

An innovative new method to diagnose enuresis objectively

Habibolah Khazaie, MD, Mahmoudreza Moradi, MD, Masoud Tabmasian, MD, Mansour Rezaei, MSc, PhD, Shobreh Dabiry, MD, Rojin Nikray, MD, Leeba Rezaie, MSc, Golrokh Younesi, MD, David C. Schwebel, MA, PhD.

Nocturnal enuresis, or bed wetting, is a disease that occurs during sleep. It is described as repeated and involuntary urination after the age at which the child usually achieves bladder control. As the most common urologic complaint in childhood, nocturnal enuresis is more frequent in boys than girls and, in most cases, is not related to a serious medical condition. In adulthood, nocturnal enuresis is rare, with an estimated prevalence of 0.5-2.3%.¹

Among both children and adults, nocturnal enuresis can be treated through pharmacological or psychological approaches, both of which have demonstrated efficacy.² One effective treatment for nocturnal enuresis is the enuresis alarm. The alarm is typically fastened to the patient's undergarments and is triggered to sound when an electrical connection is made by becoming wet from urination. The alarm awakens the patient, who is then required to clean the bedding and therefore discouraged from future incidents through behavioral strategies. The enuresis alarm is used with both children and adults. It has a success rate of around 65-75% in undifferentiated samples of children with enuresis.^{2,3}

In Iran and many other countries, young adults are compelled to serve in the national military. Exemptions from military service are generally provided for valid medical conditions. According to Iranian military law, one medical condition that allows for exemption is nocturnal enuresis. Because prevalence rates among military recruits are significantly higher than those in the general population, military managers suspect many presented cases of nocturnal enuresis may be individuals malingering in an attempt to avoid obligatory military service. Therefore, a low-cost and reliable means to detect malingering of nocturnal enuresis is needed.

The Diagnostic and Statistical Manual of Mental Disorders, 4th edition, text revision (DSM-IV-TR) criteria for nocturnal enuresis include 4 primary aspects: (a) repeated voiding of urine in inappropriate locations such as the bed or clothes, (b) clinically significant distress or impairment in functioning as a result of the inappropriate urination, (c) chronological age, and developmental functioning of at least 5 years, and (d) no presence of substance use or a medical condition that causes the repeated inappropriate voiding.^{2,4} According to those criteria, urination may occur when the individual is asleep, and therefore it is necessary to discriminate whether the individual is asleep or awake at the time of bed wetting to confirm or refuse the claim

of involuntary nocturnal enuresis. In Iran, enlisted individuals who claim that they have nocturnal enuresis are referred to the psychiatric commission for evaluation. Because such evaluations can be biased, in the present study, an objective assessment using simultaneous application of 2 medical devices, an actigraph and an enuresis alarm was developed to determine the sleep or awake state at the time of bed wetting. The goal of this study was to test the sensitivity and specificity of this 2-device system designed to detect the malingering type of nocturnal enuresis during military enlistment procedures.

An observational/descriptive research design was used in this study. This experiment included 2 studies. First, we tested the efficacy of the method on children as a pilot group. Evaluation of bed wetting among children is easier because such cases are much more frequent than among adult patients. The children were not necessarily recruited because of enuresis diagnoses (many were too young or had never achieved nocturnal continence), but all did have bed wetting episodes almost nightly. This experiment was conducted from September 2008 through August 2009. Second, after confirming potential effectiveness of the method with children, we recruited a small sample of adults with enuresis to determine whether any were malingering. This step was completed from August 2009 through November 2010. The Kermanshah Medical University's ethics committee approved both studies, and all participants (or their parents) provided informed consent to participate.

Twenty-eight children were recruited from the Urology Department, Imam Reza Hospital, Kermanshah, Iran. Inclusion criteria for children were a history of bed wetting. They may or may not have had enuresis diagnoses; many did not. Children were excluded if they had diagnoses of diabetes, spina bifida, urinary catheterization, urinary infections, or seizure disorder. After urologic work-up to rule out organic causes of bed wetting, children slept in the hospital with medical equipment attached and with a nurse observing their sleep. They were monitored until the first bed wetting episode. While sleeping, the children wore 2 pieces of medical equipment. First, an actigraph was used to monitor sleep patterns. Actigraphy is a method using computerized wristwatch-size devices (generally placed on the wrist to record movement). Collected data are displayed on a computer and analyzed for change in rhythm parameters that in turn provide an estimate on

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wake-sleep parameters.⁵ Second, they wore an enuresis alarm. The alarm was engineered with a watch that was adjusted to the actigraph timer so that we could record the exact time of bed wetting. To provide validity of the equipment recordings, a nurse monitored the patients overnight and recorded the exact time of any enuresis alarms. The nurse also collected data concerning whether the child was asleep or awake during enuresis episodes.

Data were analyzed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 15. To determine whether nurse diagnosis matched equipment diagnosis, Fischer exact test was used and Kappa parameter and diagnostic values (specificity, sensitivity, positive predictive value, and negative predictive value) were considered. We expected perfect or near-perfect matching between the 2 techniques.

The mean age of children was 5.03 (SD=2.21). Twenty participants (71.4%) were male and 8 (28.5%) female. The average time until the first enuresis alarm was 3.15 hours (SD=3.26). Both the medical equipment (actigraph and enuresis alarm) and nurse reported 27 children to be asleep during the bed wetting episode, and one boy (9 years old) to be awake. The reason for the boy's voiding while awake was unclear. A Fisher's exact test showed no differences between our designed method using the actigraph and enuresis alarm versus the nurses' report of sleep or wake state at the time of bed wetting. Kappa consistency coefficient equaled one. All diagnostic values (specificity, sensitivity, positive predictive value, and negative predictive value) were 100% (Table 1). The first study offered good evidence that the strategy of using both an actigraph and an enuresis alarm might be effective to detect malingering nocturnal bed wetting or enuresis. For military purposes, evidence of functionality among adults was needed. The second study was designed to test the assessment strategy among adults diagnosed with enuresis who were suspected to have possible malingering.

Nine adults with a history of nocturnal enuresis were recruited from the Sleep Research Center, Department of Psychiatric wards of Farabi Hospital in Kermanshah, Iran. All were diagnosed with nocturnal enuresis according to DSM-IV criteria by an interdisciplinary team of physicians. As in the pediatric sample, the inclusion criteria for adults were no evidence of organic causes for enuresis following urological exam and hospitalization in the psychiatry hospital (Farabi Hospital) for at least one night (3 days, on average). Exclusion criteria included diabetes, spina bifida, urinary infections, risperidone, and thioridazine medication, sickle cell anemia, and seizure disorder.⁴ We also excluded adults with sleep apnea syndrome. As in the pediatric sample, patients slept in the hospital with both actigraph and enuresis alarm attached. A nurse observed their sleep to establish validity of the

Table 1 - Comparison of sleep/wake results via actigraphy/enuresis alarm versus nurse observation for objective diagnosis of enuresis. Data from study one (28 children) and study 2 (9 adults) combined.

Method	Asleep number (%)	Awake number (%)	Total number (%)
Actigraphy/alarm	34 (91.9)	3 (8.1)	37 (100)
Nurse observation	34 (91.9)	3 (8.1)	37 (100)

Fisher's exact test p -value = 0.001

mechanical recording. Data were analyzed identically to the pediatric sample.

The mean age of adult participants was 19.88 years (SD=1.35). All 9 were male (100%). The average time until the first enuretic alarm was 3.55 hours (SD=3.11). Both the medical equipment (actigraph and enuresis alarm) and nurse reported 7 adult patients to be asleep during the enuretic episode and 2 cases to be awake. Again, the Fisher exact test showed no differences between our designed method and the nurses' report of sleep or wake state at the time of bed wetting. Kappa consistency coefficient equaled one. All diagnostic values (specificity, sensitivity, positive predictive value, and negative predictive value) were 100% (Table 1). Two cases had claimed involuntary nocturnal enuresis, but were awake at the time of bed wetting. They were identified as individuals malingering nocturnal enuresis, probably to avoid obligatory military service.

In conclusion, in the first pilot study, we found high sensitivity and specificity of our method among children. In the second study, we found equally high sensitivity and specificity among a sample of adults. It appears that this methodology can successfully differentiate the malingering type of enuresis from true enuresis. Using actigraphy and enuresis alarm concurrently offers an excellent and reliable strategy to detect adults who are purposely malingering enuresis symptoms. It can be used for forensic and military purposes. We also note that the strategy is of low-cost and effective. It might prove helpful to identify men drafted into military service who attempt to malingering nocturnal enuresis with the goal of avoiding obligatory military service. The strategy is relatively straightforward to administer and can be applied safely to all participants with no anticipated adverse reactions.

Our study has some limitations. We used actigraphy to detect the exact time of bed wetting. Although actigraphy is more accessible and economical than polysomnography, it is not the gold standard of sleep studies.⁵ Second, and perhaps most prominently, the size of the adult population sample was small. We had few patients with malingering enuresis included in the study. Further research with larger sample sizes that are suspected to malingering with greater frequency is

recommended to determine whether they are accurately identified by the diagnosis strategy.

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From the Sleep Research Center, Department of Psychiatry, (Khazaie, Tahmasian, Dabiry, Nikray, Rezaie L, Younesi), the Department of Urology (Moradi), the Department of Biostatistics (Rezaei M), Kermanshah University of Medical Sciences (KUMS), Kermanshah, Iran, and the Department of Psychology (Schwebel), University of Alabama, Birmingham, Alabama, United States of America. Address correspondence and reprint requests to: Dr. Habibolah Khazaie, Associate Professor of Psychiatry, Sleep Research Center, Department of Psychiatry, Farabi Hospital, Kermanshah University of Medical Sciences (KUMS), Dolatabad Blvd, PO Box 6719851151, Kermanshah, Iran. Tél. +98 (831) 8260700. Fax. +98 (831) 8264163. E-mail: hakhazaie@gmail.com

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