Improvements in self-concept after treatment of nocturnal enuresis: Randomized controlled trial

To determine whether changes in attitude and behavior occur after treatment of nocturnal enuresis, we randomly assigned 121 children aged 8 to 14 years to receive conditioning therapy (n = 66) or a 3-month waiting period (n = 55). All children completed the Piers-Harris Self-Concept Scale (P-H), the State-Trait Anxiety Scale (STAIC), and the Nowicki-Strickland Locus of Control test (NSLC) at entry and after treatment or delay. Parents completed the Achenbach Child Behavior Checklist (CBCL). There were no significant group differences in background demographic variables. Significant improvements in the P-H Scale (P = 0.04) and three of its subscales occurred in children in the treatment group compared with those in whom treatment was delayed. The changes were greatest for those who had the largest decreases in wetting frequency. Changes in CBCL, STAIC, and NSLC scores were not statistically significant. We conclude that there may be mental health benefits in children helped to master the symptom of enuresis, which in this age group is probably a chronic stressor. (J PEDIATR 1987;110:647-52)

Michael Edward Knowler Moffatt, M.D., M.Sc., Caroline Kato, and Ivan Barry Pless, M.D.

From the Departments of Pediatrics, and Epidemiology and Health, McGill University and The Montreal Children's Hospital, Montreal, Quebec, Canada

A great deal of attention has been focused on the emotional state of children with enuresis. Earlier views that enuresis was almost invariably a symptom of underlying emotional stress have given way to evidence that most children with enuresis are only minimally different emotionally from the rest of the population.[1] In the most detailed cohort study to date, Kaffman and Elizur[2] showed that certain personality types were statistically more likely to have enuresis at age 4 years: the highly dependent child, the child who resists change, and the child with motor hyperactivity. They could find no evidence of a specific behavioral syndrome in the enuretic children, although these children were more likely than those without enuresis to have had at least one behavioral symptom before age four years.

Although physicians and parents share the concern that the symptom of enuresis might act as a chronic stressor, and if persistent might have a negative effect on the child's personality, very little research has addressed this issue.

ANOVA	Analysis of variance
BMDP	Biomedical Computer Programs, P series
CBCL	Achenbach Child Behavior Check List
NSLC	Nowicki-Stickland Locus of Control Scale
SPSS	Statistical Package for the Social Sciences
STAIC	State-Trait Anxiety Scale

Initial attention was directed to determining whether symptom substitution occurred when the enuresis was relieved. Baker[3] found no evidence of deterioration in any area; indeed, neurotic scores and self-esteem tended to improve. Bindleglas and Dee[4] evaluated young adults who had been given imipramine 10 years earlier; they were now

Supported by a grant from the W. T. Grant Foundation of New York.

Submitted for publication February 17, 1986; accepted Nov. 7, 1986.

Reprint requests: M. E. K. Moffatt, M.D., Winnipeg Children's Hospital, 680 William Ave., Winnipeg, Manitoba, Canada R3E 0W1.

by and large mentally healthy. We found only three studies that hypothesized improvements in mental health after relief of the enuretic symptom.[5-7] All three of these studies had serious limitations: Biller[5] used subjective methods; Wagner et al.[6] had too small a sample; and Netley et al.,[7] who showed increased extroversion and decreased neuroticism in children randomly assigned to conditioning, was unable to relate these changes to treatment success.

Our study was designed to determine whether improvements would occur in self-concept, locus of control, anxiety ratings, and parents' behavior ratings of children after treatment of nocturnal enuresis.

METHODS

The study was conducted in the enuresis clinic of The Montreal Children's Hospital. Before the study began, an announcement was sent to all practicing pediatricians on the hospital staff, informing them that all patients referred to the clinic would be asked to participate. Those eligible for inclusion were children ages 8 to 14 years with primary nocturnal enuresis whose parents were proficient in either English or French.

The study design was a randomized controlled trial. Only two patients who were eligible refused to participate. After the parents had given informed consent, randomization was performed by having the patient select an opaque envelope that assigned the child to the treatment group or to a waiting period of 3 months. The odds of being assigned to the treatment group were slightly better than 50% so as to have nearly as many treatment successes as controls.

One hundred twenty-one children were enrolled: 66 in the treatment group and 55 for the waiting period. A special interview conducted with those assigned to the waiting period served to explain the problem of enuresis and give an outline of the proposed treatment method. The children got a chance to see the alarm devices and to ask questions. No attempt was made to see the children on a regular basis during the waiting period, but they were given a number to call if questions arose, and a definite date was fixed for the beginning of treatment.

Conditioning treatment as outlined by Meadow[8] was used for those in the early group. The Nytone Enuretic Alarm (Nytone Medical Products, Salt Lake City) was used in all but a few of the earliest patients because it proved to be the most convenient. Conditioning was continued until 14 consecutive dry nights were achieved, and then the "overlearning" procedure described by Young and Morgan,[9] which consists of having the child drink three to four glasses of liquid before bed, was followed until a further 14 consecutive dry nights occurred. Bladder control exercises and anticholinergic drugs were added for a few patients with daytime urgency who were not responding to conditioning after 3 months.

The dropout rate after randomization was the same for both groups. Four of the five children in the treatment group who dropped out did so because either the parent or the child was unable to cope with the treatment regimen. In one case the family moved and could not be located. In the waiting period, there was one spontaneous remission; three patients dropped out for other reasons.

Measures. Social class was measured by the method described by Green,[10] which seems to be most appropriate for studies related to health behavior.

The instruments chosen to measure behavioral and perceptual changes were the Achenbach Child Behavior Checklist[11], the Nowicki-Strickland Locus of Control Scale,[12] the State-Trait Anxiety scale,[13] and the Piers-Harris Self-Concept scale.[14] The CBCL, completed by the parents, has been tested on a large normal population and differentiates well between normal children and those at risk for emotional disturbance. The other measures have demonstrated reliability; all were completed by the children as paper-and-pencil tests, with a research associate in the room to answer questons and to read the questions for those with reading difficulty. The questionnaires were translated into French and backtranslated to English by a different translator. Because the patients served as their own controls, we reasoned that this would take care of at least a portion of any intraobserver variability that might arise from translation.

All questionnaires were administered at baseline (T1) and again after the treatment or waiting period (T2). Early in the study we recognized that we had underestimated the amount of time it would take to achieve complete dryness. Rather than ask control subjects to wait even longer, we simply delayed the second questionnaire when success was imminent. Thus, time between baseline and the second questionnarie was longer in the treatment group than in the controls; this was taken into account as a covariate in the analysis.

Analysis. The primary analysis was a repeated-measures ANOVA using the BMDP statistical package, with changes in scores over time between the two groups as the main effect, and interval between the two tests as a covariate. The SPSS program was also used for descriptive statistics, chi-square tests, and paired t tests.

RESULTS

There were no statistically significant differences between the treatment and control groups in demographic variables such as age, social class, parental education, sex, language, and single-parent families. Most children were from middle-class families, and on average their parents had better than high school education. More than half (58 of 112) were referred by private practitioners, 20 were sent from other hospital clinics, and another 20 referred them-

Table I. Changes in adjusted mean scores on questionnaires from T1 to T2

	Patients		Controls				
	T1	T2	T1	T2	df	F	P*
CBCL							
Sum T	60.1	55.2	61.2	59.0	1,110	2.56	.11
Internal T	60.2	54.8	60.8	58.1	1,110	2.39	.13
External T	58.0	54.7	58.3	56.7	1,110	0.93	.34
Piers-Harris Self-Concept							
Total	58.5	61.5	54.6	53.7	1,110	4.13	.04
Subscales							
Behavior	14.0	14.7	12.6	13.2	1,110	0.04	.84
School	14.1	14.7	13.1	12.2	1,110	6.86	.01
Physical appearance	8.7	8.9	8.5	7.7	1,110	4.84	.03
Anxiety	8.8	9.8	7.9	8.1	1,110	3.58	.06
Popularity	9.2	9.8	8.7	8.2	1,110	6.54	.01
Happiness	6.3	6.7	6.4	6.3	1,110	2.23	.14
NSLC	15.7	15.6	18.3	16.2	1,110	0.84	.36
STAIC	33.4	31.8	36.7	34.1	1,110	0.19	.67

T1, Baseline; T2, after treatment or waiting period. CBCL, Achenbach Child Behavior Check List; NSLC, Nowicki-Strickland Locus of Control; STAIC, State-Trait Anxiety Scale.
*BMDP repeated-measures ANOVA with interval between tests as covariate.

selves or heard about the study from others who were in it. Five were referred by the psychology or psychiatry department.

There was also no significant difference in the recorded percentage of wet nights for the 2 weeks prior to treatment (64% in each group) or the type of enuresis. The study was supposed to include only patients with primary enuresis, but on detailed questioning 14 children had had a period of at least 6 months of dryness at some point in their lives. They were no different from the other children in the study and were evenly distributed between the two groups. Seven children were also included whose parents initially said they had no problem with daytime control, but during the course of the study it was determined that they occasionally wet during the day. However, none of these children had regular diurnal enuresis. Six of the seven were in the control group.

In the treatment group, the interval between the first and second questionnaires was 18.4 ± 5.8 weeks, significantly different ($P < .001$) from the interval of 13.2 ± 1.9 weeks in the untreated group. This difference could have affected the retest scores, so was used as a covariate in the analyses.

Forty-two of the 61 children in the treated group eventually became completely dry at night, an overall success rate of 69%. However, only 35 of these became dry before the second questionnaire. A further 18 children had at least a 25% decrease in their baseline wetting scores; in these the program was classed as partially successful. Ten of these had a 75% decrease. For 8 children who did not achieve at least a 25% improvement, treatment was judged a failure. Only one of the 55 children assigned to the waiting group became dry spontaneously, leaving no doubt as to the efficacy of the conditioning therapy.

The parents ratings of behavior (CBCL) improved in both treatment and control groups (Table I); the improvement for the treatment group was not significantly greater than for the controls. The power of the study to eliminate beta error is 0.75. On the Piers-Harris Self-Concept Scale, children in the treatment group rated themselves significantly improved at the second questionnaire, compared with the controls ($P = 0.04$). The raw scores on the NSLC and the STAIC changed toward more internal locus of control and lower levels of anxiety in the treated children, but when these were adjusted through a repeated-measures ANOVA with interval between the tests as a covariate, these changes disappeared.

The Piers-Harris Self-Concept Scale yields six factors, or subscores. Significant changes occurred in the treatment group compared with the controls on three of these subscales: School Performance, Physical Appearance, and Popularity. There was also borderline improvement in Anxiety ($P = 0.06$). On the Physical Appearance scale, the difference between the treatment group and the controls ($P = 0.05$) actually represented deterioration in scores of the controls rather than improvement for those treated.

The results presented in Table II are an attempt to show that it was not a placebo effect of contact with the physician that was responsible for these changes. When success was defined as above, and partial success as greater than a 25% decrease in baseline wetting score, the successful and partially successful children in the treatment group

Table II. Changes in test scores for treatment group by success of treatment

	Success 100% (n = 35)	Partial failure	
		>25% Improved (n = 18)	<25% Improved (n = 8)
CBCL			
Sum T	−5.2	−2.3	−2.0
Internal T	−5.4	−3.4	−2.9
External T	−3.1	−0.4	−2.0
Piers-Harris Self-Concept			
Total score	3.2	3.7	0.4
Subscales			
School	0.6	−0.2	−0.3
Physical appearance	0.0	0.5	0.4
Anxiety	1.1	0.9	0.8
Popularity	0.6	1.1	−0.4
NSLC	−2.2	−1.3	+1.5
STAIC	−3.6	−2.6	−0.3

CBCL, Achenbach Child Behavior Check List; NSLC, Nowicki-Strickland Locus of Control; STAIC, State-Trait Anxiety Scale.

had greater improvements in Piers-Harris Self-Concept than did the children who showed little or no improvement (3.2 and 3.7 vs 0.4, respectively). The same gradient appeared in all the subscales except Physical Appearance, and was also seen in the results of the STAIC (−3.6 and −2.6 vs −0.3) and in the NSLC scores, which showed a tendency toward an improved sense of mastery of the environment in children in the treatment group who achieved success or partial success (−2.2 and −1.3, respectively), whereas the children who showed little or no improvement had higher levels (+1.5) of externality at the second questionnaire.

If the changes in self-concept were the result of treatment, similar changes should have occurred in the control group once they received treatment. This is exactly what happened. Their scores improved from 55.7 ± 11.8 after the second questionnaire to 61.2 ± 9.6 after treatment ($P < 0.001$, paired t test).

DISCUSSION

According to recent studies,[15,16] the usual management of enuresis by pediatricians in North America is to recommend symptomatic treatment or to reassure parents that the child will outgrow the problem. Medication (usually imipramine) is recommended by 28% of pediatricians, although parents are usually wary of this type of therapy. Conditioning alarms are recommended by only 3% of American pediatricians. Parental satisfaction with treatment is low.

At least three randomized controlled trials[17-19] have shown that conditioning is the most effective means of eliminating the symptom of bed-wetting, and the results of our study are in agreement. Conditioning treatment of enuresis has evolved to where it can be handled by a pediatrician with reasonable expectation of success. Modern technology has replaced the cumbersome bell-and-pad type of apparatus with small transistorized battery-powered devices that can be attached to the wrist or the pajamas, and very early in the treatment eliminate the need for bed changing. These devices and their use have been reviewed by Schmidt.[20] They are well accepted by parents and children, who are less resistant to the idea of conditioning than many physicians think. The cost is also about half that of the older bell-and-pad type of instruments. When used in a manner similar to that described by Meadow,[8] with the routine addition of a period of overlearning as described by Young and Morgan,[9] it is possible to attain complete remission in 65% to 75% of children, and relapse rates are as low as 10%.

The results of our study suggest that there are measurable improvements in the way children feel about themselves after they have mastered nocturnal enuresis. The improvements in self-concept in the treatment group were statistically significant even under the rigorous analysis of a repeated-measures ANOVA, and the fact that the control group showed the same degree of change when they were later treated adds consistency to this observation.

The initial ratings of behavior for both groups were clearly abnormal. T scores (a score adjusted for age) averaged >60, which is close to the 90th percentile for the normal population, and 19 of the 112 had T scores >70 (98th percentile), which is in the range where psychiatric problems might be suspected. Despite this, it was our clinical impression that few of these children had significant behavior disorders. Kaffman and Elizur[2] did the only cohort study to date that examined aspects of personality

as predictors of enuresis. The wide range of behaviors scored on the CBCL would result in children with the personality types described by Kaffman and Elizur receiving high scores. We also speculate that many parents, frustrated by the aggravation of enuresis, exaggerate the severity of some of the behaviors of their children and thus cause high scores. Improvements after treatment may be as much the parents' perception as true reflections of behavior.

In our study population, no single behavior profile stood out among the children with enuresis. Equal numbers of children had highly external and highly internal scores. The profile for each child was different.

A study such as this has limitations. Of necessity, it violates one of the principles of a randomized controlled trial: balanced cointervention between treatment and control groups.[22] It would have been impossible to get control patients to return every 3 weeks during the waiting period just to talk to a physician without receiving any treatment, yet it could be just that sort of physician support that brought about the changes in some of the measures shown. However, the children who failed to improve had the same or more physician contact than those who succeeded, yet their self-concept and anxiety scores did not improve to nearly the same extent.

Another desirable attribute of randomized controlled trial is that both the clinician and the patient should be blind to the type of treatment. In this case, it was impossible. However, the outcome measures were not dependent on the physician but were measured by the parents and the children themselves. The parents had some idea of what we hoped to find in the study, but it is safe to say that the children, in general, did not. Significant changes in the treatment group occurred only on a questionnaire completed by the children and not on those by the parents. It would also be difficult for a child to be sure which answers to many of the questions were socially desirable. For all these reasons, we do not believe that the children's knowledge of their treatment group was an important source of bias.

The findings of this study can be generalized only to the type of children who were studied: primarily middle-class children from private practice settings between the ages of 8 and 14 years. Other children may have so much stress in their lives that it would be unlikely that their self-concept would be much improved even if their environments were organized enough to allow them to carry out the therapy.

This study did not address the question of how durable the changes in self-concept might be. If use of conditioning for children with enuresis were to become widely adopted, another concern would be the children who fail to respond to conditioning. Do they feel even more like failures? Do they fail because they have significant emotional problems? Or could they have some as yet poorly understood physiologic reason for wetting? Our data did not show any deterioration in self-concept or anxiety levels in these children (Table II), but their locus of control seemed to become more external.

We have shown inprovements in self-concept in a group of children with nocturnal enuresis after successful conditioning therapy. We suggest that poor self-concept may be a secondary effect of chronic stress rather than a cause of the symptom of bed-wetting. Physicians who are willing to take the time to work with these children, using conditioning therapy, may help them to improve their mental health.

We thank Ms. Mary Cheang for assistance in handling of the data, and Dr. T. Hassard for statistical consultation.

REFERENCES

1. Couchells SM, Johnson SB, Carter R, Walker D. Behavioral and environmental characteristics of treated and untreated enuretic children and nonenureric controls. J PEDIATR 1981;99:812-6.
2. Kaffman M, Elizur E. Infants who become enuretics: a longitudinal study of 161 kibbutz children. Monogr Soc Res Child Dev 1977;42(2):1-61.
3. Baker BL. Symptom treatment and symptom substitution in enuresis. J Abnorm Psychol 1969;74:42-9.
4. Bindleglas DM, Dee G. Enuresis treatment with imipramine hydrochloride: a ten year follow-up study. Am J Psychiatry 1978;135:1549-52.
5. Baller W. Bedwetting: origins and treatment. New York: Pergamon Press, 1975.
6. Wagner W, Johnson SB, Walker D, Carter R, Wittner J. A controlled comparison of two treatments for nocturnal enuresis. J PEDIATR 1982;101:302-7.
7. Netley C, Khanna F, McKendry JBJ, Lovering JS. Effects of different methods of treatment of primary enuresis on psychological functioning in children. Can Med Assoc J 1984; 131:577-9.
8. Meadow R. How to use the buzzer alarm to cure bedwetting. Br Med J 1977;2:1073-5.
9. Young G, Morgan RTT. Overlearning in the conditioning treatment of enuresis. Behav Res Ther 1972;10:147-51.
10. Green LW. Manual for scoring socioeconomic status for research on health behavior. Publ Health Rep 1970;85:815-27.
11. Achenbach TM. The child behavior profile: an empirically based system for assessing children's behavioral problems and competencies. Int J Ment Health 1979;7:24-42.
12. Nowicki S, Strickland B. A locus of control scale for children. J Consult Clin Psychol 1973;40:148-54.
13. Speilberger CD. Manual for the State-Trait Anxiety Scale for Children. Palo Alto, Calif.: Consulting Psychologists Press, 1973.
14. Piers E, Harris D. The Piers-Harris Children's Self-Concept Scale. Nashville, Tenn.: Counselor Recordings and Tests, 1969.

15. Hague M, Ellerstein NS, Grundy JH, et al. Parental perceptions of enuresis: a collaborative study. Am J Dis Child 1981;135:809-11.
16. Shelov SP, Grundy J, Weiss JC, et al. Enuresis: a contrast of attitudes of parents and physicians. Pediatrics 1981;67:707-10.
17. Werry JS, Cohrsen J. Enuresis: an etiologic and therapeutic study. J PEDIATR 1965;67:423-31.
18. DeLeon G, Mandell W. A comparison of conditioning and psychotherapy in the treatment of functional enuresis. J Clin Psychol 1966;22:326-30.
19. McKendry JBJ, Stewart DA, Khanna F, Netley C. Primary enuresis: relative success of three methods of treatment. Can Med Assoc J 1975;113:953-5.
20. Schmidt BD. Nocturnal enuresis: an update on treatment. Pediatr Clin North Am 1982;29:21-30.
21. Cohen J. Statistical Power Analysis for the Behavioural Sciences. Academic Press, New York USA 1971.
22. Sackett D L. Design, Measurement and Analysis in Clinical Trials. in Platelets, Drugs and Thrombosis. Symp. Hamilton 1972,pp219-225 (Karger, Basel 1975)