

# Empirically Supported Treatments in Pediatric Psychology: Nocturnal Enuresis

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**Objective:** To review the medical and psychological literature concerning enuresis treatments in light of the Chambless criteria for empirically supported treatment.

**Method:** A systematic search of the medical and psychological literature was performed using Medline and Psychlit.

**Results:** Several review studies and numerous well-controlled experiments have clearly documented the importance of the basic urine alarm alone as a necessary component in the treatment of enuresis or combined with the “Dry-Bed Training” intervention, establishing them as “effective treatments.” Other multi-component behavioral interventions that also include the urine alarm such as “Full Spectrum Home Training” have further improved the outcome for bed-wetters, but are classified as “probably efficacious” at this time because independent researchers have not replicated them. Less rigorously examined approaches that focus on improving compliance with treatment or include a “cognitive” focus (i.e., hypnosis) warrant further study.

**Conclusions:** We recommend a “biobehavioral” perspective in the assessment and treatment of bed-wetting and suggest that combining the urine alarm with desmopressin offers the most promise and could well push the already high success rates of conditioning approaches closer to 100%. Much important work is yet to be completed that elucidates the mechanism of action for the success of the urine alarm and in educating society about its effectiveness so that its availability is improved.

**Key words:** nocturnal enuresis; biobehavioral treatment; urine alarm; cognitive treatments.

Of the treatment areas reviewed in this special series regarding “Empirically Supported Treatments,” the enuresis literature may most clearly depict psychological treatments with demonstrated efficacy. Our understanding of this common childhood problem results from several factors: (1) the prevalence of the problem, (2) the conceptualization of enuresis as a bio-behavioral problem, and (3) the breadth and

depth of the empirical research concerning psychological and behavioral treatments. Thus, pediatric psychologists can now confidently advocate the urine alarm in the optimal management of nocturnal enuresis. However, there is a paucity of research on the mechanisms of action explaining the urine alarm treatment and other alternative yet promising interventions that may lead to the development of even more effective management of this disorder.

Consistent with the theme of this special series, this review applies the “Chambless criteria” (Task

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Force on Promotion and Dissemination of Psychological Procedures, 1995) to the psychological treatment outcome literature for enuresis. We briefly describe the problem of bed-wetting, including incidence and etiology. Because of the physiological aspects of enuresis, we also note proper medical assessment and treatment. Finally, we suggest that future enuresis research focus on the mechanism of action for the enuresis alarm and public health policy.

The student of the enuresis literature is aware that the systematic study of this disorder dates to the first half of the twentieth century, with the majority of well-controlled psychological interventions beginning in the 1960s. During the last thirty years there have been nearly 70 well-controlled outcome studies on psychological and behavioral interventions, in addition to numerous others with less methodological rigor. Because of the challenge of summarizing this extensive literature, the content of this article includes those studies that fit the "Chambless criteria" categories and either highlight important treatment contributions or promising interventions. The term "psychological treatments" is used broadly in this discussion and denotes non-medical approaches to the treatment of nocturnal enuresis such as learning-based interventions, cognitive therapies, and hypnosis. The discussion details relevant differences in these approaches

### **Description of the Problem**

Nocturnal enuresis is defined as repeated urination into bed or clothes, occurring twice per week for at least 3 consecutive months (or the wetting produces clinically significant distress), in a child of at least 5 years of age and not due to either a drug side effect or a medical condition (American Psychiatric Association, 1994). Because there appears to be a greater incidence of medical problems in daytime wetting (Arnold & Ginsberg, 1973; Loening-Baucke, 1997; Schmitt, 1982), thus implying a different etiological pathway than that for nighttime wetters, this discussion focuses on monosymptomatic nocturnal enuresis. However, the pediatric psychologist may still be called upon to consult with physicians and should be aware of the greater medical complications associated with daytime wetting problems.

Children with daytime enuresis have a higher incidence of urinary tract abnormalities such as incomplete bladder emptying, fractionated voiding curve, and marked structural or functional disorders

(Jarvelin, 1989; Jarvelin, Huttunen, Seppanen, Seppanen, & Moilanen, 1990; Jarvelin et al., 1991). These physiological complications with the daytime enuretic child have appropriately required an emphasis on medical treatments such as medications and surgery (see reviews by Rushton [1995] and Van Gool, Vijverberg, & De Jong [1992] for managing daytime enuresis), and psychological interventions play only a complementary, minor role (e.g., scheduled voiding, biofeedback for bladder-sphincter dyssynergia, hypnosis).

Although the reported prevalence of enuresis varies (De Jonge, 1973), it is conservatively estimated that about 10% of school-age children (i.e., 5–16 years old) wet their beds, with most of them doing so every night (Essen & Peckham, 1976; Fergusson, Horwood, & Shannon, 1986; Jarvelin, Vikevainen-Tervonen, Moilanen, & Huttunen, 1988; Verhulst et al., 1985). Epidemiology studies show that the prevalence of enuresis declines with age, often leading professionals to conclude that the child will eventually outgrow the problem (Haque et al., 1981; Shelov et al., 1981). Although the spontaneous remission rate is estimated to be 16% per year, cessation of bed-wetting without treatment can take several years (Forsythe & Redmond, 1974). Less than 10% of enuretics have physical abnormalities of the urinary tract (American Academy of Pediatrics Committee of Radiology, 1980; Jarvelin et al., 1990; Kass, 1991; Redman & Seibert, 1979; Rushton, 1989; Stansfeld, 1973) that would lead to the symptoms of night wetting. Bed-wetting appears to have a strong genetic component, and enuretic children may show signs of delayed maturation of the nervous system (Jarvelin, 1989; Jarvelin et al., 1991).

The variability in the etiological explanations for enuresis manifests the heterogeneity in the disorder. Heritability, inadequate nocturnal secretion of anti-diuretic hormone, inadequate learning history, neurological delays, difficulty in sleep arousability, and emotional problems are the more common etiological explanations reported, but their discussion is beyond the scope of this article. The reader is directed to reviews by Houts (1991) and Mellon and Houts (1998) for a broader discussion of enuresis etiology.

### **Assessment of Nocturnal Enuresis as a "Biobehavioral" Problem**

The conceptualization of enuresis as a "biobehavioral" problem was perhaps most clearly articulated

by Houts (1991), who contended that enuresis is clearly a physical problem but one whose optimal management is through learning-based treatments of either conditioning or operant methods (see Azrin, Sneed, & Foxx, 1974; Lovibond, 1964) that may alter the underlying physiological mechanisms that cause or maintain the problem. However, Houts (1991) further indicated that work is now needed to investigate the physiological mechanisms of action for these behavioral treatments through collaboration between medical and behavioral researchers. Maximum treatment effectiveness for enuresis will result only through this collaboration during the assessment and treatment process.

The biobehavioral perspective for enuresis also strongly mandates proper medical assessment procedures at the outset of intervention. Pediatric psychologists are particularly sensitive to the importance of our patients' overall physical health as we endeavor to care for them, especially as we treat nocturnal enuresis. The medical screening should focus attention on a differential diagnosis that would rule out diseases of the urinary tract (cystitis, pyelonephritis, and diabetes) that would lead to the incomplete processing of urine resulting in excessive urination. Careful history taking would review family history of diabetes or kidney problems, dramatic weight changes, and excessive eating, drinking, or urination.

The basic physical exam would include a urinalysis and urine culture, as 5% of males and 10% of females will have urinary tract infections (Stansfeld, 1973) that will require antibiotic treatment prior to bed-wetting interventions. Because previous research utilizing invasive medical assessment procedures (i.e., cystoscopy, voiding cystourethrogram) has led to the identification of structural abnormalities (i.e., obstructions, reflux, or lesions) in only 2% to 5% of monosymptomatic nocturnal enuretics, these are no longer routinely recommended (American Academy of Pediatrics Committee on Radiology, 1980). Even so, the psychologist should not ignore the possibility of an active urinary tract infection or structural abnormalities in children with nocturnal enuresis (Jarvalin et al., 1990), for this would be a failure to meet accepted standards in care (Behrman & Kliegman, 1998; Schmitt, 1997).

The primary goal of the psychological assessment is to determine whether the patient and family can implement a relatively demanding behavioral intervention such as the urine alarm. The basic urine alarm approach, or one combined with other behavioral procedures, requires a substantial invest-

ment of time and energy from the child and parents. Factors associated with poor outcome or dropout with urine alarm treatment are family history of enuresis, prior failed treatment experiences, parental attitudes and beliefs, family and home environment, behavioral problems, and the child's current wetting pattern. For a thorough discussion of assessment issues, see Mellon and Houts (1995). Pediatric psychologists should be aware that stressful situations within the family (i.e., marital problems, psychiatric problems, externalizing problems of the child, extreme parental intolerance of the wetting, or complacency) have been reported to reduce the cooperation necessary to implement behavioral treatment long enough to be effective (Butler, Redfern, & Holland, 1994; Fielding, 1985; Morgan & Young, 1975).

Combining reliable screening questionnaires with a careful clinical interview of the child and parents helps the pediatric psychologist conduct the assessment more efficiently. Questionnaires such as the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1991), Locke-Wallace Marital Adjustment Test (MAT; Locke & Wallace, 1959) and the Symptom Checklist (SCL-90-R; Derogatis, 1977) are useful in identifying psychosocial problems that may need to be prioritized for intervention prior to the initiation of urine alarm treatment. Experiencing a treatment failure is likely to add to the already diminished self-efficacy associated with a child's bed-wetting (Moffatt, 1989).

### **Biobehavioral Treatments for Nocturnal Enuresis**

The modern history of biobehavioral interventions for nocturnal enuresis has evolved similarly to other psychological treatments from the dominance of verbal psychotherapies, such as psychoanalysis during the early to mid-1900s, to the prominence of learning-based approaches, such as the urine alarm and Dry-Bed Training (Azrin, Sneed, & Foxx, 1974; Lovibond, 1964) in the 1960s to the present, and finally to more cognitive and cognitive-behavioral approaches such as Self-Control Therapy (Ronan, Wozner, & Rahav, 1992) and hypnosis (Edwards & Van Der Spuy, 1985; Olness, 1975) from the 1970s to the present.

Houts, Berman, and Abramson (1994) recognized this evolution and logically categorized psychological approaches for nocturnal enuresis as (1) "basic urine alarm treatment," (2) "urine alarm

combined with other behavioral procedures," (3) "behavioral procedures without the urine alarm," and (4) "verbal psychotherapies." Houts et al. stressed the dominance of the first two interventions in the treatment outcome literature, and, thus, the strongest conclusions can be drawn regarding these interventions. In fact, of the 44 published articles that met Houts et al.'s (1994) strict inclusion criteria (i.e., randomized designs, only ordinary enuretics, studies with quantifiable outcome measures at posttreatment and/or follow-up, randomized crossover designs that must report separate outcomes for treatments before crossing over, and interventions that must have at least four published studies), 36 involved either the urine alarm alone or combined with other behavioral procedures. Although the urine alarm approaches were found to be clearly superior to pharmacological treatments, psychological interventions without the urine alarm, and no-treatment controls, restricted sample sizes prevented advocating approaches utilizing the urine alarm combined with behavioral procedures over basic urine alarm treatment alone.

Caution is recommended in reviewing the treatments' definitions for outcome variables. For example, the literature has used clear operational definitions of "cure," such as 14 consecutive dry days (Houts, Peterson, & Whelan, 1986), and more vague terms such as "positive responder," which includes both children who have remitted completely or had a reduction in wetting (Banerjee et al., 1993). This variability in measuring outcome makes it difficult to draw comparisons across different interventions. The reader will also notice that "learning-based" psychological treatments tend to use unambiguous definitions for dependent measures. Readers can use the known spontaneous remission rate in nocturnal enuresis of 16% per year as a simple evaluation tool in reviewing the adequacy of treatments described in this article.

The studies included in Appendix I use variable approaches to treating nocturnal enuresis. However, they are all based on the behavioral principles of classical conditioning and operant learning. Not all fit the "Chambless criteria." The only interventions that clearly fit the criteria of an "efficacious treatment" are the multicomponent behavioral approach called *dry-bed training* by Azrin, Sneed, and Foxx (1974) and the use of the basic urine alarm, which is also included as part of dry-bed training. Eight studies in Appendix I involved dry-bed training (all incorporating the urine alarm) with an aver-

age success rate of 75.3% cured (i.e., complete cessation of wetting) and generally occurring in less than 4 weeks. Dry-bed training stresses an operant approach to treating enuresis and has been described in detail in a self-help book (Azrin & Besalel, 1979). This approach includes a waking schedule to shape the child's wakefulness, positive practice and cleanliness training to punish the bed-wetting, and the urine alarm. However, it has been reported that dry-bed training without the urine alarm reduces its effectiveness (Bollard & Nettlebeck, 1981; Keating, Butz, Burke, & Heimberg, 1983). In addition, concerns have been raised about the severe demands of the waking schedule and positive practice with dry-bed training upon the child and family (Mellon & Houts, 1998).

The basic urine alarm approach (i.e., bell and pad method or body worn alarms that are activated with urination during sleep) alone has well-supported efficacy, in addition to studies that demonstrate greater effectiveness than other forms of therapy such as verbal psychotherapy or medications (De Leon & Mandell, 1966; Wagner, Johnson, Walker, Carter, & Wittner, 1982; Willie, 1986). Predictor variables of treatment success and subsequent positive emotional effects of urine alarm treatment are now known (Fielding, 1985; Moffatt, Kato, & Pless, 1987; Sacks, De Leon, & Blackman, 1974). Finally, the first scientific reports of the effectiveness of the urine alarm treatment and researchers' concerns for psychoanalytically predicted treatment side effects (i.e., symptom substitution) further indicate the depth of scrutiny this approach has undergone (Mowrer & Mowrer, 1938; Sacks et al., 1974). The average success rate for basic urine alarm treatment listed in Appendix I is 77.9% cured.

The urine alarm treatment represents a treatment that has held up to extensive scientific inquiry. Ample explanations unambiguously define "what" the treatment is, whether it has a reliable and positive treatment effect and clearly defined outcome variables, whether it is better than other standard treatments, and which process variables are involved in treatment outcome. In other words, the broad inquiry into the urine alarm treatment supports conclusions in these studies.

Several studies in Appendix I combine basic urine alarm treatment with other behavioral interventions (Butler, Brewin, & Forsythe, 1988; Fielding, 1985; Geffken, Johnson, & Walker, 1986; Houts, Liebert, & Padawer, 1983; Van London, Van London-Barentsen, Son, & Mulder, 1993; Wagner,

Johnson, Walker, Carter, & Wittner, 1982; Whelan & Houts, 1990). Although they include the urine alarm, which is considered an "efficacious" treatment, the combinations are classified as "probably efficacious" because they have not been standardized in a manual, or researched by different investigators, or compared with other standard treatments. However, these studies report an average success rate of 79.2% cured.

One such multicomponent treatment approach, which includes the urine alarm and other measures to reduce treatment time and relapse, is known as *Full Spectrum Home Training* (Houts & Leibert, 1984) and was designed to be easy to use. The other treatment components include retention control training with monetary rewards, cleanliness training, self-monitoring of wet/dry nights, and a graduated overlearning procedure. Two experiments with full spectrum home training in Appendix I indicated an average success rate of 78.5% cured, occurring within 8 to 16 weeks. Although full spectrum home training has demonstrated efficacy under scientifically rigorous conditions and is manualized, it would be classified as a "probably efficacious" multicomponent treatment simply because it has only been studied by one research group at the University of Memphis. The advantage of the multicomponent treatment approaches, such as full spectrum home training, over basic urine alarm treatment alone and/or dry-bed training is the inclusion of components intended to reduce relapse after successful treatment and to be less demanding than dry-bed training on the child and family. Although these goals appear to have been successfully achieved, further research is clearly needed.

Appendix II lists those approaches to treating enuresis that appear to be "promising" but lack the experimental rigor and depth of research that is exemplified in the approaches utilizing the urine alarm and required by the Chambless criteria. The predominant psychological approach to the treatment of nocturnal enuresis is hypnosis. This approach typically involves an induction phase achieved through relaxation to create a "trance state," followed by the use of suggestions by either the therapist or patient through "self-hypnosis" to achieve urinary continence. Of the four studies in Appendix II using hypnosis for treating nocturnal enuresis, the average success rate is 71.2% cured, achieved in fewer than six 1-hour sessions (Banerjee, Srivastav, & Palan, 1993; Edwards & Van Der Spuy, 1985; Olness, 1975; Stanton, 1979). However,

only Edwards and Van Der Spuy (1985) conducted a controlled experiment using quantifiable outcome measures (i.e., written record of wetting). Unfortunately, the treatment success was reported only as a reduction in wetting frequency and not number of subjects completely remitting their wetting. This makes the outcome difficult to compare to other treatments.

The remaining studies included in Appendix II are nonurine alarm behavioral approaches that target waking schedules during the night (Luciano, Molina, Gomez, & Herruzo, 1993; Rolider & Van Houten, 1986); or a cognitive-behavioral approach targeting the enuretic child's irrational beliefs that cause and maintain the wetting (Ronen, Wozner, & Rahav, 1992). However, the findings are limited due to the utilization of uncontrolled designs or single-case methodology. Similar to hypnosis, the mechanisms of action that explain the success of these interventions are inadequately defined.

Appendix III includes those studies that have systematically investigated subcomponents of dry-bed training or full spectrum home training as a means of improving outcome. Also described are important modifications of the urine alarm treatment based on learning theory that, in turn, lend further support to the effectiveness of the basic urine alarm approach to treating nocturnal enuresis. For example, Appendix III includes four studies that have systematically manipulated variables of conditioning with the urine alarm to explore the effect on treatment outcome. A delay in the onset of the alarm following an enuretic event has led to significantly fewer cures than an alarm that sounds immediately after a wet (Collins, 1973; Wagner & Matthews, 1985). However, an intermittent schedule of alarm activation (e.g., 70% of wetting events activate the alarm) reduces the relapse rate following successful treatment (Finley, Besserman, Bennett, Clapp, & Finley; 1973). Increased alarm volume not only led to more cures but also contributed to less wetting during treatment for children who progressed more slowly (Finley & Wansley, 1977).

The investigation of process variables and components analysis in full spectrum home training has demonstrated the importance of professional versus filmed presentation and shown that prevention of relapse through overlearning procedures is preferable, as successful re-treatment following a relapse is less likely (Houts et al., 1986; Houts, Whelan, & Peterson, 1987). Similarly, Nettlebeck and Lange-

luddecke (1979) have demonstrated the necessity of the urine alarm in dry-bed training, as its absence is associated with reduced success.

Appendix IV was included to emphasize the importance of the biobehavioral perspective to treating nocturnal enuresis in which more medically oriented approaches alone or combined with the urine alarm are used. We believe that combined medical/psychological approaches truly represent the most promising interventions for children with nocturnal enuresis, but significantly more research has yet to be completed. The greater efficacy of the urine alarm, or other psychological approaches combined with the urine alarm versus medication alone, is clearly reported by Houts et al. (1994). Combining medications, such as desmopressin (i.e., DDAVP), with the urine alarm may address the problems of delayed response to conditioning treatment and multiple wetting reported by Houts (1991) and Mellon and Houts (1998). The urine alarm combined with DDAVP contributed to significantly fewer wet nights during a 6-week trial compared to the urine alarm with a placebo (Sukhai, Mol, & Harris, 1989). This finding of the combination of DDAVP and the urine alarm was further extended by Bradbury and Meadow (1995), who reported significantly more children being successfully treated with less wetting during the treatment period than those using the urine alarm alone (i.e., 75% vs. 46%). Further, this outcome was even more pronounced in children with severe wetting (i.e., 67% vs. 32%) and families with child behavioral problems (i.e., 81% vs. 29%).

A little-understood physical condition that appears to be related to the onset and maintenance of enuresis, but more so with daytime wetting, is the effect of functional constipation. Simply treating nocturnally enuretic children who are also constipated with a standard constipation intervention including enemas, suppositories, more dietary fiber, and scheduled toileting has been reported to have an average cure rate of 72% after several months of treatment (Loening-Baucke, 1997; O'Regan, Yazbeck, Hamberger, & Schick, 1986). The exact mechanism of action that leads to a cessation of bed-wetting in constipated children is as yet unknown and may represent a subset in a heterogeneous population of bed-wetters. Clearly, randomized, prospective research is needed. The constipation may lead to a weakening of the urinary sphincter or reduce the strength of the signal indicating the need to urinate in a "signal-to-noise" conceptualization of urinary continence.

## Conclusions and Recommendations for Future Intervention Research

Pediatric psychologists are now able to strongly conclude that, for successful treatment of simple nocturnal enuresis, the urine alarm must be present. We need no longer debate whether the urine alarm is effective in altering the course of nocturnal enuresis, thanks to several important review studies (Doleys, 1977; Houts et al., 1994; Johnson, 1980; Moffatt, 1997). However, further work must be done to better delineate the patient characteristics that predict a better outcome with the urine alarm or the urine alarm combined with other treatments. We propose that psychosocial and/or physiological variables that interfere with effective implementation of urine alarm treatment must be better understood to improve overall outcome, as enuresis appears to involve several etiological pathways within a heterogeneous population.

For example, how the child construes the problem of bed-wetting appears to be predictive of not only successful treatment but also relapse (Butler et al., 1990; Butler, Redfern, & Holland, 1994). The role of physical conditions such as nocturnal polyuria (see Norgaard, Rittig, & Djurhuus, 1989), constipation (see Loening-Baucke, 1997) and maturational delays in nervous system development (see Ornitz, Hanna, & de Traversay, 1992) will also need to be understood in the context of the learning theory-based explanation for the effectiveness of the urine alarm from a biobehavioral perspective.

Notably, since Mowrer's and Mowrer's (1938) classical conditioning conceptualization of the urine alarm and Lovibond's (1964) extension with an avoidance learning model, there has been a scarcity in the empirical study of the exact mechanism of action for the success of this approach. The necessary preliminary work has only recently been initiated (Mellon, Scott, Haynes, & Schmidt & Houts, 1997) and may well allow us to push the already impressive success rates of the urine alarm closer to 100%. Further, the role of arousability from sleep and responsiveness to stimuli during sleep (either internal or external) may explain the mechanism of action for the urine alarm. As our understanding of enuresis as a biobehavioral problem grows, we may well discover that this effort will lead to the fruitful application of this knowledge to other problem areas addressed by pediatric psychologists.

For those psychological treatments that do not use the urine alarm, such as hypnosis, cognitive-behavioral therapy, and contingency management,

further well-controlled research is sorely needed. We have characterized these approaches as “promising” because of the comparable estimates of successful outcome with significantly less time involved in treatment and demands upon the patient and family, which have been the primary criticisms of urine alarm approaches.

A final area of research concerns the role of the urine alarm treatment for nocturnal enuresis in the public health policy debate over where health care resources are directed. The motivating force for the theme of this special series (i.e., “Empirically Supported Treatments in Pediatric Psychology”) is due to our society demanding that treatments with known efficacy should receive the limited health care funds available. It is also surprising that, even with the known efficacy of the urine alarm, as recently as the late 1980s fewer than 5% of physicians, based on a national survey, recommended the use of the urine alarm, and most continue to use medication treatments (Faxman, Valdez, & Brook, 1986). Although there is some indication that this trend has changed (see Vogel, Young, & Primack, 1996), there is a strong need for research in promotion of effective treatments at the societal level. Perhaps those promoting the effectiveness of the urine alarm should follow the model used by pharmaceutical companies that pour millions of dollars into a multimedia advertising campaign. The question of responsibility for this expense (e.g., federal government, professional organizations of behavioral psychologists, or urine alarm manufacturers) will also need to be debated.

## Appendix I

### ***Selected Empirically Supported and Learning-Based Treatments for Nocturnal Enuresis***

**Azrin, J. H., Sneed, T. J., & Foxx, R. M. (1974). Dry-bed training: Rapid elimination of childhood enuresis. *Behaviour Research and Therapy*, 12, 147–156.**

*Subjects/Dx Criteria.*  $n = 26$ ; 19 = male, 7 = female; average age = 8 yrs. Primary enuresis, no medical problems, must agree to complete treatment.

*Baseline/Design.* No baseline recording, parent report of frequency of wetting. 13 matched pairs on sex, age, wetting frequency; randomized to Dry-Bed Treatment (DBT) or standard urine alarm (control)

for 1st 2 weeks, then control given DBT with parent and child or parent only alarm.

*Measures.* Median wets/week for DBT and standard urine alarm.

*Treatment.* DBT = urine alarm + waking procedure + positive practice + cleanliness training + verbal praise. Standard urine alarm = void in toilet after wet activates alarm.

*Outcome.* At 2 weeks of treatment, DBT had median of 1 wet/wk, standard urine alarm had 5 wets/wk ( $p < .005$ ). Only 2 children were cured with standard urine alarm within 1st 2 weeks, remaining 11 then given DBT and then cured within 2 weeks. All 13 DBT children were dry within 2 weeks.

*Follow-up.* 7 children relapsed with DBT and successfully retreated within 1 wk and dry at 6-month follow-up.

**Bennett, G., Walkden, V., Curtis, R., Burns, L., Rees, J., Gosling, J., & McQuire, N. (1985). Pad-and-buzzer training, dry-bed training, and stop-start training in the treatment of primary nocturnal enuresis. *Behavioural Psychotherapy*, 13, 309–319.**

*Subjects/Dx Criteria.*  $n = 40$  who completed treatment; 25 male, 15 female; average age = 8.5 years. 72 subjects attended first treatment session. Primary enuresis, no prior treatment, no day wetting or soiling, no behavior problems, between 5 and 12 years old, at least 6 wets during 2 weeks of baseline.

*Baseline/Design.* 2 weeks. Consecutive clinic referrals randomly assigned to 3 treatment groups or waiting list control group.

*Measures.* Mean number of dry nights per 2-week period. Also reports attrition rates by group after first treatment session.

*Treatment.* Pad and Buzzer Treatment (PBT)-voiding in toilet after each wet; Dry-Bed Treatment (DBT); Start-Stop Training (SST) (i.e., urine stream interruption while voiding in toilet each time need to void); Waiting List Control group (WLC)-instructed to use star chart for dry nights.

*Outcome.* 44.5% of 32 subjects dropped out after 1st treatment session, equally represented in groups. All 3 treatment groups had significantly less wetting than control group but no between treatment group differences at posttreatment. 44.4% successful with PBT, 16.6% with SST, 50% with DBT, 0% for WLC.

*Follow-up.* Results remained the same at 2 months follow-up.

**Bollard, J., & Nettlebeck, T. (1981). A comparison of dry bed training and standard urine alarm conditioning treatment of childhood bedwetting. *Behaviour Research and Therapy*, 19, 215–226.**

*Subjects/Dx Criteria.* Experiment 1,  $n = 45$ ; 32 males, 13 females; mean age = 9.7 years; Experiment 2,  $n = 120$ ; 82 males, 38 females; mean age = 9.0 years. Subject not currently involved in other enuresis treatment, no medical/behavioral problems, at least 1 wet/week.

*Baseline/Design.* 4 weeks of baseline recording of wetting frequency. Experiment 1: random assignment to Urine Alarm (UA) with supervision or UA w/o supervision or waiting list group. Experiment 2: random assignment to 5 treatment groups and 1 waiting list group.

*Measures.* Number of successful subjects (2 dry weeks); mean number of wet nights during treatment; number of days to dryness.

*Treatment.* Experiment 1: UA + telephone supervision by therapist vs. UA w/o supervision. Experiment 2: Grp 1 = Dry-Bed Training (DBT)-trainer in home; Grp 2 = DBT-trainer in hospital; Grp 3 = DBT-parent as trainer in home; Grp 4 = DBT-parent as trainer w/o UA; Grp 5 = UA + phone supervision; Grp 6 = waiting list group.

*Outcome.* Experiment 1: both conditions of UA had more successes than control ( $p < .0001$ ) and less number of days to dryness ( $p < .0001$ ), no treatment group differences but a trend for more drop-outs with no supervision. Experiment 2: DBT with UA is significantly more effective than DBT without UA or UA alone. Level of supervision for DBT not important. No difference between waiting list and DBT w/o alarm.

*Follow-up.* 12 months of follow-up. DBT with UA had 25% relapse, 60% relapse w/o UA. 38% of UA alone relapsed.

**Bollard, J., & Nettlebeck, T. (1982). A component analysis of dry-bed training for treatment of bedwetting. *Behaviour Research and Therapy*, 20, 383–390.**

*Subjects/Dx Criteria.*  $n = 127$ , 55 from Bollard & Nettlebeck (1981); 88 male, 39 females; mean age =

9.6 years. Subject not currently involved in other enuresis treatment, no medical/behavioral problems, at least 1 wet/week.

*Baseline/Design.* 4 weeks of baseline recording of wetting frequency. 55 subjects from Bollard & Nettlebeck (1981) randomly assigned to Urine Alarm (UA) alone, Dry-Bed Training (DBT), waiting list. Remaining 72 randomly assigned to 6 forms of DBT.

*Measures.* Number of successful subjects (2 dry weeks); mean number of wet nights during treatment.

*Treatment.* Grp 1: Standard UA alone; Grp 2: UA + waking schedule; Grp 3: UA + Retention Control Training (RCT); Grp 4: UA + Positive Practice (PP) and Cleanliness Training (CT); Grp 5: UA + waking and RCT; Grp 6: UA + waking and PP and CT; Grp 7: UA + RCT + PP + CT; Grp 8: DBT (including UA).

*Outcome.* 94.5% of all subjects met the success criteria of 2 dry weeks and no differences in Tx groups in number of successes. Grp 1 had more wets during treatment than all other groups ( $p < .05$ ). Grp 6 and Grp 8 had less wets during treatment than all other groups ( $p < .05$ ). Groups using the waking schedule had less wets during treatment than groups not using waking schedule (mean = 13.04;  $df = 3$ ;  $p < .01$ ).

*Follow-up.* None reported.

**Breit, M., Kaplan, S., Gauthier, B., & Weinholt, C. (1984). The dry-bed method for the treatment of enuresis: A failure to duplicate previous reports. *Child & Family Behavior Therapy*, 6, 17–23.**

*Subjects/Dx Criteria.*  $n = 28$ ; 17 males, 11 females; mean age = 9.8 years; mean wetting frequency = 5.2 nights/week. No medical problems, must be a bed-wetter.

*Baseline/Design.* No baseline recorded. Single group, pre-test, post-test design. Follow-up between 6 and 12 months.

*Measures.* Number of successful children (2 dry weeks), number of days to treatment success, number of relapses.

*Treatment.* Dry-Bed Training (DBT) with Urine Alarm (UA).

*Outcome.* 11% dropped out. 71% successfully treated. Mean number of days to success was 51.9.



Age was significantly related to successful treatment with younger children more likely to reach 2 weeks of dryness.

*Follow-up.* 50% relapse within 6 to 12 months.

**Butler, R., Brewin, C., & Forsythe, W. (1988). A comparison of two approaches to the treatment of nocturnal enuresis and the prediction of effectiveness using pre-treatment variables. *Journal of Child Psychology and Psychiatry, 29*, 501-509.**

*Subjects/Dx Criteria.*  $n = 74$ ; 56 males, 18 girls; mean age of 9.7 years. 11 subjects improved symptoms after baseline and excluded.  $n = 63$  included in study.  $\geq 6$  yrs., at least 5 wets/wk for 1 month, no medical problems, not currently receiving any drug or psychotherapy for wetting.

*Baseline/Design.* 4 weeks of wetting frequency. Consecutive clinic referrals and alternately assigned to Standard Urine Alarm (UA) or Modified Dry-Bed Training (DBT).

*Measures.* Number of wets/week, parent questionnaire regarding beliefs of causes, Enuresis Tolerance Scale, child interview of their beliefs of enuresis causes.

*Treatment.* Group 1: Standard Urine Alarm (UA). Group 2: Modified Dry-Bed Training (DBT) (excluded the positive practice and verbal reprimands during cleanliness training).

*Outcome.* 70% of subjects in both groups were successful. When adjusting for DBT-Modified having more prior UA experience, still no differences in groups in number who were successfully treated, number of wet nights in treatment, nor number of dry nights in last 4 weeks of treatment.

*Follow-up.* None reported.

**De Leon, G., & Mandell, W. (1966). A comparison of conditioning and psychotherapy in the treatment of functional enuresis. *Journal of Clinical Psychology, 22*, 326-330.**

*Subjects/Dx Criteria.*  $n = 87$ , 3:1 males to females in treatment groups, 2:1 for control group. Nocturnal enuresis, no medical problems.

*Baseline/Design.* 7 weeks. Random assignment to 2 treatments ( $n = 56$  conditioning Urine Alarm (UA);  $n = 13$  psychotherapy) or control ( $n = 18$ ). Pretest-posttest measures.

*Measures.* "Enuresis Ratio" = (number of wets/ number of nights recorded). Number of cures, failures, relapses. Number of days to cure, number of days to relapse.

*Treatment.* Group 1: Urine Alarm (UA). Group 2: Psychotherapy-Counseling (unspecified form) by a psychiatrist, a psychologist, and a psychology intern. Group 3: no-treatment control.

*Outcome.* Significantly more cures for urine alarm vs. therapy, control (% cure = 86.3, 18.2, 11.1, respectively). Less time to reach success for urine alarm vs. therapy, control (days to cure = 55, 104, 84, respectively).

*Follow-up.* All groups had high relapse, defined as at least 1 wet after treatment (% relapsed = 80, 100, 50 for urine alarm, therapy, control). 73% successfully retreated with urine alarm.

**Doleys, D. M., Ciminero, A. R., Tollison, J. W., Williams, C. L., & Wells, K. C. (1977). Dry-bed training and retention control training: A comparison. *Behavior Therapy, 8*, 541-548.**

*Subjects/Dx Criteria.*  $n = 19$ , 9 in group 1 (mean age = 7.8), 10 in group 2 (mean age = 6.6). No medical problems, agree to complete all parts of treatment, pay a refundable deposit to complete study.

*Baseline/Design.* 3 weeks. 2-Tx(Dry Bed Training vs. Retention Control Training), pretest-posttest design. Nonrandomized.

*Measures.* Mean number of wets/week, maximum functional bladder capacity (MBC = ml. voided after fluid load and holding back until too uncomfortable).

*Treatment.* Group 1: Dry-Bed Training (DBT) (manualized). Group 2: Retention Control Training (RCT). (i.e., fluid load-hold urine for daily increasing time limit up to 30 min-void in toilet-verbally praised; positive practice of getting out of bed during training to visit toilet 10 times; also included urine stream interruption 1 time each day).

*Outcome.* DBT had significantly less wets than RCT (RCT showed no change from baseline) after 6 weeks of treatment. Although 15 of 19 subjects had smaller MBC's than normals at pretreatment, neither DBT or RCT showed significant increases at posttreatment. For DBT, 39% met success criterion (14 consecutive dry nights).

*Follow-up.* Up to 12 months follow-up. 5 of the 13 (39%) subjects treated with DBT were dry at follow-up. Authors do not report if these were the same subjects that remitted at the end of treatment.

**Fielding, D. (1985). Factors associated with drop-out, relapse and failure in the conditioning treatment of nocturnal enuresis. *Behavioural Psychotherapy*, 13, 174–185.**

*Subjects/Dx Criteria.*  $n = 97$ ; 46 children with day and nighttime wetting (DNW), 51 with nighttime only wetting (NW). Must be between ages of 5 and 15, no medical problems, have had no treatment within prior 12 months, children with day wetting only excluded.

*Baseline/Design.* 4 weeks. Children of both enuretic groups (DNW vs. NW) randomly assigned to treatments.

*Measures.* 30 variables from 3 pre-Tx assessment measures; 4 treatment outcome measures: number of successes, failures, drop-out, relapse.

*Treatment.* Group 1: Standard Urine Alarm (UA). Group 2: Standard UA preceded by 4 weeks of retention control training.

*Outcome.* 67% of children completing treatment were successful. Drop-out positively related to early toilet training, child being youngest in family, and if parent prompts child to visit toilet during day. Treatment failure positively related to frequency and urgency of micturition, and prior UA experience.

*Follow-up.* 12 months of follow-up. 53% relapsed but most were successfully retreated. None of the 30 study variables was related to relapse.

**Fournier, J., Garfinkel, B., Bond, A., Beauchesne, H., & Shapiro, S. (1987). Pharmacological and behavioral management of enuresis. *Journal of American Academy of Child and Adolescent Psychiatry*, 26, 849–853.**

*Subjects/Dx Criteria.*  $n = 64$ , 47 = male, mean age = 8.4 years, mean number of reported baseline wets = 6. Age range 5–14 years, no history of Urinary Tract Infection (UTI), no medical problems, minimum of 2 wets/week for last 6 months, no medical/psychological treatment 3 months prior to study, no developmental delays.

*Baseline/Design.* 2 weeks. Random assignment to 7 treatments and 1 placebo only group.

*Measures.* Mean number wets/week.

*Treatment.* Group 1: Imipramine (IMI), Group 2: Urine Alarm(UA), Group 3: UA + placebo, Group 4: IMI + UA, Group 5: random waking (RA), Group 6: RA + placebo, Group 7: IMI + RA, Group 8: placebo.

*Outcome.* At 6 weeks, placebo significantly worse than IMI, IMI + UA, and UA; RA significantly worse than UA.

*Follow-up.* 3 months follow-up, placebo significantly worse than IMI, UA.

**Geffken, G., Johnson, S., & Walker, D. (1986). Behavioral interventions for childhood nocturnal enuresis: The differential effect of bladder capacity on treatment progress and outcome. *Health Psychology*, 5, 261–272.**

*Subjects/Dx Criteria.*  $n = 50$ , 33 = males, 17 = females. No medical problems, must have been wetting for at least 3 months' duration.

*Baseline/Design.* 2 weeks. Subjects grouped as having large or small functional bladder capacity. 1/2 subjects within each group randomly assigned to Retention Control Training (RCT).

*Measures.* Mean functional bladder capacity, Peirs-Harris Self Concept Scale, Behavior Problems Checklist, Enuresis Tolerance Scale, number of wets/week.

*Treatment.* Group 1: Urine Alarm (UA) + Cleanliness Training (CT). Group 2: UA + CT + RCT.

*Outcome.* 20% of children dropped out of treatment regardless of group and had lower self-esteem and more behavior problems. 92.5% of all subjects reached 2 week dryness success criteria with no differences in outcome between groups.

*Follow-up.* 41% of all children relapsed within 2 to 12 months after successful treatment. All of those who were retreated became dry.

**Houts, A. C., Liebert, R. M., & Padawer, W. (1983). A delivery system for the treatment of primary enuresis. *Journal of Abnormal Child Psychology*, 11, 513–520.**

*Subjects/Dx Criteria.*  $n = 60$ , 48 males, mean age = 8.05 years. Primary enuresis, no medical problems,

38% had previous treatment with imipramine hydrochloride.

*Baseline/Design.* Treatment was delayed for 1/2 the sample for 8 weeks due to space limits. The other 1/2 began treatment within 24 hours of their first phone contact. Pre-test, post-test single group design.

*Measures.* Mean wets/week, number of success, failure, drop-out, relapse.

*Treatment.* Full Spectrum Home Training FSHT (manualized). Includes urine alarm, retention control training with monetary rewards, cleanliness training, overlearning, child self-recording of wet and dry nights.

*Outcome.* 81% successfully completed Tx (14 consecutive dry nights during overlearning). 69% of successes became dry within 8 weeks. The two groups did not differ in spontaneous remission rates.

*Follow-up.* 19% of group relapsed by 6 months, and 24% by 1 year follow-up. Prior imipramine use was significantly associated with relapse.

**Keating, J., Butz, R., Burke, E., & Heimberg, R. (1983). Dry-bed training without a urine alarm: Lack of effect of setting and therapist contact with child. *Journal of Behaviour Therapy and Experimental Psychiatry, 14*, 109–115.**

*Subjects/Dx Criteria.*  $n = 30$ , males = 18, females = 12, mean age = 8.1. No daytime wetting, child must be able to follow simple instructions, no medical problems.

*Baseline/Design.* 3 weeks. Random assignment to 3 treatment groups or waiting list control group. Pre-test, post-test (13 weeks), 17, 21, and 25 weeks after starting treatment.

*Measures.* Number of dry nights/week, number of cure, drop-out, relapse. Parental satisfaction questionnaire.

*Treatment.* Group 1: Dry-Bed Training (DBT) without alarm and In-Home Trainer (IHT). Group 2: DBT without alarm and Office Training of Parent + Child (OTPC). Group 3: DBT w/o alarm and Office Training of Parent only (OTP). Group 4: Waitlist control group.

*Outcome.* No group differences in treatment outcome but all did significantly better than no treatment. Overall 78% initial success, 33% relapse rate.

*Follow-up.* Long-term success rate of 57%.

**Moffatt, M., Kato, C., & Pless, I. (1987). Improvements in self-concept after treatment of nocturnal enuresis: Randomized controlled trial. *Journal of Pediatrics, 110*, 647–652.**

*Subjects/Dx Criteria.*  $n = 121$ . Primary nocturnal enuresis, between ages of 8 and 14 years old.

*Baseline/Design.* 2 weeks for treatment group, 3 months for waitlist control group. Two group (urine alarm, waitlist control) randomized trial.

*Measures.* A measure of social-economic status, Child Behavior Checklist (CBCL), State-Trait Anxiety Inventory for Children (STAIC), Nowicki-Strickland Locus of Control Scale (NSLC), Piers-Harris Self-Concept Scale.

*Treatment.* Urine alarm with overlearning procedure. A "few" subjects received bladder control exercises and anticholinergic drugs if not responding to urine alarm after 3 months.

*Outcome.* Percent cure = 69% for urine alarm in 18.4 weeks of treatment. No differences between urine alarm and control group on CBCL, NSLC, or STAIC. Significant differences noted in total score of Piers-Harris Self-Concept Scale, and subscales of School Performance, Physical Appearance, and Popularity in direction of improvements in self-concept for treatment group. Results were replicated in wait list control group when they were treated with urine alarm.

*Follow-up.* Not reported as this was not within the scope of the study.

**Mowrer, O., & Mowrer, W. (1938). Enuresis: A method for its study and treatment. *American Journal of Orthopsychiatry, 8*, 436–459.**

*Subjects/Dx Criteria.*  $n = 30$  (ranging in age from 3 to 13 years). Nocturnal enuresis, highly neurotic and psychotic subjects excluded. One "feeble" minded child with  $IQ < 65$  was included and successfully treated.

*Baseline/Design.* No baseline recording. Case studies of 30 consecutive enuretic subjects.

*Measures.* Number of wets/week.

*Treatment.* Urine alarm (bell and pad design) only if less than 5 years, and with overlearning (1 or 2 cups of water just before retiring) in children 5 years or older.

*Outcome.* Percent cured = 100%, no evidence of "personality changes" or "symptom substitution." (This was a concern at the time given the strong psychoanalytic theoretical perspective of behavior).

*Follow-up.* "Some relapses did occur" but frequency was not reported. (This is a historically important article. It is included not because of design sophistication, but because it attempts to measure process variables with this treatment).

**Sacks, S., De Leon, G., & Blackman, S. (1974). Psychological changes associated with conditioning functional enuresis. *Journal of Clinical Psychology*, 30, 271-276.**

*Subjects/Dx Criteria.* Same sample as De Leon & Mandell (1966). Nocturnal enuresis, no medical or psychiatric problems.

*Baseline/Design.* 7 weeks. Random assignment to 2 treatments ( $n = 56$  conditioning-Urine Alarm UA;  $n = 13$  psychotherapy) or control ( $n = 18$ ). Pretest-posttest measures.

*Measures.* Treatment outcome measures same as De Leon & Mandell (1966). Psychological measures included: Staten Island Behavior Scale, Children's Personality Scale, and a "school adjustment measure."

*Treatment.* Group 1: Urine Alarm (UA). Group 2: Psychotherapy-Counseling, unspecified form, by a psychiatrist, a psychologist, and a psychology intern. Group 3: no-treatment control. Purpose of this study was to measure psychological changes as a result of treatment.

*Outcome.* Treatment outcome: see De Leon & Mandell (1966). No differences between groups on any of the psychological measures at end of treatment, nor those subjects successfully treated (regardless of tx) vs. failed. Main finding is that there was no symptom substitution for successfully treated subjects with the urine alarm.

*Follow-up.* Results remained the same at 1 month, 6 months, and 1-year follow-up.

**Wagner, W., Johnson, S., Walker, D., Carter, R., & Wittner, J. (1982). A controlled comparison of two treatments for nocturnal enuresis. *Journal of Pediatrics*, 101, 302-307.**

*Subjects/Dx Criteria.*  $n = 49$ , males = 40. Between 6-16 years old, IQ > 70, primary nocturnal enuresis, no day wetting, no physical disorders, at least 3 wets/week, no drug or urine alarm treatment within previous year, agree to random assignment.

*Baseline/Design.* No baseline recording. Pretest-posttest, three group (urine alarm, imipramine, waitlist control) randomized design.

*Measures.* Weekly wetting frequency; number of cures, failures, relapses, drop-outs; Peirs-Harris Self-Concept Scale, Children's Manifest Anxiety Scale, Enuresis Nuisance and Tolerance Scale, Personality Inventory for Children, Behavior Problem Checklist, Peabody Picture Vocabulary Test.

*Treatment.* Group 1: Urine Alarm plus cleanliness training (UA). Group 2: Imipramine Hydrochloride (IMP). Group 3: Waiting List Control (WL).

*Outcome.* Percent cured: UA = 83%, IMP = 33%, WL = 8%. No differences in the psychological measures between groups. All subjects improved on Peirs-Harris Self-Concept Scale and Children's Manifest Anxiety Scale regardless of treatment or outcome. Children seen as more outgoing by parents (Behavior Problems Checklist) were more likely to become dry regardless of treatment. Enuresis Tolerance Scale was a significant predictor of early termination of UA but not IMP.

*Follow-up.* Up to 6 weeks post treatment. Relapse = 3 wet nights during a 2-week period following end of treatment. Percent relapsed: UA = 50%, IMP = 100%, WL = 100%.

**Whelan, J. P., & Houts, A. C. (1990). Effects of a waking schedule on primary enuretic children with full-spectrum home training. *Health Psychology*, 9, 164-176.**

*Subjects/Dx Criteria.*  $n = 37$ , 20 in FSHT, 17 in FSHT + Waking Schedule. Primary enuresis, no prior treatment, no medical/behavior problems, no day wetting, > 5 years of age.

*Baseline/Design.* Half of subjects in each treatment began immediately, half waited 16 weeks. 2-

Treatment (FSHT/FSHT + Waking) × Waiting (Wait/No Wait), randomized design.

*Measures.* Average wets/week, number of successes, failures, dropouts, relapses, length of treatment, consumer satisfaction.

*Treatment.* Full Spectrum Home Training-FSHT (manualized), or FSHT plus Waking Schedule per Azrin's Dry Bed Training.

*Outcome.* No group differences in success/failure/dropout/length of treatment, or satisfaction. 76% successfully treated collapsing across groups.

*Follow-up.* 1-year follow-up reported 16% of subjects resuming wetting.

**Wille, S. (1986). Comparison of desmopressin and enuresis alarm for nocturnal enuresis. *Archives of Disease in Childhood*, 61, 30–33.**

*Subjects/Dx Criteria.*  $n = 50$ , attrition due to spontaneous remission, illness or voluntary withdrawal led to 24 patients in drug group, 22 in urine alarm. Primary nocturnal enuresis, > 6 years old, at least 3 wets/week during baseline, no prior treatment for enuresis, no day wetting, no physical problems of urinary tract, heart or nervous system.

*Baseline/Design.* 2 weeks. Randomized to either drug or urine alarm treatment for 3 months. Failures crossed over to opposite treatment. Relapses re-treated for another 3 months.

*Measures.* Lab tests pre and post treatment: complete blood counts; at same times and after 1 month of tx, urine cultures, density and osmolality were taken of void at 0500 in morning. Mean number of dry nights/week.

*Treatment.* Group 1: Desmopressin (DDAVP): 20 mcg. at bedtime, dose given by nasal catheter. Group 2: Urine Alarm (UA) administered by parents without supervision during 3 months of treatment.

*Outcome.* Outcome not reported for number of subjects who completely remitted wetting. Subjects who wet with a frequency of  $\leq 1$  wet/week were also counted as successful. No differences between groups during treatment, but there were significantly higher relapses 2 weeks and 3 months after treatment for DDAVP. DDAVP had significantly higher urine concentrations in morning.

*Follow-up.* Percent of patients who "improved" on long-term treatment was 42% (DDAVP) and 82% (UA).

## Appendix II

### **Selected Psychological Treatments for Nocturnal Enuresis**

**Banerjee, S., Srivastav, A., & Palan, B. (1993). Hypnosis and self-hypnosis in the management of nocturnal enuresis: A comparative study with imipramine therapy. *American Journal of Clinical Hypnosis* 36, 113–119.**

*Subjects/Dx Criteria.*  $n = 50$ , male = 30, age range = 5 to 16 years. Nocturnal enuresis only, no medical problems.

*Baseline/Design.* No baseline recording. Subjects assigned alternately on admission to the 2 treatments. A nonrandomized, 2-group design with repeated Z tests.

*Measures.* No clear indicators of wetting frequency reported. "Positive Responders" ranged from complete remission of wetting to less wetting. "No Response" = no change in wetting frequency to dropped out of tx. Stanford Hypnotic Clinical Scale for Children to assess hypnotic responsivity.

*Treatment.* Hypnosis treatment: included brief anatomy lesson of urinary tract, relaxation training, hypnosis induced with imagery and suggestions given to control their own circumstances and to get up from bed to urinate in toilet when needed, subjects also taught self-hypnosis and instructed to use at bedtime each night. Imipramine treatment: 25 mg at bedtime, depending on response after each week the dose was increased by 25 mg and continued based on individual tolerance.

*Outcome.* No differences between hypnosis and Imipramine at end of treatment, positive response was 72% and 76%, respectively. However, subjects 5–7 years old less successful than older subjects (significance was not reported). In neither group was outcome of treatment related to hypnotic responsivity.

*Follow-up.* At 6 months follow-up, significantly more subjects in the hypnosis group continued

with a positive response, 68% versus 24% for imipramine.

**Edwards, S., & Van Der Spuy, H. (1985). Hypnotherapy as a treatment for enuresis. *Journal of Child Psychology and Psychiatry, 26*, 161–170.**

*Subjects/Dx Criteria.*  $n = 48$ , all males, mean age = 10.5 years, 24 primary enuretics. No medical problems, no day wetting.

*Baseline/Design.* 11 to 21 weeks. The 24 primary and 24 secondary enuretics were matched on age and then randomly assigned to 4 treatment conditions. Weekly measures of wetting frequency during 6 weeks of treatment and at 6 months follow-up.

*Measures.* Mean wets/week, Children's Hypnotic Susceptibility Scale, Barber Suggestibility Scale, Diagnostic Ratings of Hypnotizability.

*Treatment.* Trance plus suggestions (H+): induction through relaxation to sleep, suggestions given to increase bladder size, waking to visit toilet upon full bladder, etc. using headphones. (a manual of suggestions available from author). Suggestions without trance (W+): same suggestions as H+ but no trance induced. Trance alone (H): trance induced for few minutes and then subject awakened. No-treatment control (NT): recorded wetting frequency for 6 weeks and offered treatment after 6 month follow-up.

*Outcome.* Trance plus suggestions, and suggestions alone, showed a significant reduction in wets over baseline during treatment ( $p < .01$ ).

*Follow-up.* Significant reduction in wetting frequency for all 3 treatments combined and separately over baseline, but not for controls ( $p < .01$ ) at 6 month follow-up.

**Londen, A. van, Londen-Barentsen, M. van, Son, M. van, & Mulder, G. (1993). Arousal training for children suffering from nocturnal enuresis: A 2-½ year follow-up. *Behavior Research and Therapy, 31*, 613–615.**

*Subjects/Dx Criteria.*  $n = 113$ , mean age = 8.6 years. 89 males. (Data based on unpublished dissertation completed in 1989, not in English). Must assume screened out subjects with medical/psychiatric problems.

*Baseline/Design.* No baseline recording. Randomized, 3 treatment group (Arousal Training vs. Control Group 1 vs. Control Group 2) pretest-posttest-follow-up design.

*Measures.* All data were collected by telephone interviews at weeks 1, 4, 8, 12, 16, 20, and 40; and again at 2½ years. Parents asked to report number of wets that occurred in prior 2 weeks.

*Treatment.* Group 1: Arousal Training (urine alarm + sticker rewards for compliance with cleanliness training within 3 minutes after alarm sounds, and loss of stickers for noncompliance). Group 2: Control-1 (urine alarm + sticker reward in morning for dry bed or loss of stickers for wet). Group 3: Control-2 (urine alarm only). No therapist contact for any group, therapy given in form of a separate written instruction set for each group.

*Outcome.* At end of 20 weeks, 85% of subjects regardless of Tx were dry. Significantly more in Group 1 (97%) vs. Group 2 (85%) vs. Group 3 (72%).

*Follow-up.* At 2½-year follow-up, significantly more subjects in Group 1 remained dry (92%) vs. Group 2 (77%) vs. Group 3 (72%).

**Luciano, M., Molina, F., Gomez, I., & Heruzo, J. (1993). Response prevention and contingency management in the treatment of nocturnal enuresis: A report of two cases. *Child & Family Behavior Therapy, 15*, 37–51.**

*Subjects/Dx Criteria.*  $n = 2$ , subject 1: 9-year-old male with primary enuresis, subject 2: 14-year-old male primary enuresis. Nocturnal enuresis.

*Baseline/Design.* 2 weeks. Case study: A-B.

*Measures.* Number of wets/week.

*Treatment.* Subject 1: retention control training, stream interruption, scheduled awakening with alarm clock, social positive and negative consequences. Subject 2: scheduled awakening with alarm clock, cleanliness training following a wet and positive practice, money and social reinforcement for dry nights.

*Outcome.* Subject 1: completely remitted wetting by week 18. Subject 2: completely remitted wetting by week 26.

*Follow-up.* Subject 1: only 2 wets between week 18 to 57. Subject 2: no more wetting between week 18 to 44.

**Olness, K. (1975). The use of self-hypnosis in the treatment of childhood nocturnal enuresis. *Clinical Pediatrics, 14*, 273–279.**

*Subjects/Dx Criteria.*  $n = 40$ , 20 males, age range 4.5 to 16 years, 20 primary enuresis. Nocturnal enuresis, no medical or severe emotional problems.

*Baseline/Design.* No baseline recording. 40 consecutive cases in private practice.

*Measures.* Self-report of number of dry nights since prior visit, reported separately for child and parent.

*Treatment.* Trance induction through relaxation, suggestion given to toilet before bed and to wake self during sleep if need to urinate in toilet. Subject also asked to do self-hypnosis before bedtime.

*Outcome.* 31 of 40 subjects ceased wetting completely, 28 did so within 4 weeks. 4 subjects had 1 or less wets per week, 2 subjects had a 50% reduction in number of wet beds, 3 subjects showed no improvement.

*Follow-up.* Follow-up was monthly since the child became dry as long as the family desired, ranged from 6 to 28 months. Relapse was not reported.

**Rolider, A., & Van Houten, R. (1986). Effects of degree of awakening and the criterion for advancing awakening on the treatment of bed-wetting. *Education and Treatment of Children, 9*, 135–141.**

*Subjects/Dx Criteria.*  $n = 2$  in experiment 1, females 6.5 and 11 years old.  $n = 4$  in experiment 2; 6, 5(male), 5, and 4 years old. Nocturnal enuresis, no medical or serious emotional problems.

*Baseline/Design.* 1 to 3 weeks. Multiple baseline across subjects for both experiments.

*Measures.* Number of wets per week.

*Treatment.* Experiment 1: Phase I—subject awakened 5 hours before usual waking time and placed on toilet (partial awakening); each 6 dry nights waking moved up until waking at 8 hours before morning. Phase II: same as above but subject fully awakened by asking questions (complete awakening). Experiment 2: Phase I—same as partial awakening above, waking time faded with 6 nonconsecutive dry nights. Phase II: same as complete

awakening above but fading with 6 consecutive dry nights.

*Outcome.* Experiment 1: slight reduction in wets with partial awakening, complete remission with complete awakening condition. Experiment 2: no differences in the effectiveness of fading procedure.

*Follow-up.* Experiment 1: parents reported no relapses. Experiment 2: parents reported no relapses.

**Ronen, T., Wozner, Y., & Rahav, G. (1992). Cognitive Intervention in enuresis. *Child & Family Behavior Therapy, 14*, 1–14.**

*Subjects/Dx Criteria.*  $n = 77$ , treatment; 1 = 20, treatment; 2 = 19, treatment; 3 = 20, control = 18. No medical/developmental problems, > 5 years old.

*Baseline/Design.* 3 weeks all groups. Quasi-random assignment, 3 treatment groups, 1 control group

*Measures.* Self-Control Scale, Daily Charting Sheet, Wetting frequency, rate of wetting decline, number of days in treatment, number of dropouts, relapsers, and change in self-control.

*Treatment.* Self-Control Treatment (SCT) vs. Bell and Pad (urine alarms UA) vs. Token Economy (TE) vs. Wait List Control.

*Outcome.* SCT = 75% cure, UA = 63% cure, TE = 30% cure, Control = 0% cure.

*Follow-up.* 6 months, SCT had significantly less relapse than BP and TE.

**Stanton, H. (1979). Short-term treatment of enuresis. *American Journal of Clinical Hypnosis, 22*, 103–107.**

*Subjects/Dx Criteria.*  $n = 28$ , age range of 7 to 18, median age of 12. Nocturnal enuresis.

*Baseline/Design.* No baseline recording. Consecutive clinical cases.

*Measures.* Self-report of wets/week.

*Treatment.* One-hour session: 15–20 minutes of rapport building. Then trance induction through various methods. Finally, suggestions are made for general “ego-enhancement” and specific suggestions of remaining dry at night.

*Outcome.* 20 out of 28 patients became dry (71%).

*Follow-up.* 12-month follow-up: 25% relapsed.

## Appendix III

### **Studies of Component Analysis or Process Variables in Learning-Based Treatments for Nocturnal Enuresis**

**Collins, R. (1973). Importance of the bladder-cue buzzer contingency in the conditioning treatment of enuresis. *Journal of Abnormal Psychology, 82*, 299–308.**

*Subjects/Dx Criteria.*  $n = 60$ , 40 males, mean age of total sample was 8 years. No medical problems or day wetting, > 5 years old, at least 3 wets/week.

*Baseline/Design.* No baseline recording. Subjects matched on age, sex, frequency of wetting and primary vs. secondary enuresis with double-blind assignment to groups. 3 Group (2 levels of conditioning and no-tx control), pretest-posttest, follow-up design.

*Measures.* Mean number of wets/week; number of subjects reaching success criterion of 10 consecutive dry nights; number of subjects who relapsed (relapse = wetting frequency during follow-up > wet/2 weeks); number positive symptoms endorsed on Symptom Checklist.

*Treatment.* Group 1: Urine alarm with immediately sounding alarm to wet (IUA). Group 2: Urine alarm with 5 minute delay to alarm after wet (DUA). Group 3: No treatment for 8 weeks then given same treatment as group 1 (NT).

*Outcome.* Significantly more subjects in (IUA) became dry versus (DUA) and (NT). Percent dry = 65% (IUA), 25% (DUA), 20% (NT). All subjects that consistently used the alarm in the (IUA) group were successfully treated versus those who were inconsistent and this group difference was significant.

*Follow-up.* 3 to 9 months follow-up. 46% relapsed in (IUA) and 80% in (DUA), but there were no significant differences between groups.

**Finley, W., Besserman, R., Bennett, L., Clapp, R., & Finley, P. (1973). The effect of continuous, intermittent, and "placebo" reinforcement on the effectiveness of the conditioning treatment for enuresis nocturna. *Behaviour Research and Therapy, 11*, 289–297.**

*Subjects/Dx Criteria.*  $n = 30$ , all males between 6 and 8 years old. No day wetting, primary enuresis, no medical or psychological problems.

*Baseline/Design.* No baseline recording. Random assignment to 3 levels of alarm conditioning (100% vs. 70% vs. 0% conditioning). Subjects blind to independent variable. Pretest, posttest, follow-up measures.

*Measures.* Average wets/week, number of weeks in treatment, number of subjects cured and relapsed, size of wet spot in inches, elapsed time to first wet each night.

*Treatment.* Group 1: Urine alarm with 100% of trials conditioned. Group 2: Urine alarm with 70% of trials conditioned. Group 3: Urine alarm with zero trials conditioned.

*Outcome.* Group 1 and Group 2 differed significantly from Group 3 in mean number of wets during treatment, and in number of subjects who reached cure. However, no significant differences between Groups 1 & 2 in this regard. Number of subjects reaching success criterion (cure = 7 consecutive dry nights) by group was: Group 1: 90%, Group 2: 80%, Group 3: 0%

*Follow-up.* 3 months follow-up. Relapse  $\geq 3$  wets/week. Significantly more subjects relapsed in Group 1 (44%) vs. Group 2 (13%).

**Finley, W., & Wansley, R. (1977). Auditory intensity as a variable in the conditioning treatment of enuresis nocturna. *Behavior Research and Therapy, 15*, 181–185.**

*Subjects/Dx Criteria.*  $n = 20$ , all males between the ages of 6 and 9 years. No day wetting, primary enuresis, no medical or psychological problems.

*Baseline/Design.* No baseline recording. Random assignment to 2 levels of alarm intensity (105dB vs. 80dB). Subjects blind to independent variable. Pretest, posttest, follow-up measures.

*Measures.* Average wets/week, number weeks in treatment, number of subjects cured and relapsed.

*Treatment.* Group 1: Urine alarm at 105dB. Group 2: Urine alarm at 80dB.

*Outcome.* Percent of subjects cured (cure = 14 consecutive dry nights): 70% at 105dB, 40% at 80dB ( $p < .05$ ). Percent of subjects relapsed (relapse:  $\geq 3$  wets/week): 43% at 105dB, 25% at 80dB ( $p =$  not



significant). Post hoc look at fast/slow responders to treatment (fast = last wet occurred within 4 weeks of starting treatment): among slow responders there were significantly less wets with the 105dB alarm.

*Follow-up.* Follow-up lasted 16–24 months after end of treatment. No significant differences in relapse rates between 105dB and 80dB alarms.

**Houts, A. C., Peterson, J. K., & Whelan, J. P. (1986). Prevention of relapse in Full Spectrum Home Training for primary enuresis: A components analysis. *Behavior Therapy, 17*, 462–469.**

*Subjects/Dx Criteria.*  $n = 45$ , mean age = 8.4 years. Primary enuresis, no medical problems.

*Baseline/Design.* 8 weeks. Random assignment to 3 treatment groups or within-subjects wait list control group. Pre, post, 3, 6, 12 month follow-up.

*Measures.* Behavior Problems Checklist, A-B Status Scale, Locus of Control Scale, mean wets/week, number of success, failure, dropout, relapse.

*Treatment.* Group 1: Full Spectrum Home Training-FSHT (manualized, includes urine alarm). Group 2: Urine Alarm (UA) + cleanliness training (CT). Group 3: (UA) + (CT) + retention control training (RCT).

*Outcome.* No group differences in success, failure, dropout with 69% of all subjects reaching success criteria. FSHT reached success criteria significantly faster than (UA + CT) but not (UA + CT + RCT).

*Follow-up.* Significantly lower relapse rate with FSHT vs. Group 2 and Group 3 within 2 months follow-up. Only 22% of relapsers successfully retreated.

**Houts, A. C., Whelan, J. P., & Peterson, J. K. (1987). Filmed versus live delivery of Full Spectrum Home Training for primary enuresis: Presenting the information is not enough. *Journal of Consulting and Clinical Psychology, 55*, 902–906.**

*Subjects/Dx Criteria.*  $n = 40$ , mean age = 8.8 years. Primary enuresis, no medical problems, no daytime wetting problems.

*Baseline/Design.* 20 subjects randomly assigned to 16 weeks baseline, remaining 20 immediate treatment. Experiment 1: delivery mode (film vs. live) X wait condition (wait vs. no-wait)  $2 \times 2$  factorial design. Experiment 2: replication of experiment 1.

*Measures.* Average number wets/week, number of success, failure, dropout, relapse; Behavior Problem Checklist, Family Environment Scale, Tolerance for Enuresis Scale, Peirs-Harris Self-Concept Scale, Treatment Satisfaction Measure, Confidence in Treatment and Therapist Measure.

*Treatment.* Full Spectrum Home Training-FSHT (manualized, includes urine alarm). Group 1: Live delivery of FSHT. Group 2: Filmed delivery of FSHT.

*Outcome.* Experiment 1: 75% initial success rate for live delivery of FSHT vs. 30% for filmed FSHT; live FSHT had significantly lower dropout and relapse than filmed; consumer satisfaction differed as a function of outcome rather than treatment mode. Experiment 2: Parent and child's knowledge of treatment was the same for live vs. filmed delivery of FSHT; outcome was replicated in terms of success, failure, dropout and relapse.

*Follow-up.* 3-, 6-, and 12-month follow-up reported.

**Nettlebeck, T., & Langeluddecke, P. (1979). Dry-bed training without an enuresis alarm. *Behaviour Research and Therapy, 17*, 403–404.**

*Subjects/Dx Criteria.*  $n = 24$ , 14 = male, mean age = 8.25 years. Nocturnal enuresis only, no medical problems, not currently being treated.

*Baseline/Design.* 2 weeks. Nonrandom assignment to two treatments or no-treatment control group. Pre-test, posttest design.

*Measures.* Mean number wets/week, number of cures, failures, relapses.

*Treatment.* Group 1: Dry-Bed Training with urine alarm. Group 2: Dry-Bed Training without urine alarm. Group 3: No Treatment Control Group.

*Outcome.* All 8 subjects in Group 1 successfully treated by 8 weeks. Subjects in Groups 2 & 3 continued wetting with slightly less frequency.

*Follow-up.* None of the subjects in Group 1 relapsed within the 2-month follow-up period.

**Rolider, A., Van Houten, R., & Chlebowski, I. (1984). Effects of a stringent vs. lenient awakening procedure on the efficacy of the dry-bed procedure. *Child and Family Behaviour Therapy, 6*, 1–17.**

*Subjects/Dx Criteria.* Experiment 1:  $n = 4$  (age 9–11 years). Experiment 2:  $n = 4$  (age 9–13 years). Experi-

ment 3:  $n = 3$  (age 4.5–8 years). Nocturnal enuresis, no medical or serious emotional problems.

*Baseline/Design.* 2 to 4 weeks. Multiple baseline across subjects for all three experiments.

*Measures.* Number of wets per week.

*Treatment.* Experiment 1: Modified Dry-Bed Training with cleanliness training and positive practice (Phase I), then a Stringent Awakening with Urine Alarm (Phase II). Experiment 2: 2 of 4 subjects had Stringent Awakening with Urine Alarm only, the other 2 subjects replicated experiment 1. Experiment 3: All 3 subjects had the Stringent Awakening procedure without the Urine Alarm.

*Outcome.* Experiment 1: 24% reduction in wetting with Phase I, 93% with Phase II with all subjects becoming dry. Experiment 2: 95% reduction in wetting for Stringent Awakening plus Urine Alarm, 40% for subjects starting with Modified Dry-Bed Training, but complete dryness with introduction of Stringent Awakening plus Urine Alarm. Experiment 3: 81%, 68%, and 96% wetting reductions for subjects 1, 2, and 3, respectively, within first 7 weeks of tx.

*Follow-up.* Experiment 1: all subjects were dry at 24, 30 and 48 weeks posttreatment. Experiment 2: all subjects were dry at 24, 30 and 48 weeks posttreatment. Experiment 3: all subjects were dry at 24, 30 and 48 weeks posttreatment.

**Wagner, W., & Matthews, R. (1985). The treatment of nocturnal enuresis: A controlled comparison of two models of urine alarm. *Developmental and Behavioral Pediatrics, 6*, 22–26.**

*Subjects/Dx Criteria.*  $n = 39$ , male = 20, mean age = 7.9 years. Between 5–16 years old, IQ > 70, primary nocturnal enuresis, no day wetting, no physical disorders, at least 3 wets/week, no drug or urine alarm treatment within previous year, agree to random assignment.

*Baseline/Design.* 7 days or more. Pretest-posttest, three group (continuous urine alarm, delayed urine alarm, waitlist control) randomized design.

*Measures.* Weekly wetting frequency; numbers of cure, failure, relapse, dropout; Peirs-Harris Self-Concept Scale, Children's Manifest Anxiety Scale,

Enuresis Nuisance and Tolerance Scale, Personality Inventory for Children, Behavior Problem Checklist, Peabody Picture Vocabulary Test.

*Treatment.* Group 1: Continuous Urine Alarm (CUA). Group 2: 3 Second Delay Urine Alarm (DUA). Group 3: Waiting List Control (WL).

*Outcome.* Percent Cure: CUA = 62%, DUA = 54%, WL = 8%. CUA and DUA significantly more cures than WL. No differences between CUA and DUA in days to cure or number of relapses. Significantly more malfunctions with DUA vs. CUA. No differences on psychological measures between groups at pretreatment indicating that subjects exhibited no psychopathology.

*Follow-up.* Up to 6 months. Relapse = 3 wet nights during a 2-wk period following end of treatment. Percent relapse: CUA = 29%, DUA = 71%, no significant differences.

## Appendix IV

### *Treatments Emphasizing the Utility of Bio-Behavioral Aspects in the Management of Enuresis*

**Bradbury, M., & Meadow, S. (1995). Combined treatment with enuresis alarm and desmopressin for nocturnal enuresis. *Acta Paediatrica, 84*, 1014–1018.**

*Subjects/Dx Criteria.*  $n = 71$ , age range from 6–15 years. Nocturnal enuresis, no medical problems, no deafness or severe learning problems.

*Baseline/Design.* 3 weeks. 2 treatment groups, pretest-posttest, subjects assigned on quota allocation system based on factors associated with outcome.

*Measures.* Number of dry nights/week; number of cures, relapses, nonattenders and dropouts; number of weeks to success; pretest measure of behavior problems.

*Treatment.* Group 1: Urine Alarm plus 40 mcg. of intranasal desmopressin (DDAVP) (medication for first 6 weeks of treatment only). Group 2: Urine Alarm only.

*Outcome.* Group 1 had significantly better response than Group 2 in number of dry nights, successes.

Same results when analyzed for subjects with severe wetting and behavior problems.

*Follow-up.* Minimum of 6 months, no differences in relapse rates between Group 1 and 2.

**Loening-Baucke, V. (1997). Urinary incontinence and urinary tract infection and their resolution with treatment of chronic constipation of childhood. *Pediatrics*, 100, 228-232.**

*Subjects/Dx Criteria.*  $n = 234$  consecutive patients with functional constipation and encopresis; 176 boys, mean age = 9. All had functional constipation and encopresis, 29% had day wetting, 34% with nighttime wetting, 17% both day/night wetting. 11% of total sample had a urinary tract infection. Overall prevalence rate for some form of urinary incontinence was 46%.

*Baseline/Design.* No baseline recording. Single group, post hoc evaluation, pretest-posttest comparison.

*Measures.* Daily record of bowel movements, soiling accidents, day and night wetting, medication usage, urine culture.

*Treatment.* Rectal disimpaction with hypertonic phosphate enema, increase dietary fiber, scheduled toileting, laxatives and stool softeners, antibiotic therapy for urinary tract infections. Treatment lasted approximately 12 months.

*Outcome.* 52% of sample had constipation successfully relieved. Significant reduction in day and night wetting for boys and girls. Significantly fewer subjects who were successfully treated for constipation continued with day and night wetting (89% of subjects with day wetting cured, 63% of night wetting, 100% with urinary tract infections without urologic anatomic abnormalities).

*Follow-up.* None.

**O'Regan, Yazbeck, S., Hamberger, B., & Schick, E. (1986). Constipation a commonly unrecognized cause of enuresis. *American Journal of Diseases of Children*, 140, 260-261.**

*Subjects/Dx Criteria.*  $n = 25$ , 22 with constipation, 17 consented to treatment for constipation, mean age of 8.47 years, 10 were girls. Any kind of functional

urinary incontinence, no renal dysfunction, constipation present in total treated sample.

*Baseline/Design.* No baseline recording. Single treatment group, pretest-posttest measures.

*Measures.* Parent report of wetting frequency based on recollection (no written records kept of wetting).

*Treatment.* Decreasing frequency of phosphate enemas over 3-month period, recommended increase in dietary fiber intake.

*Outcome.* All constipated enuretics had decreased perception of rectal distention with balloon insufflation, and uninhibited bladder contractions. At the end of 9.2 months of treatment, 71% of males and 90% of females ceased wetting.

*Follow-up.* None.

**Sukhai, R., Mol, J., & Harris, A. (1989). Combined therapy of enuresis alarm and desmopressin in the treatment of nocturnal enuresis. *European Journal of Pediatrics*, 148, 465-467.**

*Subjects/Dx Criteria.*  $n = 28$ , 21 males, mean age of 11. Nocturnal enuresis only, no medical problems, at least 3 wets/week, must have normal urine concentrating ability.

*Baseline/Design.* 2 weeks. Randomized, placebo controlled, 2 treatment groups, with crossover after 2 weeks no medication.

*Measures.* Dry nights/week, urine osmolality.

*Treatment.* Group 1: urine alarm plus 20 mcg. of desmopressin (DDAVP) for 2 weeks, then crossed over to placebo for 2 weeks after 2 weeks no medication. Group 2: urine alarm plus placebo for 2 weeks, then crossed over to DDAVP for 2 weeks after 2 weeks no medication.

*Outcome.* Significant urine concentrating effect while on DDAVP. Significantly more dry nights with combination urine alarm and DDAVP. 58% became dry, 17% improved after 6 weeks of treatment.

*Follow-up.* 36% of subjects successfully treated relapsed.

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