co-occurrence of NE and daytime incontinence in 21.17% and 17% of cases, respectively [26], while Egypt reported a figure of 16% [6]. We attribute this finding to the probable presence of an underlying physiological or psychological factor affecting bladder function, impacting daytime and nighttime continence. Understanding these associations reinforces the importance of

considering family history when assessing and managing the condition and improving diagnostic and therapeutic strategies for managing both NE and daytime incontinence, ultimately enhancing the quality of life for affected individuals.

Regarding management modalities, our study shows that participants used various methods, with behavioral modification, including waking up the child throughout the night 45.7%, and fluid restriction 43.6%, the most used methods, followed by the pharmacological treatment 17.1%. Meanwhile, a small percentage opted for

Table 5 Multivariate analysis of variable independently associated with NE

	SE	aP-value	aOR (95%CI)
Sex (Ref: female)	0.174	0.014	1.6 (1.1–2.2)
Family history (Ref: No)	0.173	<0.001	6.1 (4.3–8.5)
Grade			
One (Ref)			
Two	0.344	0.846	0.94 (0.48–1.8)
Three	0.359	0.762	1.1 (0.55–2.3)
Four	0.372	0.826	0.92 (0.45–1.9)
Five	0.372	0.323	1.5 (0.67–2.9)
Six	0.410	0.623	0.82 (0.37–1.8)
School performance (Ref: Excellent)			
Good	0.317	0.449	1.3 (0.68–2.4)
Satisfactory or passing	0.194	0.035	1.5 (1.1–2.2)
Behavioral problems (Ref: No)	0.296	0.360	1.3 (0.73–2.3)
Snoring (Ref: No)	0.246	0.066	1.6 (0.97–2.5)
Consuming large amounts of fluid before sleep (Ref: No)	0.166	0.007	1.6 (1.2–2.2)
History of psychological trauma (Ref: No)	0.240	0.291	1.3 (0.81–2.1)
History of UTI (Ref: No)	0.193	0.086	1.4 (0.96–2.1)
Daytime incontinence (Ref: No)	0.455	0.006	3.5 (1.4–8.5)
Social anxiety (Ref: None)			
Mild	0.955	0.086	5.2 (0.79–33.5)
Moderate	0.944	0.125	4.3 (0.67–27.1)
Severe/extreme	0.961	0.037	7.4 (1.2–49.0)
Separation anxiety (Ref: None)			
Mild	0.708	0.769	0.81 (0.20–3.3)
Moderate	0.694	0.547	0.66 (0.17–2.5)
Severe/extreme	0.705	0.832	1.2 (0.29–4.6)

aP-value; adjusted P-value; aOR: adjusted Odds Ratio; 95%CI; 95% Confidence interval; Ref: reference group

herbal treatment (6.1%) and bedwetting alarm (1.1%), and 37.9% of parents said they did not use these methods. When compared to other countries like Saudi Arabia, it was found that the most commonly applied management methods were as follows: behavioral modification (31.6%), pharmacological treatment (29.6%), bedwetting alarms (6.8%), and bladder muscle exercises (6.2%) along with surgery (1.5%) [20]. The International Children’s Continence Society has recognized a variety of treatment approaches, encompassing both pharmacological and non-pharmacological strategies, aimed at alleviating symptoms of NE and improving the quality of life for impacted children [27]. In cases of nonmonosymptomatic enuresis, it is important to offer basic advice regarding voiding behaviors and fluid intake practices [28].

Alarm therapy continues to be a fundamental approach in current practices, demonstrating a notable response rate of 50–70% and exhibiting no associated side effects [29]. Their lack of widespread availability may explain our participants’ limited use of wake-up devices.

The findings revealed a heightened prevalence of NE among students in advanced grades, which contradicts existing literature suggesting a decline in NE prevalence among older children. It is essential to acknowledge that these different findings could be attributed to the inadequately sized samples for each separate grade that fail to accurately reflect each grade’s prevalence. Additionally, mothers of children experiencing NE might exhibit heightened awareness and concern, potentially influencing participation and prevalence rates. Therefore, we emphasize that future research must attempt a more balanced representation across grade levels to ensure the conclusions’ reliability.

One of the study’s key strengths is that it is the first to investigate the prevalence of NE in Palestine. Additionally, it achieved a substantial sample size, enhancing the findings’ statistical power. Furthermore, the study offers an in-depth analysis of various NE-related factors, encompassing demographic, biopsychosocial, and behavioral aspects. However, the study encountered a few limitations. Firstly, we faced challenges accessing schools as the Ministry of Education declined collaboration, resulting in our adoption of convenient sampling. We distributed questionnaires via closed WhatsApp groups with the cooperation of school managers. This may have resulted in an overrepresentation of health-conscious families, potentially skewing the prevalence of NE and the identification of associated factors like social anxiety and academic performance, thus impacting generalizability. Secondly, utilizing a cross-sectional design limits the ability to identify causal relationships. For instance, while we observed associations between NE and factors such as social anxiety and academic performance, we cannot determine whether these factors are causes or consequences of NE. Thirdly, reliance on parental-reported data introduces the potential for reporting bias, possibly leading to underreporting of NE or associated psychosocial issues due to stigma. Lastly, the absence of clinical data limits diagnostic confirmation, which may have influenced the accuracy of the reported prevalence and associated factors.

Conclusion

Considering the high prevalence of NE at 27.9% in the West Bank and the significant factors identified, such as gender, family history, poor school performance, high fluid intake before bedtime, daytime incontinence, and SAD, there is a critical need for tailored health programs and effective management strategies that address these

risk factors directly. Key recommendations include fostering collaboration between the Ministry of Health and Education to educate school staff on NE, enabling them to identify affected students and recognize signs of SAD. Integrating mental health screening and NE assessments into routine pediatric care and school health programs can facilitate early detection and intervention, particularly for children with poor academic performance or signs of SAD. Educating families on the relationship between NE, family history, and daytime incontinence is also essential, along with encouraging prompt medical consultations for children in need. Targeted educational workshops for parents should focus on risk recognition, such as family history and signs of SAD, and management strategies, such as fluid regulation before bedtime. Additionally, providing parental guidance and integrating mental health services within educational settings, including establishing psychological counselling units, will support children and families in managing NE. Teacher training programs should be introduced to help educators identify at-risk children and foster supportive learning environments. Furthermore, evaluating physical and mental health capacities before school entry can facilitate early diagnosis and intervention. Establishing a clinical database on NE would support further research and inform improved treatment approaches.

Abbreviations

NE	Nocturnal Enuresis
SAD	Social anxiety disorder
SepAD	Separation anxiety disorder
UTI	Urinary tract infection

Supplementary Information

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- Supplementary Material 1
- Supplementary Material 2
- Supplementary Material 3

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Author contributions

ZN and Beesan M conceived the idea and managed the study. ZN, Beesan M, and Baraa M were responsible for designing the study and supervising data collection, analysis, and manuscript preparation. GM and LA participated in data collection and analysis and wrote the initial draft of the manuscript. All authors interpreted the results, provided feedback on earlier drafts, read and approved the final manuscript, and agreed to submit it to the journal.

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Data availability

All data generated or analyzed during this study can be obtained from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

All study procedures adhered to the principles outlined in the Declaration of Helsinki and received approval from the Institutional Review Board of An-Najah National University (Ref #: Med.August.2023/20). In alignment with ethical guidelines, data collection was conducted through the parents of participating children rather than directly from the children. Participation in the study was voluntary, and informed consent was obtained from the parents, who acted as legal guardians, ensuring compliance with ethical standards for participants under 16.

Consent for publication

Not applicable.

Clinical trial number

Not applicable.

Competing interests

The authors declare no competing interests.

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