Behavioral Treatment for Nocturnal Enuresis

Patrick C. Friman and Kevin M. Jones

Abstract

Nocturnal enuresis is one of the most prevalent and distressing of all childhood problems. The treatment of nocturnal enuresis has shifted in the past few decades from a strictly psychopathological perspective to a biobehavioral perspective. Although the primary clinical features of this disorder are medical/organic, there is currently strong evidence for a behavioral treatment package consisting of the urine alarm and various skills-oriented components. Alternative devices, methods, and adjunctive components are reviewed and presented in the context of an optimal treatment plan.
KEYWORDS: Nocturnal Enuresis, Bed-wetting, Urine Alarm

Nocturnal enuresis (NE) is one of the most common of all childhood problems. Prevalence rates vary according to diagnostic criteria, but "frequent" bedwetting, defined as 6 or more episodes in the past year, occurs in approximately 5.5% of children aged 5 to 17 years (Byrd, Weitzman, Lamphear, & Auinger, 1996). For most of these individuals, bedwetting occurs at least twice per week. The need for treatment of NE predates modern civilization and the variety of techniques used in antiquity have been limited only by the imagination of the ancient therapists and their tolerance for inflicting unpleasantness on young children in order to possibly secure therapeutic gain. Penile binding, buttock and sacrum burning, and forced urine-soaked pajama wearing are among the many highly aversive treatments reported in a review of ancient approaches to NE (Glicklich, 1951). In fairness to the ancient therapists, the health-based consequences of prolonged NE during their time were severe, due to the limited means for cleaning bedding and ineffective methods for managing infection. The evolution of treatment for NE that began in earnest early in the 20th century abandoned the physically harsh treatments in favor of approaches that were more humane from a physical perspective but still problematic from a psychological one. Specifically, with the rise of Freudian psychodynamics came psychopathological characterizations of common childhood problems such as NE. Although more protected from harsh physical treatment than their ancestral peers, early twentieth century enuretic children were often subject to stigma, isolation, and other negative social consequences.

The advent of behavioral theory and the conditioning type treatments derived from it inaugurated a virtual paradigmatic shift in the treatment of NE. Specifically, behavioral theory rendered psychopathological interpretations obsolete and highly aversive physical treatments unnecessary. The cardinal conditioning type treatment for NE has been the urine alarm and, if not the first, certainly the foremost early user of it was Herbert Mower (Mower & Mower, 1938). Since the mid 1970's, psychological research on medically uncomplicated NE in children has been dominated by either the development of alternative behavioral procedures based on operant conditioning or improving urine alarm treatments (Houts, 2000; Mellon & McGrath, 2000). Controlled evaluations of the urine alarm indicate that this relatively simple device is 65 to 75% effective, with a duration of treatment around 5 to 12 weeks, and 6-month relapse rate of 15-30% (Butler, 2004). Most of this research has been conducted using the bed device and, more rarely, the pajama device.

Bed Devices

The urine alarm features a moisture sensitive switching system which, when closed by contact with urine seeped into pajamas or bedding, completes a small voltage electrical circuit and activates a stimulus theoretically strong enough to cause waking (e.g., buzzer, bell, light or vibrator). The device is placed on the bed or sewn into the pajamas (see Table 1 for sample alarms). The bed device typically involves two aluminum foil pads, one of which is perforated, with a cloth pad between them. The bed

pads are placed under the sheets of the target enuretic child's bed with the perforated pad on top. A urinary accident results in urine seeping through perforations in the top pad, collecting in the cloth pad, and causing contact with the bottom sufficient to complete an electrical circuit and activate a sound-based alarm mechanism. In principle, the awakened child turns off the alarm and completes a series of responsibility training steps associated with their accidents (Friman & Jones, 1998), such as completing urination in the bathroom, changing pajamas and sheets, and returning to bed. In practice, the alarm often alerts parents first, who then waken the child and guide them through the training steps.

Table 1.

Sample Urine Alarms

Device	Type	Manufacturer	Approximate Cost
Wet Stop	Pajama, buzzer	Palco Labs Santa Cruz, CA 800-346-4488	$65.00
Potty Pager	Pajama, buzzer	Ideas For Living Boulder, CO 800-497-6573	$49.95
Sleep Dry	Pajama, buzzer	Star Child Labs Aptos, CA 800-346-7823	$45.00
Malem Bedwetting Alarm	Pajama, various combinations of sounds and light	Bedwetting Store Olney, MD 800-214-9605	$74.95
Wet Call	Bed pad, buzzer	Bedwetting Store Olney, MD 800-214-9605	$84.95
Vibrating Enuresis Alarm	Pajama, vibrating	Enabling Devices Hastings on Hudson, NY	$58.95

Pajama Devices

Pajama devices are similar in function yet simpler in design. The alarm itself is either placed into a pocket sewn into the child's pajamas or pinned to them. Two wire leads extending from the alarm are attached (e.g., by small alligator clamps) on or near the pajama bottoms. When the child wets during the night, absorption of urine by the pajamas completes an electrical circuit between the two wire leads and activates the alarm. Wide ranges of stimuli are available for use with the pajama devices and include buzzing, ringing, vibrating, and lighting. In principle, as with the bed devices, the alarm is supposed to waken the child. In practice, the sound-based alarms sometimes alert parents first, who proceed to assist

the child through the steps mentioned above. The light and vibration based alarms have yet to be subjected to controlled evaluation and thus questions pertaining to whether they awaken parent or child, their effectiveness, and how they compare with sound-based alarms remain unanswered.

Child and Parent Focused Methods

Actual alarm use can be divided into different methods, depending on the primary management role of the child and parent. In the child-focused method, the alarm awakens the child, who independently completes the responsibility training procedure. In the parent-focused method the alarm awakens or alerts the parent, who awakens the child and guides them through the procedure. The training procedures vary across published accounts and guides, but generally include full arousal, going to the bathroom to complete (or attempt) urination, changing bedding and pajamas, resetting the alarm, and going back to bed. Parent-focused methods are obviously dependent on the saliency of the alarm stimulus, and with the bed device wire leads can be extended to the parent's auditory range (e.g., in their bedroom). For the pajama device, either a very loud alarm or periodic checking is necessary to allow parents to readily attend to accidents. Although it seems logical that no matter what method or device is used, reduced latency between onset of urination and awakening is best, no data are available to support this position.

Underlying Process

The mechanism of action in alarm treatment was initially described as classical conditioning, with the alarm as the unconditioned stimulus, bladder distention as the conditioned stimulus, and waking as the conditioned response (Mowrer & Mowrer, 1938). More recent literature emphasizes a negative reinforcement or avoidance paradigm (Friman, 1995; Friman & Jones, 1998) in which the child increases sensory awareness to urinary need and exercises anatomical responses (e.g., contraction of the pelvic floor muscles) that effectively avoid setting off the alarm (Mellon, Scott, Haynes, Schmidt, & Houts, 1997). Cures are obtained slowly; however, and during the first few weeks of alarm use the child often awakens only after voiding completely. The aversive properties of the alarm, however, inexorably strengthen those skills necessary to avoid it.

Evidence of Effectiveness

Reports of controlled comparative trials show the alarm-based treatment is superior to drug treatment and other non-drug methods such as retention control training. In fact, numerous reviews of the literature show its success rate is higher and its relapse rate lower than any other method (Doleys, 1977; 1995; Friman & Jones, 1998; Houts, Berman, & Abramson, 1994). One problem with interpreting the review literature on alarm treatment is that adjunctive components are often added to improve effectiveness, resulting in treatment "packages" such as dry bed training (Azrin, Sneed, & Foxx, 1974) or full spectrum home training (Houts & Liebert, 1985).

Contraindications and Initial Concerns

Prior to beginning alarm-based treatment, the child therapist should ensure that a physician has evaluated the enuretic child. Although fewer than 10% of NE cases have pathophysiological causes such as diabetes or urinary tract infections (Houts et al., 1994), alarm treatment for incontinence caused by them may be contraindicated. When organic complications are ruled out, age, developmental level, and motivation levels are cardinal concerns. For example, clinical treatment is not recommended until enuretic boys are at least seven years old or until girls are at least five years old. The difference in ages is due to the lower incidence of NE, higher motivation, and advanced maturation in enuretic girls versus boys. If the enuretic child is not motivated, treatment should be suspended for six months, with follow-up scheduled with the child and family again at that point. In every case, the history of punishment for accidents should be assessed and a verbal commitment obtained by parents, while all are present, to never

again punish or even criticize the child for having one.

Another issue pertains to whether enuretic children are more difficult to awaken than their nonenuretic peers. Enuresis is considered a parasomnia or a manifestation of sleep disturbance by some sleep researchers, and as an outcome of deep sleep by many parents (Friman & Jones, 1998). Generally, findings from studies are mixed and marred by experimental limitations (e.g., sleep stages are not established). A recent study with 15 enuretic boys and 18 controls addressed this problem by employing sleep EEGs and auditory tones delivered via earphones. During 512 arousal attempts enuretic children awoke 8.5% of the time compared to 39.6% of the time for controls (Gellis, 1994). Thus the common parental complaint about bed wetting children who are difficult to awaken may have an empirical basis. Still, sleep dynamics have not been established as a cause of enuresis. Wetting episodes occur in all stages of nonrapid eye movement (NREM) sleep and the probability of their occurrence appears to be a function of the amount of time spent in each stage. Enuretic episodes also rarely occur during REM sleep, therefore thematically related dreams (e.g., dreaming of urinating) may be a result rather than a cause of wetting.

Methods for Augmenting Alarm Treatment

Retention control training (RCT). RCT expands functional bladder capacity by increasing a child's capacity to forestall and thus increase the volume of their urinations. Training requires that children drink extra fluids (e.g., 16 oz of water or juice), notify parents of the urge to urinate and delay urination as long as possible. Parents should establish a regular time for RCT each day, and conclude the training at least a few hours before bedtime. Progress can be assessed by monitoring the amount of time the child is able to delay urination and/or the volume of urine they are able to produce in a single urination (Friman, 1986, 1995; Friman & Jones, 1998). Either or both can be incorporated into a game context wherein children earn rewards for progress.

Overlearning. An adjunct related to RCT involves overlearning. Like the RCT procedure, this method requires that children drink extra fluids – but just prior to bedtime. Overlearning is an adjunctive strategy only, and is used to enhance the maintenance of treatment effects established by alarm-based means. Thus, it should not be initiated until a dryness criterion has been reached (e.g., seven dry nights; Houts & Liebert, 1985).

Kegel/stream interruption exercises. Kegel exercises involve purposeful manipulation of the muscles necessary to prematurely terminate urination. Originally developed for stress incontinence in women, a version of these exercises called stream interruption is often used in NE treatment packages (e.g., Friman, 1995; Friman & Jones, 1998). For children, stream interruption requires initiating and terminating urine flow at least once a day during a urinary episode. "Dry practice" or actual Kegel exercises can be practiced far more frequently once the child has learned to detect and manipulate the requisite musculature while conducting stream interruption. Dry contraction of pelvic musculature consists of the child "holding" a contraction for 5 to 10 seconds, followed by a 5-s rest, at least 10 times on three separate occasions per day (Schneider, King, & Surwitt, 1994).

Paired associations. Paired associations involve pairing stream interruption with the urine alarm in a reward-based program (Friman, 1995; Friman & Jones, 1998). In one version, the parent stands outside the bathroom door with the alarm and activates it two or three times while the child urinates, whereupon the child practices stream interruption. The parent can also use the alarm to cue Kegel (dry practice) exercises. Alternatively, the parent can make an audiotape of the alarm that when played intermittently would allow the child to practice alone with stream interruption and/or Kegel exercises. To establish and maintain motivation, the parent should use praise and a reward system, described in the next section.

Reward systems. Contingent rewards alone are unlikely to cure NE, but they may be critical in

sustaining a child's motivation to participate in treatment, especially when the system reinforces success in small steps. An example involves a dot-to-dot drawing and a grab bag (Friman, 1986; 1995; Friman & Jones, 1998), wherein the child identifies an affordable and desirable prize and the parent draws (or traces) a picture of it using a dot-to-dot format, with every third or fourth dot larger than the others. The child is allowed to connect two dots for each dry night and each time the line reaches a larger dot, they earn access to a grab bag with small rewards (e.g., small toys, edibles, money, privileges, special time with parents). When all dots are connected, the child earns the prize. This system may also be used to motivate participation in other components of a package program (e.g., paired associations).

Waking schedule. This treatment component involves waking the child prior to accidents and guiding them to the bathroom for urination. Results obtained are attributed to a change in arousal, increased access to the reinforcing properties of dry nights, and increased awareness of urinary urge in lighter stages of sleep. Several schedules are possible, a minimally effortful example of which involves waking the child just before the parents go to bed and systematically waking them one-half hour earlier on nights following several successive dry nights, until the child awakens to urinate without assistance (Friman, 1986; 1995; Friman & Jones, 1998; Houts & Liebert, 1985).

Self-monitoring. Self-monitoring provides data that can be used to evaluate progress. One simple method for monitoring NE merely requires the child to record on a calendar whether the previous night was wet or dry. A more complex and more sensitive method involves placing tracing paper over the stain resulting from an accident and tracing the outline of the stain. Next, the tracing paper is placed over a grid, and the number of squares inside the area is recorded (Friman, 1986, 1995). Beyond progress monitoring, charting these data and setting goals may have the additional therapeutic benefit of reactivity: The direction of change is determined by the valence of the behaviors that are monitored (e.g., behaviors viewed negatively are reduced).

Visual sequencing. This procedure involves mentally rehearsing nightime continence skills. Although its empirical support is still at the successful case-report stage, visual sequencing is often included in multicomponent treatment plans (Friman & Warzak, 1990). The procedure involves visualization of the behavioral sequences leading to nocturnal continence. The sequence includes detection of urgency and subsequent contraction of the pelvic floor muscles, followed by either (a) holding urine throughout the night or (b) rising and going to the bathroom. The terminal step in the sequence will likely depend on whether holding urine throughout the night, based on the child’s immediate skill level, is a realistic goal. The procedure can be taught and rehearsed in the office. First, the child is asked to sit in a comfortable chair, take three to four deep breaths, close their eyes, and relax fully. Next, the therapist discusses each detail of what will happen at night while asking the child to focus on a mental picture of the details (Friman, 1995; Friman & Jones, 1998).

Responsibility training. All of the skill-based components mentioned thus far (e.g., RCT, paired association) are designed to promote a mature voiding repertoire in the child (Ferber, 1989). To be consistent with this goal, the child should be treated in a way that promotes independence and responsibility. For example, a child should not be left in diapers at night. Rather, the enuretic child should be assigned reasonable household responsibilities associated with their accidents. In younger children this may merely mean bringing their sheets to the laundry basket. Older children, however, should be expected to actually launder sheets and clothing. These responsibilities should not be presented as a punishment but as a correlate of increased responsibility and a demonstration of the parent's confidence in and respect for their maturing child (Friman, 1995; Friman & Jones, 1998; Houts & Liebert, 1985).

Medication. There are two primary drugs used for treatment of NE, imipramine and DDAVP. The former is a tricyclic antidepressant that represents one of the most frequently prescribed drug treatments for NE, although its mechanism for reducing bed-wetting is not clear. Somehow, imipramine makes the bladder less sensitive to filling and thus allows it to hold more urine before urinary urge

(Stephenson, 1979). Synthetic antidiuretics such as DDAVP concentrate urine, thereby decreasing urine volume and intravesical pressure. Due to alarming reports of the potential cardiotoxic effects of imipramine overdose (e.g., Herson, Schmitt, & Rumack, 1979) and other side effects of imipramine, DDAVP has emerged as the most preferable adjunct to treatment (Friman & Jones, 1998).

It is imperative that therapists carefully consider several important issues related to any medication treatment of NE. First, the use of medication does not teach continence skills and may, in fact, diminish sensory awareness and thus reduce opportunities to practice needed responses. In some cases, medications may actually interfere with continence skill training programs (Houts, Peterson, & Liebert, 1984). Once withdrawn, there is a high rate of relapse (Friman & Jones, 1998), so the primary therapeutic gain from medication appears to be a respite from wetting episodes that may allow the enuretic child and family a temporary semblance of normality. Second, it is clear that psychological treatments are generally more effective than pharmacological ones, especially when one considers evidence of *cure* rate (Houts et al., 1994). Past reviews have indicated that research on psychological treatments has typically defined success in terms of the cessation of bed-wetting (e.g., 14 consecutive dry nights), while research on pharmacological treatments has focused on reducing the frequency of bed-wetting episodes. If the goal of treatment is to cure (rather than manage) enuresis, research on psychological treatments have been more closely aligned with this clinical outcome.

Despite its superior efficacy, the urine alarm has only recently gained acceptance in the medical community. A recent survey indicated that physicians recommend this treatment for 80% of enuretic cases, compared to only 5% in prior studies (Vogel, Young, & Primack, 1996). This same survey indicated, however, that medication continues to be recommended for more than half of cases. Although drugs should not be used as a primary treatment (Friman, 1986, 1995; Friman & Jones, 1998), one advantage of medication is that the effects, when they occur, are often established the night they are ingested and thus can be used to improve a child's chances of having an isolated "dry night" while on a sleep over or at camp. Obviously a physician's assistance would be necessary to add these drugs to a treatment plan.

Sample Treatment Plan

A sample treatment plan is presented in Table 2. During the assessment phase (Steps 1 – 4), the initial concern is to obtain a history of wetting episodes. There is some evidence that children who wet less frequently and children who wet only at night have a better prognosis (Houts et al., 1994), although the type of enuresis (primary or secondary) does not appear to moderate treatment outcomes. Next, the therapist provides information about enuresis, including the most effective parental response to accidents. For example, the child and parents should be informed that numerous other children, many probably in the child's neighborhood and school, also experience NE. With the child in attendance, the therapist should tell the parents to avoid blaming or shaming the child for wetting. The therapist should then enthusiastically solicit the child's cooperation in treatment and work with the child and family on a treatment plan. No direct treatment is planned until a medical examination is completed and pathophysiological variables are ruled out (Friman, 1986, 1995).

Table 2.

Sample Treatment Plan

Assessment
1. Have physician rule out pathophysiology.
2. Begin initial data collection (e.g., for two weeks prior to first visit).
3. Assess developmental and motivational readiness.
4. Eliminate punishment.

Treatment Planning
5. Establish a trial treatment period (e.g., 3 months).
6. Parent and child select alarm type.
7. Instruct parent to purchase alarm (see Table 1) and protective bed covering.
8. Negotiate for inclusion of adjunctive treatment components with special emphasis on the waking schedule, reward system, and responsibility training.
9. Instruct parent and child to conduct daytime practice of nighttime procedures.

Progress Monitoring and Evaluation
10. See parent and child at least once per month for three months.
11. If progress is limited, negotiate for additional adjunctive components with special emphasis on retention control training and stream interruption.
12. When initial dryness goal is achieved (e.g., one week) add in overlearning component.
13. When 14 consecutive days of dryness have been achieved, discontinue alarm and overlearning.

Address relapses by revisiting steps 4 through 13.

Treatment planning, described in steps 5 – 9, consists of establishing a trial treatment period, the selection and purchase of necessary materials, and the negotiation of treatment components such as daytime practice. The number and selection of treatment components should be based on the provider's assessment of child readiness, child and parent willingness, and family resources, but it is recommended that primary elements include waking schedule, reward system, and responsibility training. These components in the plan can be "titrated" over time in accord with family resources and motivation until cure is obtained. For example, a two-parent, one-wage earner middle-income family with a motivated 10 year-old bed-wetting child whose parents are also motivated could be started out on an alarm-based package that also includes all three adjunctive components. In subsequent weeks, as the child and parents gain facility with the initial alarm package, other treatment components could be added as needed, along with a small prescription of (DDAVP or imipramine) for sleep-overs or campouts.

Families with fewer resources or less motivation to conduct treatment may be given only the alarm until they succeed with it, the home situation changes in a way that favors more complex treatment, or the child’s and/or parent’s motivation heightens. In the rare case in which the child is motivated but the parents are much less invested, only the treatment components that can be independently completed by the child should be prescribed. Unfortunately, this may preclude use of the alarm either because the parents are not willing to purchase one or because the child is not capable of using it without assistance. If an alarm can be obtained, however, older children or sophisticated younger children may be able to master independent use with minimal training provided by the therapist. If not, treatment components that can readily be performed independently may be prescribed (e.g., stream interruption, self-monitoring, urine retention, possibly a waking schedule). The chances for cure are less likely when fewer components are used (especially if the alarm is not used) but still higher than if no treatment were used. Furthermore, the active involvement of the child may lead to increased involvement by the parent, at which point the provider could add more components.

Treatment planning concludes with progress monitoring and evaluation, described in steps 10 – 14. If progress is limited, additional adjunctive components may be added, with primary emphasis on retention control training and stream interruption. When 14 consecutive days of dryness have been achieved, the alarm may be discontinued. As with most enuretic treatments, the potential for relapse is serious concern and follow-up contact should be a routine element of treatment plans.

Conclusions

Bedwetting is the third most distressing experience reported by children, exceeded only by divorce and parental fights (Van Tijen, Messer, & Namdar, 1998). Left untreated, NE will likely persist for years and, in some cases, into young adulthood, with considerable negative social consequences and disruption of family life. Urine alarm treatment is an easily used, highly effective method for treating one of the most prevalent and chronic of all childhood problems. It represents an enormous breakthrough for enuretic children because it does not involve the physically aversive experiences typical of ancient treatments, its effectiveness undermines the historical psychopathological characterization of NE, and it eliminates much of the expense, high relapse, and potential side effects of medication treatment. Furthermore, its effectiveness can be enhanced by combining the alarm with various adjunctive treatment components (Houts et al., 1994). At this point in the evolution of alarm-based treatment, it seems safe to assert that it should be part of the armamentarium of every child therapist seeing children with NE and if it is not, it seems appropriate to pointedly ask why.

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Address correspondence to:

Patrick C. Friman, Ph.D., ABPP
Clinical Services,
Youthcare Building
Girls and Boys Town, NE 68010
frimanp@boystown.org