A SYSTEMATIC MODIFICATION OF DRY-BED TRAINING FOR THE TREATMENT OF NOCTURNAL ENURESIS

Jeffrey Bollard
B.A., Dip. App. Psych.

Thesis submitted in fulfilment of the requirements
for the Degree of Doctor of Philosophy

Department of Psychology
University of Adelaide

June, 1982

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

TABLES (continued)

ABSTRACT

Dry-Bed Training (DBT) employs a urine-alarm apparatus but adds training in rapid awakening, practice in withholding urination, self-correction of toileting accidents and increased social motivation to the standard conditioning treatment of nocturnal enuresis. Initial training is done in an all-night intensive programme conducted by a professional trainer in the child's home. A post-training supervision programme is then conducted by the child's parents until the child becomes continent.

Claims for the relative success of DBT over the standard conditioning procedure in arresting bedwetting might be attributable to a higher degree of patient/therapist contact within DBT's initial all-night training session, resulting in higher motivation directed towards correct alarm usage on the part of parents and children.

The significance of patient/therapist contact was addressed in the first two experiments. The first, involving 45 nocturnally enuretic children, compared the effectiveness of the standard conditioning procedure, both closely supervised and not supervised, following an initial description of the procedure. Results showed that supervised training significantly enhanced the effectiveness of treatment. One hundred and twenty children took part in the second experiment which compared standard conditioning with DBT administered under four different conditions - by the child's parents at home, by a professional trainer at home, by a professional trainer in hospital, and by the child's parents without the adjunct of a urine-alarm. When used in conjunction with a urine-alarm, DBT was equally effective under all conditions of administration and was significantly more effective than standard conditioning, both in terms of

the proportion of children successfully treated and the overall speed of treatment. The superiority of DBT was not simply attributable to greater therapist contact. Although the Dry-Bed procedure without an alarm resulted in significantly fewer bedwettings than a no-treatment control, it was less effective in arresting bedwetting than any of the alarm-based treatments.

Results of the second experiment demonstrated that parents could successfully be trained to administer DBT. The third study attempted to reduce the time required to instruct parents in the complex procedure by initially instructing parents in small group settings, followed by regular group meetings with the therapist until the child achieved dryness. Thirty nocturnally enuretic children took part. Results showed that instructing parents in a group to administer DBT with an alarm is a more economical large-scale method of treatment than individual instruction, because of savings in therapist time and effort.

The results of the second and third experiments highlighted the importance of the alarm to the success of the DBT procedure, questioning the practical efficacy of a 'no-alarm' treatment. Nevertheless, the effect of the DBT exercises on their own in reducing bedwetting frequency raised theoretical issues in respect of the role of operant factors in achieving nocturnal bladder control. The fourth experiment aimed to delineate which aspects of DBT, in addition to the alarm, contribute most to the procedure's overall effectiveness. The major components were identified as (i) the waking schedule; (ii) retention control training; and (iii) positive practice. Combinations of these components yielded six treatment groups each comprising twelve subjects. Together with an

alarm-only group from the first two experiments and a DBT group from the second experiment, these groups were compared for effectiveness. Bedwetting frequency was reduced to slightly below levels achieved with the alarm-only treatment by the addition of either retention control training, or positive practice. A more substantial decrease in bedwetting resulted from the addition of the waking schedule, although none of the effects of the single components was statistically significant. The effects of the three components were cumulative, so that the more components added to the alarm-only procedure, the better the therapeutic response. The relative success of the waking schedule combined with the alarm points to a possible relationship between 'ease of arousability from sleep' and bedwetting. The results suggest, further, that retention control training and positive practice could be eliminated from the DBT schedule without sacrificing its overall effectiveness.

The fifth study addressed the problem of relapse in bedwetting following standard conditioning treatment. It was hypothesized that because of training features in addition to the urine-alarm, DBT would result in a lower rate of relapse than standard conditioning. Sixty children treated by DBT from Experiment 2 and 35 children treated by standard conditioning from the first two experiments were followed up over a two-year period. Results showed that after achieving the initial success criterion of 14 consecutive dry nights, 39 percent of the DBT group and 41 percent of the standard conditioning group subsequently relapsed, so that the hypothesis of greater effectiveness for DBT was not supported. Children who relapsed following initial treatment were compared with those remaining dry in respect of the child's age and sex, bedwetting frequency prior to treatment, the number of bedwets (and consequent

conditioning trials) during treatment, a history of primary or secondary enuresis, and a history of diurnal micturitional difficulty. The only variable found to be significantly associated with proneness to relapse was a history of day-time wetting accidents beyond the age of four years. Although the relapse rate following DBT was found to be virtually the same as that following standard conditioning, the fact remains that the former treatment was significantly faster in bringing about the initial arrest of bedwetting. It was concluded that DBT results in significantly less total time for alarm-usage, a major practical consideration for large-scale treatment.

DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university and, to the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except when due reference is made in the text of this thesis.

Signed: _____

Jeffrey Bollard
June, 1982

PREFACE AND ACKNOWLEDGEMENTS

Prior to the commencement of this research, the urine-alarm conditioning procedure popularized by Mowrer and Mowrer (1938), had become the usual form of therapy for bedwetters referred to the Psychiatry Department of the Adelaide Children's Hospital, as indeed it was in many other child guidance clinics worldwide. The use of this conditioning procedure was based on a substantial body of literature attesting to its superior effectiveness in arresting bedwetting for the vast majority of nocturnally enuretic children, when compared with other available forms of therapy such as drugs and psychotherapy.

However, by 1977 when the current research began, a long waiting period had developed at the Adelaide Children's hospital, between referral of the child and the commencement of treatment. For children under ten years of age the waiting period was usually 12 to 18 months. Several interrelated factors had contributed to this situation. Firstly, it was readily apparent, from the number of referrals made to the hospital and from the epidemiological surveys, that bedwetting is a very prevalent condition in our community. Secondly, the number of urine-alarm devices available at the hospital was insufficient to meet the demands for treatment. Thirdly, limitations within the standard conditioning procedure itself had contributed to delay in providing treatment. Studies into this form of therapy have usually reported average treatment times of about two months in order to effect initial arrest of bedwetting, although some children may take several months longer. In addition, not all children are successfull in achieving nocturnal continence following standard conditioning. The average rates of initial

arrest of bedwetting are usually reported to be in the order of 75 to 90 percent with some 40 percent of these resuming wetting the bed within a two-year follow-up period.

One solution to the problem of coping with large numbers of referrals at the Adelaide Children's Hospital would simply have been to obtain sufficient urine-alarm devices to match the demand for treatment. However, this would have involved considerable expense, both for equipment and for the additional staff to supervise its use. An alternative solution was to attempt to develop a more efficient treatment than the standard conditioning procedure. In order to do this, it was considered that further research should pursue the following aims:

(a) Reduce the time required to achieve initial dryness, thereby speeding up the 'turn-over rate';

(b) eliminate bedwetting in a greater proportion of cases treated than the success rates commonly reported following standard conditioning;

(c) reduce the relapse rate since relapse is possibly the most significant shortcoming of standard conditioning; and

(d) develop an effective treatment that does not rely on the use of a urine-alarm, since it is often the limited availability of these devices which contributes to the waiting list in many clinics.

Dry-Bed Training, reported by Azrin, Sneed and Foxx (1974), offered promise of achieving these aims and therefore provided the basis for the research reported in this thesis. Azrin et al. (1974) claimed that DBT is a more rapid treatment of nocturnal enuresis than the standard conditioning procedure. Furthermore, their results raised the possibility of an effective treatment not reliant on the urine-alarm, it being claimed that training features of DBT aimed at maximizing the social/motivational

consequences of bedwetting contribute more to the success of the procedure than direct conditioning of the bladder.

Unfortunately, the research reported in this thesis showed that DBT did not live up to early expectations. Firstly, the Dry-Bed schedule of exercises without the adjunct of a urine-alarm device was found to be ineffective in completely arresting bedwetting. Secondly, while DBT with an alarm was shown to be more effective in arresting bedwetting than standard conditioning, the former treatment was found to involve a number of practical difficulties which would limit its viability for large-scale clinical practice. However, it was found that the effectiveness of standard conditioning could be improved substantially by the addition of one of the major components of DBT, namely a night-time waking schedule, and this treatment regimen subsequently became the usual form of therapy for nocturnally enuretic children referred to the Adelaide Children's Hospital.

There are many people to whom my thanks are due for invaluable assistance throughout this research. I should like to mention first of all my supervisor, Dr. Ted Nettelbeck, to whom I am greatly indebted for his expert guidance, prompt correction of written work and general support. On a more personal note, I wish to express my appreciation of Dr. Nettelbeck for his friendship, sense of humour and company as a jogging partner, all of which helped make this work much more enjoyable.

I should like to express my gratitude to my colleagues in the Psychiatry Department of the Adelaide Children's Hospital for their interest in the project. In particular, thanks are extended to Mr. Phil Woodroffe for his many helpful suggestions and support over a long period, to Dr. Jeffrey Gerrard for permission to conduct the research, and to Mrs. Kath Carney and Mrs. Colleen Nelson for their encouragement and all-round assistance. I am indebted also to Dr. Eric Sims and Dr. Hugh Douglas for making available ward facilities and to the nursing staff who willingly offered their help during an early stage of the investigation.

My thanks are also due to Miss Lesley Roxbee for her help with some of the parent groups reported in Chapter 3, and to the many parents and children who took part in the various experiments.

I wish to acknowledge the sacrifices made by my family in order for me to undertake this degree. I am especially grateful to my wife Frances for her tolerance during the many hours spent writing the thesis. I look forward to the opportunity in the future of being able to spend more time with my children Olivia and Nicholas.

Finally, I wish to thank Mrs. Margaret Blaber and Mrs. Judith Fallon for their expert typing services, and to Helena van Ruth for her part in preparation of the figures.

The experiments reported in this thesis together with much of the theoretical and analytic discussion appear in the following articles:

(i) Chapter 2:

BOLLARD, J., & NETTELBECK, T. (1981)

A comparison of Dry-Bed Training and standard urine-alarm conditioning treatment of childhood bedwetting. Behaviour Research and Therapy, 19, 215-226.

(ii) Chapter 3:

BOLLARD, J., NETTELBECK, T., & ROXBEE, L. (1982)

Dry-Bed Training for childhood bedwetting: A comparison of group with individually administered parent instruction. Behaviour Research and Therapy - in press.

(iii) Chapter 4:

BOLLARD, J., & NETTELBECK, T. (1982)

A component analysis of Dry-Bed Training for treatment of bedwetting. Behaviour Research and Therapy - in press.

(iv) Chapter 5:

BOLLARD, J. (1982)

A two-year follow-up of bedwetters treated by Dry-Bed Training and standard conditioning. Behaviour Research and Therapy - in press.

While the first three of these articles involved collaboration with Dr. T. Nettelbeck, the experimental work in each case was done entirely by myself. It is not possible to precisely distinguish the relative contribution of Dr. Nettelbeck or myself to the writing of the articles,

however this too, was predominantly my effort. Miss Roxbee's name appeared in the list of authors in the second article, because as noted earlier, she assisted in the running of some of the parent training groups. The fourth article was entirely my work although Dr. Nettelbeck offered helpful comments on the manuscript prior to its submission for publication.

CHAPTER 1

INTRODUCTION : NOCTURNAL ENURESIS

1.1 DEFINITION OF NOCTURNAL ENURESIS

Functional nocturnal enuresis has been defined as persistent wetting of the bed during the night in the absence of neurologic or urologic pathology (Campbell, 1970). In more common terms a person with nocturnal enuresis is known as a bedwetter.

Lovibond and Coote (1970) have emphasised that any definition of nocturnal enuresis necessarily involves a number of arbitrary features. Firstly, there is no specific age at which normal children achieve nocturnal control of the micturition process. All of us, of course, start life wetting the bed. The incidence of bedwetting decreases steadily from infancy, but a small proportion of people continue to wet the bed into their teens and even into adulthood. The age at which children are expected to become continent at night varies between communities and between social classes within communities. However, three to four years of age is often considered to be significant, because according to physiological evidence, normal urinary control can be established by this age and because potential long-term bedwetters can be identified as early as this (Campbell, 1970; Muellner, 1960a, 1960b).

Secondly, there is no firm concensus concerning the minimum frequency of bedwetting for a child to be termed 'enuretic'. Patterns of bedwetting are highly variable, with some children wetting the bed several times each night, some wetting only occasionally, and still others wetting heavily but sporadically.

Thirdly, two types of enuresis have been suggested, based on the child's history of bedwetting. The 'primary' or life-long enuretic has never demonstrated complete control over nocturnal micturition. The 'secondary' or

'acquired' enuretic has experienced a significant period of nocturnal continence (usually for a minimum of six months) prior to reverting to regular night-time wetting. Some writers (e.g. Kolvin & Taunch, 1973) have argued for this distinction, based on the hypothesis that primary enuresis has a mainly psychogenic basis. However, to date, there is little evidence to support the notion that this distinction has any prognostic validity and it appears to exist primarily for classification purposes (Doleys, 1977; Lovibond, 1964; Sacks & De Leon, 1973).

1.2 INCIDENCE OF NOCTURNAL ENURESIS

There is evidence that nocturnal enuresis has been a cause of concern in a wide variety of cultures since ancient times (Glicklick, 1951). However, it is only recently that reliable data on the prevalence of bedwetting in the general population have become available, and this development exists only for more technologically advanced countries.

There are substantial difficulties in estimating the prevalence of bedwetting. A summary by De Jonge (1973) of epidemiological studies revealed a wide variability in the population of children regarded as enuretic at various age groups. Reasons for such disparate figures are, firstly, that there has not been consistent agreement among researchers concerning the minimum frequency of wetting for the child to be regarded as enuretic. Some authors (Hallgren, 1956; Notschaele, 1964; Oppel et al., 1968) have used the criterion of a minimum frequency of one wet bed per month, while others (Blomfield & Douglas, 1956; Martin, 1966) have required a frequency of at least two wet nights per week. Secondly, the method of investigation has varied with different surveys. Incidence data have been collected by personal interview (Blomfield & Douglas, 1956; De Jonge, 1969; Martin, 1966; Oppel et al., 1968), by questionnaire (Hallgren, 1956), and by retrospective questioning (Thorne, 1944). Thirdly, the populations sampled have varied widely, for

example from war-time recruits (Levine, 1943; Thorne, 1944), to peace-time conscripts (Bieger, 1954), to all children born in Great Britain during the first week of March, 1946 (Blomfield & Douglas, 1956).

Despite these difficulties, studies reviewed by De Jonge (1973) employing a criterion for bedwetting of at least one wet night per month, highlight several important trends with respect to the incidence of bed wetting. The vast majority of children are nocturnally enuretic at the end of the first year of life, although perhaps about seven percent have achieved nocturnal continence by this time (Hawkins, 1962). The most obvious trend is for the incidence of bedwetting to decrease with increasing age. This decline in incidence is rapid from the end of the first year of life to about the fifth year. Thus, incidence of bedwetting drops to about 20 percent of three year olds, 15 percent of five year olds, five percent of ten year olds and two to three percent of teenagers, reaching an apparent asymptote in adulthood. Since these estimates are confirmed by a number of studies from several different economically developed countries they may be regarded as representative of such societies, including Australia.

It is clear from the above summary data that bedwetting is a very common problem during childhood. Lovibond (1964) combined the incidence data from three large-scale surveys conducted in England by Bransby, Blomfield and Douglas (1955) with the most recent Commonwealth Census returns available at the time, estimating that there were approximately 100,000 nocturnal enuretics in Australia between the ages of five and 14 years. Adjusting for current population data, this figure is now likely to be in the order of 120,000 children.

A second trend from the surveys cited by De Jonge (1973), is that more males than females are bedwetters, the ratio being approximately 3:2. Shaffer (1980) notes that this ratio is similar to that observed in a number of

childhood developmental disorders, although the reason for the gender difference is not understood.

A third observation is of the association between social and cultural differences and the incidence of bedwetting. Nocturnal enuresis has been found to occur more frequently among children from working class homes than among children of middle class parents (Douglas & Blomfield, 1958; Miller et al., 1960; Stein & Susser, 1967). As this social gradient exists in several countries (Germany, Sweden, Britain and Israel), it seems unlikely that it is attributable to biased reporting by parents or investigators. On a larger social scale, cultural differences in the prevalence of bedwetting have been reported. Oppel et al. (1968) found nocturnal enuresis to be more prevalent in the United States of America and Australia than in Great Britain and Sweden.

1.3. THE PHYSIOLOGY OF MICTURITION

1.3.1. The mechanism of micturition

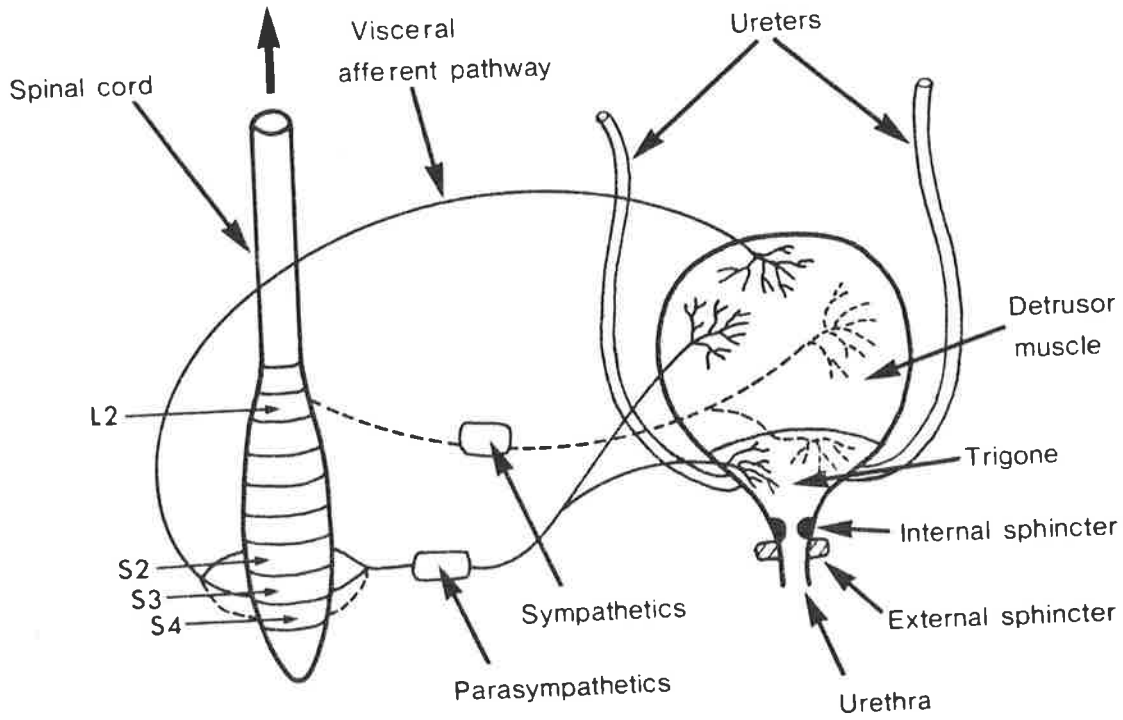


FIGURE 1.1. The urinary bladder and its innervation (after Guyton, 1966).

The urinary bladder, which is illustrated in Figure 1.1, is comprised of two principal parts:

(i) the 'detrusor muscle' which is the main body of the organ, and

(ii) the 'trigone', a muscular mass near the mouth of the bladder through which both 'ureters' (the tubes conveying urine from each kidney to the bladder) and the 'urethra' (the canal through which urine is discharged), pass.

The trigonal muscle embraces the 'internal sphincter' of the bladder. About 2 cm below the bladder, the urethra passes through the 'external sphincter' of the bladder. As urine passes from the kidneys to the bladder via the ureters, the detrusor muscle tone is repeatedly adjusted, thereby allowing larger volumes of urine to be stored with little increase to internal pressure. A normal adult can store up to about 200 mls of urine in the bladder before intravesical pressure increases significantly. With further distention of the bladder, nervous impulses arising from stimulation of the sensory end organs in the bladder wall trigger the micturition reflex. This involves strong rhythmical contractions of the detrusor, relaxation of the internal sphincter followed by relaxation of the external sphincter, and, ultimately, the passing of urine. The act of micturition, although described here as a simple reflex, is actually a complex response resulting from an integrated chain of reflexes.

1.3.2. The development of bladder control

Infants begin life with reflex voiding in response to bladder distention. Bladder capacity is small, so that spontaneous voiding occurs frequently during the first few months of life. Following maturation of the parasympathetic nervous system most children learn to perceive stimulation from increasing bladder tension between one and two years of age (Muellner, 1960b). At this stage many children show behavioural signs of approaching voiding. With this awareness the ability is acquired to "hold" urine for a brief time after the sensation of a full bladder is perceived and bladder capacity increases. By

three years of age most children have learned to hold urine for a considerable time when the bladder is full, and so get to the toilet before voiding (Muellner, 1960a, 1960b). This requires the voluntary tensing of the perineal muscles in the crutch which raises the bladder neck and tightens the internal sphincter (Muellner, 1960a, 1960b; Vincent, 1959, 1960, 1964, 1966). Bladder capacity increases so that there is a drop in frequency of voiding and a larger volume voided at each elimination. Between three and four years of age the ability to start the urine flow from a full bladder is required. This is achieved by combining the pushing down of the thoracic wall and tightening of the abdominal muscles (Muellner, 1960a, 1960b). By about four years of age most children can also stop the urinary stream at will. The final stage in the development of continence occurs at about six years of age, when the ability is mastered to start the urinary stream at almost any degree of bladder filling. Toilet training is complete when the child learns to initiate micturition only in the appropriate places.

In order to achieve nocturnal continence the child must transfer inhibitory control over the micturition process to the sleeping state. Normally, this is achieved by three to four years when, as a consequence of increased functional bladder capacity together with the reduced level of urine production during sleep (Franczak, 1965), the child can effectively hold-on to urine during the hours of sleep. If bladder pressures exceed the limits of compensatory adjustment of the detrusor during sleep, feedback stimuli from the filling bladder interrupts sleep so that the child awakens before the micturitional reflex is triggered (Lovibond & Coote, 1970).

1.4 THEORIES OF ENURESIS

There have been a number of quite different and at times contradictory explanations of the nature and aetiology of nocturnal enuresis. It is possible, however, to divide the unifying threads of these explanations into three main categories:

1. psychodynamic theories;
2. physiological theories; and
3. behaviouristic theories.

1.4.1. Psychodynamic Theories

The belief that enuresis is a symptom of underlying emotional disturbance has been promoted mainly by the psychoanalytical theorists. This explanation received widespread approval early in the twentieth century and many variants of the theory were elaborated. Mowrer (1950, p. 416) summarized the more commonly held theories as follows:

"(i) enuresis is a substitutive form of gratification of repressed genital sexuality.

(ii) it is a symptom of deep-seated anxieties and fears.

(iii) it is a disguised expression of hostility directed towards parents and parent substitutes which the victim of enuresis does not dare to express more openly."

A number of implications follow from the proposition that enuresis is a surface indicator of some underlying emotional disturbance of a general and fundamentally more important nature. Firstly, a representative sample of enuretic children should evidence a substantially greater degree of maladjustment than a matched group of non-enuretics. This association remains uncertain however, despite considerable research. The problem is that while

general population surveys such as the Isle of Wight Investigation (Rutter et al., 1973) and the National Child Development Study (Essen & Peckham, 1976) have indicated an association between enuresis and psychological disorders, particularly the common neurotic and conduct disorders, they have also made it abundantly clear that the vast majority of children who are wet are actually well-adjusted and free from other problems affecting their behaviour. Comparative studies of the personalities of enuretics and non-enuretics have indicated similar results (Collins, 1973; Lickorish, 1964; Lovibond, 1964). Although the relationship between enuresis and psychological disorders is somewhat stronger when bedwetting is accompanied by diurnal enuresis (Hallgren, 1956), and enuretic children referred to child guidance clinics are more likely to be psychologically disturbed (Hallgren, 1957), even so, the majority of enuretic children are free from other behavioural difficulties.

Even when an enuretic child displays signs of emotional disturbance it is not proof of a psychogenic origin since the disturbance may be secondary to the enuresis itself. A necessary condition which must be met to support a psychogenic explanation is that the postulated stress or conflict should have preceded or coincided with the onset of acquired enuresis, or, in the case of primary enuresis, have been operating at a time when the child would normally have been becoming dry. To date, the evidence is not clear on this point.

A second explanation of the psychodynamic position is that a direct attack on the symptom itself would be both futile and undesirable, since this strategy would not deal with the real problem - i.e. underlying emotional disturbance. Psychoanalytic theorists warn that it is dangerous to attempt to eliminate enuresis directly, lest in doing so the underlying anxieties be

exacerbated, thereby producing some other serious disturbance. De Curtins (1957), for example, warns that symptom substitution may sometimes be worse than the enuresis, listing severe neuroses and fire-setting as examples. Lovibond (1964), however, has suggested that quite the reverse can occur, prolonged enuresis resulting in psychological disturbance. Thus, although enuresis is natural for very young children, when it persists into childhood the child's own reactions and those of others can lead to serious consequences. From this perspective, enuresis is less the result of a serious problem; rather it is a cause. Direct removal of the symptom should, if anything, be beneficial for the overall psychological health of the child.

The evidence clearly has borne out Lovibond. Elimination of bedwetting following conditioning treatment has been shown to be at least psychologically benign and more often beneficial (Baker, 1969; Collins, 1973; Shaffer, 1973, and Thomson, 1971). Even if direct treatment of bedwetting is not successful, parents have generally not reported additional symptoms (Collins, 1973).

A third implication of psychodynamic theories is that psychotherapy must be the treatment of choice because it is only in this way that the underlying conflict can be removed. Again however, the facts do not support this assertion. As will be shown in more detail in Section 1.5.1 below, psychotherapy has not been shown to be effective in arresting nocturnal enuresis.

Overall, then, while the belief that enuresis has a deep-seated psychogenic origin enjoyed popularity for many years, and indeed is still held today in some quarters, there is very little factual evidence in its favour.

1.4.2. Physiological Theories

The essence of physiological theories of enuresis is that the disorder represents a failure for the person to develop cortical control over sub-cortical reflex mechanisms (Lovibond & Coote, 1970). Possible sources of this failure include immaturity of the central nervous system connections governing bladder control, immaturity of the bladder itself, or deep sleep which makes the child less sensitive to the stimulation reaching the cortex from the bladder. These sources are discussed in the sections which follow.

(i) Immaturity of the Central Nervous System (CNS)

Many authors subscribe to the view that the primary cause of enuresis is a type of neurophysiological immaturity of structures subserving bladder control (Barbour et al., 1963; Bakwin & Bakwin, 1972; Illingworth, 1968). Collins (1976) suggests that this viewpoint, along with its implication that age is the best cure for enuresis, is so widespread as to have become a "cultural truism".

Evidence supporting a maturational disorder is derived from a variety of sources. Firstly there is the strong tendency to spontaneous improvement in bedwetting with increasing age, already noted in Section 1.2. Secondly, evidence for the relative somatic immaturity of bedwetters is often cited in support of the maturational disorder argument. For example, Kaffman and Elizur (1977) and Lockorish (1964) have found higher rates of motor and speech abnormalities among enuretic patients than among non-enuretics. Douglas (1973) also reported an excess of speech deficits in younger enuretics, and in older boys, a delay in the development of secondary sex characteristics. P. Miller (1973) has suggested that the physical growth of enuretics tends to be slower than that of non-enuretics. Several writers have reported an increased risk of bedwetting among children with low birthweight resulting

from short gestation (Kaffman & Elizur, 1977; Oppel et al., 1968), and children with low birthweight after normal gestation (Kolvin & Taunch, 1973; Neligan et al., 1976). Compared with the norms for the appropriate age group, electroencephalogram (EEG) records of persistent enuretics have been found to contain diffuse abnormalities, which have been interpreted as indicating immaturity of cortical development (Campbell & Young, 1966; Turton & Spear, 1953).

There is however, contrary evidence in relation to the above claims. For example, Oppel et al. (1968), found no relationship between a delay in the development of urinary continence and other developmental milestones. Enuresis has been found to be unrelated to a delay in general intellectual development (Rutter et al., 1973). In addition, Werner et al. (1971) have argued that the findings of an association between low birthweight and increased risk for bedwetting, cannot be accepted as evidence of developmental delay because later developmental correlates of low birthweight children are in general poorly understood, and in many cases can be accounted for by associated adverse environmental factors. In respect of EEG studies, Salmon et al. (1973) point out that the mechanisms governing the acquisition of urinary continence and the significance of statistically unusual features in the EEG's of children are insufficiently understood to support the notion of immaturity of cortical development. If, as has been suggested, the disrythmia in the EEG's of enuretics is a reflection of immaturity in cortical development, then a prospective study of patients with such EEG's is necessary to demonstrate the normalisation of the recording over a given period of time coincident with the spontaneous establishment of bladder control. Shaffer (1980) has further noted that the development of sphincter control is often intermittent in nature which is different from the usual pattern of acquiring competence in other developmental disorders. This, together with the contradictory evidence

noted previously, has led Shaffer (1980) to conclude that the data do not indicate a clear relationship between delays in acquiring urinary continence and other forms of somatic immaturity.

A third source of evidence relevant to the issue of CNS immaturity as a cause of enuresis has been sought in studies that highlight the influence of genetic factors and gender differences in the incidence of enuresis. The greater prevalence of bedwetting among males than females was noted in virtually all of the reported epidemiological surveys. The higher incidence of enuresis occurring in the parents, siblings and other near relatives of bedwetters has also been reported in many studies (e.g. Bakwin, 1961; Kolvin et al., 1972; Turner et al., 1970; Young & Turner, 1965). Furthermore, the frequency of occurrence of bedwetting in other members of the family may be directly related to the closeness of the genetic relationship. Bakwin (1973), for example, found concordance for enuresis between identical twins to be double that for fraternal twins.

Fourthly, various authors have reported that enuretics are "emotionally" immature compared with non-enuretics (Biering & Jesperson, 1959; Gunnarson & Melin, 1951; Hallgren, 1957; MacFarlane et al., 1954) and this is sometimes taken as additional evidence for a possible generalized maturational delay (De Jonge, 1969; Kolvin & Taunch, 1973). However, the evidence for such emotional immaturity is not clear-cut. As has been discussed in Section 1.4.1, the vast majority of enuretic children appear to differ little from the rest of the population in terms of emotional and social adjustment (Lovibond & Coote, 1970).

It seems likely that late maturation is an important factor in nocturnal incontinence of younger children. However, the notion that slow maturation is, per se, the crux of the older enuretic's problem is difficult to maintain in the light of certain basic facts. For example, some children who do not advance from incontinence in infancy to complete dryness in childhood, do nevertheless

have occasional dry nights or even short sustained periods of dry nights. Miller et al. (1960) reported that among five year old children who did not have complete nocturnal bladder control, 50 percent, while rarely dry, had had occasional dry nights, 20 percent had intermittent dryness, and 29 percent experienced periods of dryness lasting from three to nine months. Among the Baltimore children studied by Oppel et al. (1968), one third of five year olds nocturnally enuretic at the time of the study had been dry for at least six months at an earlier age. One could argue that the more dry nights manifested, the more probable that maturation of the CNS mechanisms was present. Accordingly, in about half of Miller et al's sample and at least a third of Oppel et al's cases, delayed maturation would not provide a sufficient explanation for persistent bedwetting in five year olds. Further evidence which is difficult to reconcile with the view that late maturation is responsible for enuresis is that alteration of the older enuretic child's environment may lead to temporary control. Stein and Susser (1967), for example, reported that students at boarding school are frequently dry on nights spent in sick bay, but revert to regular bedwetting in their usual quarters. Young (1965) suggested that the high rate of success achieved with conditioning treatment among nocturnally enuretic children aged seven years or more provides evidence that in the majority of such children, maturation has already occurred.

Thus, while immaturity of CNS mechanisms may well be a factor in the failure of young children to achieve normal continence, for enuretic children beyond the age of about five years, delayed maturation seems unlikely to provide an explanation for more than a small proportion of failures to become continent.

(ii) Immaturity of the bladder

It has been suggested that nocturnal enuresis is the result of the child's failure to develop an increase in functional bladder capacity.* This position originally gained impetus from the work of Hallman (1950) and Muellner (1960a, 1960b), and it has subsequently received the support of Esperanca and Gerrard (1969), Starfield (1967), Troup and Hodgson (1971) and Zaleski et al. (1973) who have found that enuretic children have smaller functional bladder capacities than non-enuretic children the same age. This smaller capacity results in frequent diurnal voidings in response to small volumes of urine in the bladder. The storage of only small volumes of urine in the bladder is said to not function as adequate stimulus for the development of a micturition inhibitory response (Meullner, 1960a, 1960b).

It is, however, difficult to determine what degree of bladder capacity is adequate for nocturnal control. Diurnal frequency is an index of day time functional bladder capacity but since young children who pass urine hourly during the day can be dry at night, diurnal frequency is not a reliable index of an individual child's nocturnal status. In addition, attempts to increase functional bladder capacity as a means of improving bedwetting have met with mixed success. Starfield and Mellits (1968), for example, showed that increasing bladder capacity by retention control training correlated positively with decreased bedwetting and support for this finding was provided by Miller (1973b) and Paschalis et al. (1972). However, more recent studies using similar bladder training programmes have shown some increase in day-time bladder capacity but no significant reduction in bed-wetting (Doleys & Wells, 1975; Doleys et al., 1977; Harris & Purohit, 1977; Rocklin & Tilker, 1973). These studies are discussed in more detail in Chapter 4, Section 4.2.2.

---

* The term 'functional bladder capacity' refers to the amount of urine a child will retain before voiding and not the actual structural size of the bladder.

Given these anomalies, it is difficult to establish the relative importance of bladder maturity to the development of nocturnal continence. An overall assessment of the theory that nocturnal enuresis is the result of immature bladder development appears to result in a similar conclusion to an evaluation of the theory which relates bedwetting to immaturity of the CNS; namely, that while inadequate functional bladder capacity may account for nocturnal incontinence in some cases, it is unlikely to be the only factor involved, especially when older enuretic children are considered.

(iii) Depth of Sleep

The belief that bedwetting is associated with deep sleep is very common among the parents of enuretic children, and many authors have noted this anecdotal evidence (Baller, 1975; Bostock, 1962; Finley et al., 1977; Hallgren, 1957). However, early studies of the relationship between sleep and enuresis based on clinical observation produced conflicting results. Bostock (1958) compared the 'arousability from sleep' of seven enuretic and 12 non-enuretic children using an auditory stimulus produced by a buzzer. The enuretic children took an average of 418 seconds to reach the awakened state whereas the non-enuretics took 319 seconds. Although statistical data were not provided, the author concluded that the results supported the view that enuretics sleep more deeply than non-enuretics. However, Boyd (1960) has published results contrary to this conclusion. He examined 100 enuretic children aged between five and 15 years, comparing them with a control group matched for age and sex. The children were awakened by calling their names, and if they did not respond, by shaking them gently. The enuretic children, who took an average of 16 seconds to awaken, were quicker to rouse than the non-enuretics who took 20.5 seconds, though the differences were not significant.

Most empirical data relating to sleep and enuresis has come from studies employing EEG recordings of sleep patterns.*

The issues of interest in relation to bedwetting are, firstly, whether the overall EEG sleep profiles of enuretics differ in fundamental ways from non-enuretics, and secondly, whether bedwetting episodes occur predominantly out of stage 3 and stage 4 sleep; i.e. slow-wave or deep sleep. In respect of the first issue, studies comparing the amount of time spent in the four sleep stages have generally failed to reveal any reliable differences between enuretic and non-enuretic children (Graham, 1973). The evidence in respect of the second question is somewhat contradictory. Several studies, while observing that bedwetting can occur during all NREM sleep stages, report that enuretic episodes are infrequent during stage 1 sleep and are much more commonly associated with stage 3 and 4 (Broughton, 1968; Evans, 1971; Pierce et al., 1961; Ritvo et al., 1969). Broughton (1968) found that bedwetting in childhood and adolescence only very rarely occurs during REM sleep. However, more recent studies have reported that bedwetting events are not associated with any particular sleep stage (Kales et al., 1977; Mickellsen, 1980).

---

*Based largely on scoring criteria for EEG patterns initially proposed by Dement and Kleitman (1957), human sleep is now typically classified into four stages, the numbering of these from 1 to 4 corresponding to the relative 'depth of sleep', and with stage 4 considered to be the deepest. In addition to these stages there is rapid-eye-movement (REM) sleep which has a number of separate behavioural and neurophysiological characteristics. After infancy, a night of normal sleep consists of a series of cycles, each containing non rapid-eye-movement (NREM) sleep then REM sleep interspersed with occasional awakenings. The first cycle usually has much stage 3 and stage 4 sleep (slow-wave activity) and may lack a REM stage. As the cycles pass, the proportion of REM sleep increases and that of NREM sleep, especially slow wave sleep, decreases (Dement, 1975).

The significant observation according to Broughton (1968) was not so much the particular sleep stage during which bedwetting occurred, but rather that bedwetting accompanied a marked and maintained "lightening" of deep NREM sleep, occurring during the transition from stage 4 to stage 1. Broughton (1968) claimed that this result reconciles the different views on whether bedwetting episodes are synchronous with EEG patterns of slow-wave sleep, light sleep or even wakefulness. On the basis of his results, Broughton concluded that bedwetting is best thought of as a 'disorder of the sleep-arousal system'.

Several other studies have confirmed Broughton's (1968) findings in relation to bedwetting episodes occurring during arousal from deep sleep (Arguner et al., 1978; Gastaut et al., 1964; Pierce et al., 1961; Szabo & Popoviciu, 1969). Arguner et al. (1978) also found that bed-wetting tends to occur during the first sleep cycle of the night, when there is a predominance of slow-wave sleep. Finley (1971) offered support for Broughton's (1968) position by demonstrating that the 'arousal threshold' of enuretics is abnormally high compared with non-enuretics. Finley (1971) defined arousal threshold in terms of progressive increments of stimulus intensity until the child is awake both behaviourally and electroencephalographically, and distinguished this from the traditional definition of deep sleep based on EEG recording of sleep stage. In addition to being relatively unresponsive to external stimulation, a study by De Perri and Meduri (1972) has demonstrated that enuretic children can also be relatively unresponsive to introceptive stimulation, such as a distended and rapidly contracting bladder. Simultaneous polygraphic and cystometric recordings were obtained during spontaneous sleep, and during pharmacologically induced sleep, for seven bedwetters and seven control subjects, following artificial filling of the bladder. Results showed that in the enuretic group, reflex micturition occurred without

clinical signs of wakefulness but with transient polygraphic evidence of arousal. The control group showed definite electro-clinical arousal for cystometric pressure below the threshold levels of reflex voiding.

Thus, the weight of evidence suggests that the relationship between sleep patterns and enuresis can be thought of in terms of the bedwetter having an impairment of the sleep-arousal system, as proposed by Broughton (1968).

1.4.3. Behaviouristic Theories

Behaviouristic theories of nocturnal enuresis like the physiological theories discussed in the previous section, conceive the disorder as being essentially a failure to develop cortical control over subcortical effector mechanisms. However, while physiological theories hold this cortical control to result from neural maturation, behaviouristic theories emphasize the role of conditioning in the development of the complex sequence of processes necessary for urinary continence at night.

As noted earlier, the processes involved in the achievement of bladder control are very complex and still a matter of controversy. The importance of neural maturation can hardly be over-stressed but it seems feasible that conditioning is also involved. Various conceptualizations as to the nature of these conditioning processes have been suggested. Campbell (1934) and Mowrer and Mowrer (1938) were among the earliest authors to suggest the view that enuresis commonly reflects a habit deficiency; that is, a deficiency of inhibitory control over an essentially automatic function because of faulty habit training. Morgan and Witmer (1939) believed that ordinary continence training serves to teach the child to respond to bladder stimulation by awakening, and, ultimately, to substitute a toilet action for bedwetting.

Smith (1948) extended the habit deficiency view by suggesting that bedwetting results from inefficient toilet training, and becomes fixated because of the atmosphere of anxiety and frustration that it engenders.

Crosby (1950) provided a somewhat different point of view, arguing that bedwetting is not necessarily only a habit deficiency, but in some cases may represent the acquisition of a bad habit. He termed the continuation into childhood of the automatic bladder reflexes of infancy "simple enuresis". "Complicated enureris" was held to occur when the child acquired the habit of urinating during sleep in response to specific environmental conditions and both types were ascribed to faulty training procedures.

Lovibond's (1964) summary of the behaviourists' viewpoint in respect of the aetiology of enuresis was that for the majority of children cause is related to an absence of environmental conditions ordinarily necessary for learning the response of sphincter inhibition, and/or low levels of condition-ability. In a minority of cases the failure to develop control may be due to conditions inimical to efficient learning or productive of breakdown of previously established linkages (e.g. high levels of anxiety or nervous tension).

A more recent behaviouristic theory of enuresis has been put forward by Azrin, Sneed and Foxx (1973, 1974). These researchers argue that the achievement of control over reflex bladder voiding is an operant process; i.e. the child achieves the potential for physiological control by a relatively early age but may neglect to exercise that control because he is either not reinforced socially when he remains continent or, conversely, he is not subjected to sufficiently aversive consequences when he fails to be continent. According to Azrin et al. (1973, 1974), nocturnal enuresis persists after the child has achieved diurnal continence because of the longer delay in social reactions to a wetting accident at night, the greater difficulty in toileting

correctly at night because of interference from sleep, and the reduced state of alertness during sleep.

From the foregoing discussion it is clear that behaviouristic therapists have turned to an analysis of environmental conditions associated with the learning of bladder control, in attempting to elucidate the aetiology of enuresis. The case for behaviouristic theories is supported by demonstration of the role of toilet training in the establishment of continence both diurnally and nocturnally. Much of the earlier published information on this topic is of limited value, being sketchy and based on retrospective accounts given by mothers - evidence which is notoriously unreliable (Wenar & Coulter, 1962). However, in their prevalence survey of bedwetting Blomfield and Douglas (1956) found that where earlier toilet training had been given, a higher proportion of children developed earlier dryness. Then, in more recent years, researchers have clearly demonstrated the efficacy of day-time toilet training programmes, based on operant conditioning principles, for bladder and bowel control (Azrin & Foxx , 1971, 1974; Bettison, 1978; Bettison et al., 1976; Foxx & Azrin, 1973). These programmes have been used successfully with retarded persons, as well as with groups of normal children.

Further support for the view that learning plays a facilitative role in the attainment of bladder control is the well-established high success rate associated with the Mowrer-type conditioning treatment of bedwetting, to be described below in Section 1.5.3.

1.5 TREATMENTS OF NOCTURNAL ENURESIS

Bedwetting was recognised as worthy of attention and treatment as long ago as 1550 B.C. (Glicklick, 1951). Over the centuries a remarkable array of curative measures for enuresis have been proposed but present day remedies can be reduced to three main categories - medical therapies, psychotherapy and behavioural therapies. In general, the form of therapy prescribed reflects the therapist's theoretical orientation, with respect to the aetiology of enuresis.

1.5.1. Psychotherapy

Therapists who believe that bedwetting is principally a symptom of psychological conflict or stress are committed to the use of psychotherapy as the means of identifying and removing the presumed underlying disturbance. However, when reviewing literature on the efficacy of different forms of therapy in treating enuresis Behrle et al. (1956) and Lovibond (1964) found so few adequately reported studies of psychotherapy carried out with reasonably large groups of enuretics that no firm conclusions regarding this type of treatment could be drawn. A similar conclusion was reached more recently by Kolvin and Taunch (1973) and Baller (1975). Moreover, there are two studies frequently cited as providing evidence for the ineffectiveness of psychotherapy as a method of treating bedwetting (De Leon & Mandell, 1966; Werry & Cohrssen, 1965).

Subjects in the Werry and Cohrssen study were primary nocturnal enuretics who had a wetting frequency of at least one wet bed per week. They were assigned to one of three groups. A "no treatment" control group (n = 27) was simply told that mothers would be contacted after a period of four months to check the child's progress. A psychotherapy group (n = 21) received six to eight sessions of "psychodynamically orientated supportive

psychotherapy" over a period of four months. The third group (n = 22) underwent conditioning therapy with the bell-and-pad apparatus in their own homes; (this procedure is described fully in the section on behaviour therapies). The apparatus was set up each night by the parents and remained in use until the child had been dry for at least one month, or until four months of treatment had elapsed. After the initial interview, no contact was made with the parents of this group apart from an occasional telephone call. At the end of four months, the parents of all children were telephoned and asked to report on the child's bedwetting frequency during the preceding months. Results showed quite clearly that brief psychotherapy was ineffective in arresting bedwetting. Conditioning on the other hand resulted in a significantly higher rate of improvement than either psychotherapy or no-treatment.

These results were later supported by De Leon and Mandell in a study of similar design to that done by Werry and Cohrssen. Subjects were allocated to one of three groups - no-treatment, psychotherapy and conditioning. The exact form of psychotherapy in this case was not made clear although it was referred to as "psychotherapy - counselling" and was conducted by a psychologist or psychiatrist. Twelve weekly sessions were given, each consisting of 40 minutes with the child and 20 minutes with the mother alone. At the end of the 90 day experimental period, psychotherapy was again shown to be ineffective in eliminating bedwetting compared with the control, whereas conditioning resulted in a significantly higher success rate.

While the results of these studies pose problems for the theoretical stance underlying the belief that psychotherapy is the treatment of choice for bedwetting, they do not permit the conclusion that psychotherapy 'per se' is ineffective in treating bedwetting. As De Leon and Mandell point out there are many parameters not yet explored, such as the form of the

therapy, the number of therapeutic sessions, the interval between sessions, and individual differences among therapists as to skills and experience. Nevertheless, these studies do not provide support for psychotherapy as an effective treatment of nocturnal enuresis, when compared with the conditioning treatment. Even if psychotherapy could be shown to arrest enuresis it is difficult to see how this prolonged and expensive form of treatment could be offered to more than a minority of the large number of enuretic children suggested by the prevalence surveys.

1.5.2. Medical Therapy

Medical therapists are likely to prescribe either of two treatments for bedwetting, the choice being determined by the child's age. For younger children, treatment may involve no formal therapy at all, except for the advice that the child will eventually out-grow the problem. This approach is motivated by the belief that bedwetting results from immaturity of the appropriate physiological mechanisms governing bladder control. As demonstrated in Section 1.4.2 this advise is difficult to reconcile with the evidence for children beyond the age of about five years. Surveys of prevalence do suggest that a certain proportion of children will spontaneously stop wetting the bed as they grow older. However, as noted by De Jonge (1973), Forsythe and Redman (1974), and Lovibond (1964), only about one in six of enuretic children become continent for each year between the ages of five to 15 years. At present one cannot predict which children will become dry spontaneously, nor those who will constitute the two or three percent of the population which remain enuretic into the latter teenage years. Furthermore, the longer bedwetting persists, the greater the risk of developing psychological problems as a reaction to the bedwetting.

The second and frequently practised medical treatment, especially for older enuretic children, is the prescription of some form of medication. A

wide range of medications have been used in attempts to control enuresis but their effects have generally been disappointing. Blackwell and Currah (1973) reviewed more than 100 such studies since 1962, concluding that only the tricyclic antidepressants have been shown consistently to be better than placebo. The most commonly used and extensively studied tricyclic is imipramine (Tofranil).

Although the mechanism of action of tricyclic antidepressants in controlling enuresis is not understood, Blackwell and Currah (1973) have suggested three possible explanations. One is that the drug somehow increases the child's sensitivity or responsivity during sleep to cues arising from a filling bladder. A second is that such drugs may be effective because of certain biochemical properties (anticholinergic) which act at the level of the bladder and sphincter to prevent voiding. The third interpretation is that, in line with psychoanalytic theory, the drug acts on the enuretic child's underlying depression, for which bedwetting is a symptom.

The response of enuretics to tricyclic antidepressants is usually quite rapid, with a reduction in bedwetting frequency occurring in the first week of treatment. A plateau of reduced bedwetting (perhaps two or three wet nights less per week) subsequently results for most children still wetting (Stewart, 1975). While this reduction is typically of the order to be statistically significant, it is nonetheless unsatisfactory for most families who hope for normal, total continence. Total remission is usually seen in under half the people treated and is often in the range of only 10 to 20 percent at six months follow-up (Blackwell & Currah, 1973). In addition, relapse tends to occur immediately following the withdrawal of medication, an obvious shortcoming of treatment. Blackwell and Currah have reported that the lowest immediate relapse rate from among a number of well controlled studies was 70 percent.

A further shortcoming of drug therapy that is often overlooked is the possibility of the child suffering imipramine poisoning (Collins, 1976; Meadow, 1981). This risk is not limited to the enuretic child but includes siblings who may have access to the tablets. Imipramine poisioning is an awkward condition to treat and there remains a possibility of long-term heart damage (Goel & Shanks, 1974). Furthermore the long-term effects of these medications on growth and development are yet to be established and are therefore of concern (Collins, 1976).

1.5.3. Behavioural Therapies

Behavioural treatments of nocturnal enuresis encompass a collection of procedures based on the common theory that achievement of nighttime continence involves the learning of discriminative cues that enable inhibition of urination until appropriate toileting is possible. In the following discussion, behavioural therapies for nocturnal enuresis are subdivided into two procedures or procedural categories

(i) The use of a bell-and-pad device - commonly referred to as the standard conditioning method.

(ii) Dry-Bed Training.

In addition to the above, there are other behavioural treatments of bedwetting, such as retention control training, and procedures that manipulate external environmental conditions without the use of a bell-and-pad apparatus. These procedures are discussed in Chapter 4, Section 4.2.

(i) Standard Conditioning

The first systematic rationale for the treatment of nocturnal enuresis based on conditioning principals was put forward by Mowrer and Mowrer (1938). The Mowers' postulated that enuresis results from failure to acquire the habit of responding to the stimulus arising from a filling bladder in the

night, by awakening and/or contracting the urethral sphincter muscles to prevent reflexive voiding. The development of the bell-and-pad procedure was a logical outcome of the Mowrers' theoretical analysis, although the potential therapeutic effects of an apparatus of this kind had earlier been recognised by Pfaundler (1904).

Treatment involves having the child sleep on a urine sensitive pad which is connected to a loud bell or buzzer. When a bed-wetting occurs the loud alarm is triggered, thereby causing the child to awaken and micturition to cease. The child is then required to complete the act of micturition in the toilet before drying the detector pad, resetting the alarm and retiring to bed again. With younger children the alarm also serves to waken an attendant, usually the parent, who helps the child through this procedure. Treatment is usually regarded as successful when 14 consecutive dry nights have been reached. Modern equipment still follows the basic design of the Mowrer apparatus, though incorporating more recent technological advances to eliminate many of the hazards initially encountered, such as dangerous electrical currents and ulcers, caused by contact with the pad electrodes, and to improve its overall efficiency (Borrie & Fenton, 1966; Coote, 1965; Greaves, 1969; Neal & Coote, 1969; Pheiffer & Lloyd, 1978).

Mowrer and Mowrer's (1938) explanation of the mechanism of conditioning treatment was based on the principals of classical conditioning. They reasoned that in the child's enuretic state, increasing muscle tension acts as an unconditioned stimulus (US) to produce the unconditioned reflex voiding response (UR). With conditioning training, increasing detrusor muscle tension (US) produces voiding (UR) that in turn triggers the alarm (US2). The sounding of the alarm has two effects: it wakens the child (UR2) and inhibits urination by producing reflexive sphincter contraction (UR3). As this proce

is repeated, increasing detrusor muscle tension (now acting as a conditioned stimulus, CS) itself eventually comes to wake the child (CR) and inhibit urination (CR2). Because increasing detrusor muscle tension involves a gradient of intensity, it was argued that with training the process would move backwards in time and the child would wake without having urinated, before the alaram was triggered. Thus, as this CS became established by the conditioning procedure, the child would become dry.

Crosby (1950) introduced the "Dri-Nite" conditioning instrument which is similar in concept to the Mowrer apparatus except that the waking stimulus took the form of an electric shock. Crosby (1950) was less explicit than Mowrer and Mowrer (1938) in describing the conditioning process by means of which the respective instruments were believed to have their effect, but Crosby's comments suggest that he also had the classical conditioning model in mind.

In the years that followed the Mowrers' original postulation, writers such as Place (as reported by Lovibond, 1964) and Jones (1960) began to question the validity of the classical conditioning explanation. Lovibond (1963a,b; 1964) criticised the classical conditioning explanation on several grounds. Firstly, unlike the CS in the classical Pavlovian model for salivary conditioning, the presumed CS in the conditioning treatment for enuresis (bladder distention) is not originally a neutral stimulus with respect to micturition but is an unconditioned stimulus for reflexive voiding. Secondly, the classical conditioning model would not predict the sustained dryness noted after treatment because of the phenomenon of experimental extinction. Thirdly, according to the classical conditioning model, awakening to urinate is essential to the conditioned linkage between bladder distention (CS) and the awakening response (CR). However, as Lovibond and Coote (1970) noted, some children respond to the conditioning treatment without waking to

urinate. Furthermore, the Mowrer explanation does not account for children who initially demonstrate nocturnal continence by waking before urinating but then acquire the ability to sleep through the night without waking or wetting.

Lovibond (1963a) proposed an alternative explanation for the conditioning treatment based on passive avoidance learning, or punishment, rather than classical conditioning. Influenced by studies on avoidance learning by Church and Solomon (1956) and Mowrer (1950, 1960), Lovibond initially considered that escape from the noxious stimulus (the alarm) might facilitate the development of passive avoidance. Accordingly, he designed a "Twin-Signal" instrument providing the opportunity of escape from the auditory stimulus. This apparatus emitted a brief loud signal at the onset of wetting and a second alarm after one minute of silence. A duration of one second was chosen for the first signal, this being slightly longer than the latency plus the duration of the response of sphincter contraction. Thus, this response would appear to provide escape from the noxious stimulation and should become conditioned more readily to the preceding stimuli arising from sphincter relaxation. The second alarm operated continually until switched off and was simply to summon the attendant. Comparison of the Twin-Signal conditioning treatment with the continuous signal used in the Mowrer-type alarm procedure and the Crosby apparatus, showed a significant trend towards the Twin-Signal being the most effective and the Mowrer the least effective in bringing about the initial arrest of bedwetting.

After this initial experiment, Lovibond (1964) discussed the confounding of provision for escape and stimulus intensity in accounting for the apparent superiority of the Twin-Signal device. Lovibond pointed out that if, as previously argued, the conditioning treatment of enuresis conforms in essentials to passive avoidance learning, the key variable might be the total

aversiveness of the stimulus rather than the provision of escape from the noxious stimulus. The difference between the Mowrer and Twin-Signal instruments, in terms of acquisition of dryness might therefore result from the greater intensity of the auditory stimulus of the Twin-Signal device and not its provision for escape learning.

The notion that the conditioning treatment of enuresis can best be explained in terms of punishment (i.e. passive avoidance learning) was also asserted by Turner et al. (1970). It is surprising to note however, that in making essentially the same claim as Lovibond (1963a) in respect of the underlying conditioning paradigm, Turner et al. (1970) were critical of Lovibond's theoretical stance. As subsequently pointed out by Lovibond (1972), it seems that Turner et al. (1970) had misinterpreted Lovibond's original work.

The theoretical debate notwithstanding, ample experimental data show that procedures utilizing conditioning instruments are very effective in arresting nocturnal enuresis. Three types of conditioning apparatus have been used; namely, the Mowrer bell-and-pad, Lovibond's Twin-Signal instrument, and Crosby's Dri-Nite device. Of these, the case for the Mowrer-type instrument appears to be the strongest on practical grounds and this device has become the most extensively used and studied. While Lovibond (1963a) reported the Twin-Signal to be more effective than the Mowrer instrument, he later commented that the case for adopting the Twin-Signal instrument for run of the mill therapy is not strong since the Mowrer device is also very effective in arresting bedwetting and has the advantage of being relatively simple and cheap to construct and maintain (Lovibond, 1964). In a later study, Turner et al. (1970) found no difference in effectiveness between the Twin-Signal and Mowrer devices. The Dri-Nite apparatus has not been shown to have significant therapeutic

advantages over the Mowrer device and indeed the Dri-Nite apparatus has very distinct drawbacks since most parents and enuretics find the delivery of electric shocks in response to bedwetting, excessively frightening and distasteful.

A review of 12 studies since 1965 by Doleys (1977) indicates that on average, bedwetting is arrested in about 75 percent of cases treated by the Mowrer bell-and-pad procedure. Earlier reviews (Jones, 1960; Lovibond, 1964; Yates, 1970) have suggested that the rate of initial arrest can be as high as 80 to 90 percent. Among studies reviewed by Doleys (1977), the average duration of treatment with the bell-and-pad procedure ranged from five to 12 weeks. This method has been shown to be more effective in arresting bedwetting than drug therapies (Blackwell & Currah, 1973; Meadow, 1974; Shaffer et al., 1968), dynamic/supportive counselling psychotherapies (De Leon & Mandell, 1966; Novick, 1966; Werry & Cohrssen, 1965), advice and encouragement (Dische, 1971), and retention control training (Fielding, 1980).

Over the years several problems associated with the standard conditioning method have been observed. Young and Morgan (1972a), for example, suggested that the procedure is inconvenient for many families and there is a consequent lack of co-operation from both parents and child which results in failure to persist with treatment in about a third of cases. Frustrations with the procedure are particularly marked when the child wets several times each night or when false alarms occur because of machine malfunction or excessive sweating during the night by the child. Occasionally treatment is sabotaged by the child switching off the buzzer before going to sleep, or sometimes by parents forgetting to switch it on. However, Dische (1973) had suggested that these problems can largely be

overcome by closer supervision from the clinician. In addition, the overall efficiency of currently available conditioning devices has been improved with advances in technology which have reduced the incidence of malfunction (Coote, 1965; Pfieffer & Lloyd, 1978).

Another complication that arose from the use of earlier models of the bed-buzzer device was the possibility of ulcers caused by contact with the electrode pads of the conditioning apparatus (Dische, 1973; Lovibond & Coote, 1970). Fortunately, guidelines for the design and manufacture of conditioning devices were issued by the Ministry of Health in England in 1968 and nowadays ulceration is extremely rare; in fact, Collins (1976) reported that the Ministry had not received a report of ulcers since 1968.

By far the biggest shortcoming of the standard conditioning procedure is the substantial number of children who resume wetting the bed after achieving an initial period of dryness. Doleys' (1977) review of the relevant studies suggests that, on average a relapse rate of approximately 40 percent can be expected following standard conditioning.

Countermeasures to relapse have generally followed two strategies; an intermittent schedule of alarm presentation (e.g. an alarm following 50 percent or 70 percent of the wets on a variable ratio schedule) and over-learning (i.e. increasing the child's fluid intake towards the end of treatment). Both strategies have been shown to reduce relapse rates following conditioning treatment. However, this reduction appears to be at the expense of increasing the duration of treatment time to achieve initial dryness (Taylor & Turner, 1975). Thus, relapse remains one of the fundamental problems of the standard conditioning procedure. This issue is discussed in more detail in Chapter 5.

(ii) Dry Bed Training

Azrin, Sneed and Foxx (1973, 1974) view the achievement of nocturnal continence as an operant learning process in which social and motivational factors play as great a role as does sensitivity to bladder sensation. Enuresis is seen to persist because of both insufficient social reinforcement and insufficient social inhibitory influences. In keeping with this model, Azrin et al. developed a procedure termed Dry-Bed Training (DBT) which emphasizes positive reinforcement for nocturnal bladder control and aversive consequences immediately following bedwetting accidents. DBT employs the standard urine-alarm apparatus but the role ascribed to the alarm is different from that originally conceived by Mowrer and Mowrer (1938). According to Azrin et al., the urine-alarm in DBT serves as a convenient tool for organising important social reinforcement factors to be applied as close in time as possible to the occurrence of a bedwetting accident, rather than providing direct conditioning of the bladder sphincter.

In developing DBT, it appears that Azrin et al. have taken a variety of operant training procedures which have been shown in other studies to curb bedwetting, and incorporated them into one comprehensive training programme. These operant procedures are discussed in Chapter 4, Section 4.2. In addition to the standard urine-alarm conditioning procedure, the major features of DBT include regular night time awakenings, increased fluid intake and practice in withholding urine before voiding, practice in correct night time toileting behaviour, positive reinforcement for nocturnal control and punishment for bedwetting accidents.

DBT, as described in detail by Azrin et al. (1974) consists of three stages - the "initial training night", "post-training supervision", and the "normal routine".

(a) Initial Training Night. This was supervised by a professional trainer in the child's home. About an hour before bed time the trainer described the Dry-Bed procedure to the parents and the child, including the rationale for each step as well as highlighting the advantages of eliminating the bedwetting problem. In order to increase the frequency of urination, the child was then given a glass of a favourite drink and the urine-alarm placed on the bed in the usual way. The child next rehearsed the 'positive practice' procedure, which involved lying in bed with the lights off and slowly and silently counting to 50 (younger children counted to a lower number). Once the counting was done the child rose from bed, walked to the toilet and attempted to urinate. He/she then returned to bed and began counting again, repeating the procedure until 20 such trips had been made. This procedure was designed to establish the habit of rousing and self-toileting. The parents remained outside of the child's bedroom but kept a check on the number of trips to the toilet. Then the child again had a large drink, reviewed understanding of the ensuing procedure, and went to sleep.

Every hour thereafter, the trainer awakened the child using minimal prompts and directed the child to the toilet. At the toilet door the child was encouraged to inhibit urination for another hour. If the child agreed to try, he/she was praised for bladder control and allowed to return to bed. If unable to inhibit urine for another hour, the child was persuaded to hold on for just a few minutes, after which he/she was praised for control and allowed to urinate in the toilet. Immediately following urination the trainer praised the child for correct toileting and the child returned to bed. At the bed-side the child was directed to feel the sheets, praised for having kept them dry, and encouraged to remain dry for the next hour. Finally, the child was asked to repeat the instructions for the next hourly awakening,

given another drink, and then allowed to return to sleep. The hourly awakenings were continued throughout the first night.

Whenever a bedwetting accident occurred the child was awakened by the alarm (or by the trainer if the alarm alone was insufficient) and reprimanded for having wet the bed. The child was then directed to the toilet to finish urinating. Upon return to the bedroom the child was given 'cleanliness training' which involved changing pyjamas, removing the wet sheets from the bed, depositing them in the laundry, and drying off the urine-detector pad. Once cleanliness training was completed the child was told that the accident indicated the need for more practice in correct toileting in order to stay dry in the future. He/she was then given another 20 positive practice trials before returning to sleep. Positive practice was repeated before retiring to bed on every evening that followed a bedwetting accident.

(b) Post-training supervision. This stage of training commenced on the night after the intensive all-night session and was conducted by the child's parents. If the child had had a bedwetting accident during the previous night he/she was given 'positive practice' before retiring to bed. During this phase of training he/she was awakened once only during the night to go to the toilet. The first awakening occurred three hours after the child had gone to bed. After each dry night the parents awakened the child for toileting a half hour earlier on the following evening. The night time awakening was discontinued when the time of awakening was scheduled to follow the child's bed-time by no more than one hour. Increased fluid intake and encouragement for inhibition of urination were discontinued during 'post-training supervision'. The urine-alarm device remained on the child's bed and wetting accidents were managed in the

same manner as they were during the initial all-night session; i.e. awakening, reprimand for wetting, cleanliness training and positive practice in toileting.

The parents were instructed to praise the child as much as possible at appropriate and convenient times following a dry night. Family relatives and significant others in the child's life were also invited to add reinforcement for not wetting.

Post-training supervision continued until the child had been dry for seven consecutive nights.

(c) Normal routine. After the child had achieved seven consecutive dry nights, the final stage of training was entered. At this point the urine-alarm was removed from the child's bed and the night time awakenings were discontinued. The child went to bed in the usual way and slept uninterrupted through the night. The parents inspected the bed each morning, and if wet, the child was required to remake it immediately and before bedtime that evening, he was given another 20 positive practice trials. If bedwetting occurred on two nights within a week, training reverted back to the 'post-training supervision' phase until the child had no accidents on seven consecutive dry nights. Training was completed when the child achieved 14 consecutive dry nights.

Azrin, Sneed and Foxx performed two experiments which they interpreted as supporting the overall effectiveness of DBT in arresting bedwetting and, at the same time, supporting their theoretical conception of the nature and aetiology of enuresis. In the first experiment Azrin et al. (1973) compared the effectiveness of DBT with a simple associational procedure that employed a urine-alarm but had no operant or social consequences for bedwetting. Subjects were 12 profoundly retarded institutionalized

adults. They were randomly assigned to one of two groups and treated according to the following experimental design:

	TIME		
	3 weeks	3 weeks	after 6 weeks
Group 1	Baseline	Standard Method	DBT
Group 2	Baseline	DBT	DBT

Baseline bedwetting frequency was collected over a three-week period in each group. During the standard method for Group 1, the urine-alarm device was placed on the subject's bed each night. When a bed-wetting occurred, the alarm sounded and was allowed to continue for five minutes before being switched off by a staff member. No other consequences followed the occurrence of bedwetting; i.e. the subject was not awakened and directed to the toilet nor was there a requirement to change the wet sheets and pyjamas. This procedure was implemented for three weeks after which subjects were given DBT. Subjects in Group 2 were given DBT immediately following the establishment of the baseline.

Results indicated that the standard method reduced bedwetting somewhat but this was not statistically significant. Ultimately, all 12 subjects were given DBT and under this treatment regimen, bedwetting was arrested very rapidly. Following the intensive training night, the frequency of bedwetting was reduced by 85 percent during the first week, by 95 percent after five weeks and by 97 percent after three months.

The authors suggested that the standard method provided an estimate of the degree of reduction in bedwetting attributable to the passage of time (three weeks), to the sudden concern of staff about bedwetting, to the purely associational relation between the alarm and the act of urinating, and to the awakening effect of the alarm. These factors were insufficient

to effect a substantial decrease in bedwetting frequency. The immediate reduction of bedwetting following DBT was attributed to the additional reinforcement, the practice at correct toileting and the other social motivational features of the Dry-Bed procedure.

The results of this study suggested the possible use of DBT for non-retarded subjects for whom Azrin, Sneed and Foxx (1974) predicted an even better response than the retarded subjects in the previous experiment since learning ability would be intact and verbal instructions could be used. Azrin et al. (1974) therefore conducted a second experiment with 24 children of normal intelligence and whose average age was eight years.

The experimental design, shown below, provided a within-subject as well as a between-subject comparison of the standard conditioning method with the Dry-Bed procedure.

		First two weeks	After two weeks
Condition 1	Experimental Group	DBT (parent and child alarm)	DBT (parent and child alarm)
	Control Group	Standard Conditioning (child only alarm)	DBT (parent and child alarm)
Condition 2	Experimental Group	DBT (parent only alarm)	DBT (parent only alarm)
	Control Group	Standard Conditioning (child only alarm)	DBT (parent only alarm)

Subjects were divided into pairs matched for age, sex and frequency of bedwetting. Within each pair, the children were randomly assigned to the Control Group (Standard conditioning) or the Experimental Group (DBT). In one condition, the urine-alarm sounded in the parents' bedroom as well as in the child's room, thereby providing the additional likelihood of

awakening the parent. In another condition the urine-alarm sounded only in the parents' room and not in the child's room, thereby enabling an evaluation of the Mowrer interpretation which involves direct conditioning of the bladder via the alarm. The within-subjects comparison was provided by instituting DBT for the children in the Control Group after two weeks of standard conditioning treatment.

Results indicated that DBT was more effective in arresting bedwetting than the standard conditioning procedure. Before treatment, all subjects were reported to be wetting the bed every night. The standard conditioning procedure reduced accidents to an average of six bedwettings during the first week of treatment and to an average of five accidents during the second week. After the one night of intensive training by the Dry-Bed procedure, the average number of accidents was one during the first week, one during the second week and none after the third week. Ultimately, all 24 subjects treated by DBT reached the dryness criterion of 14 consecutive dry nights and the average time required to achieve this was four weeks. None of the children relapsed to his/her pre-training level of bedwetting during a six month follow-up. The procedure required that the urine-alarm apparatus be reinstated should two accidents occur within one week. In seven instances, two or more such accidents occurred during follow-up and in each instance bedwetting was again arrested within one week following reinstatement of the alarm and the Dry-Bed procedure.

A second finding of this study was that bedwetting was eliminated just as effectively when the alarm sounded only in the parents' bedroom as when the alarm sounded in both the child's and the parents' bedroom. Azrin et al. (1974) concluded therefore that Pavlovian conditioning did not contribute to the success of DBT, since omission of the alarm from the child's room precluded direct conditioning of the bladder. Rather,

the alarm was seen as a means of producing other more important events, such as annoyance on the part of parents and child at being awakened, the need to change the wet sheets and pyjamas, etc.

At first glance, the results of the studies by Azrin et al. (1973, 1974) strongly support the claim by these authors that DBT is more effective in arresting bedwetting than urine-alarm associational procedures. However, closer scrutiny of these studies reveals a serious deficiency in the control procedures. In both experiments, the results of the DBT groups included data from subjects who had urine-alarm treatment immediately prior to the DBT procedure. In the first study (Azrin et al., 1973), six of the 12 subjects were given DBT immediately following three weeks of alarm-only treatment. In the second study (Azrin et al., 1974), 11 of the 24 subjects were given DBT immediately following the standard conditioning method for a two week period. The alarm-only phase of treatment was found to reduce bedwetting frequency, albeit slightly, in both experiments. It is likely that this prior gain, together with general experience of the urine-alarm, would have affected subjects' progress during subsequent treatment by DBT.

A second drawback to the claim by Azrin et al. (1973, 1974) that DBT is more effective than alarm-only conditioning procedures is the brief period over which the latter form of treatment was given. To date there is surprisingly little experimental data relating to the effectiveness of standard conditioning with profoundly retarded enuretics, but that which does exist (e.g. Smith, 1981) suggests that this procedure requires considerably longer than three weeks to effect significant change to bedwetting frequency. Evidence from the much more extensive literature on normal enuretic subjects also suggests that significant treatment effects of standard conditioning are not usually seen until after the first few weeks (Baker, 1969;

Turner et al., 1970). Thus, while the results of Azrin et al. (1973, 1974) indicate a more rapid arrest of bedwetting following DBT than the alarm-only procedure during the initial stages of treatment, a more valid assessment of the ultimate effects of these two treatments would require comparison over a longer time period.

Three studies using DBT were reported in the interval between the Azrin et al. (1973, 1974) articles and the research contained in this thesis. In the first of these, Doleys et al. (1977) administered DBT to 13 nocturnally enuretic children whose average age was 6.6 years. Results showed a significant decrease in mean bedwetting frequency following six weeks of treatment. Five of the 13 subjects had 14 or more consecutive dry nights and two subjects demonstrated a one-to-two week dry period by the end of six weeks of treatment by DBT. A further three subjects met the success criterion of 14 consecutive dry nights after the initial six-week treatment phase. One child became dry during baseline and the remaining two children presumably did not improve significantly. A three-month follow-up of subjects showed four to have had zero to two wets per month, five had three to five wets per month, two subjects wet six or more times per month and two had dropped out.

Doleys et al. (1977) claimed these data supported the efficacy of DBT in the treatment of nocturnal enuresis but at the same time noted that the results were less remarkable than those reported by Azrin et al. (1974). Doleys et al. (1977) commented that it is difficult to determine the factors responsible for these different results although it was speculated that there may have been differences between the two studies in terms of parental co-operation, a factor which has been shown previously to correlate highly with success rates of conditioning treatments (Collins, 1973; Forsythe & Redmond, 1970; Taylor & Turner, 1975). It is also possible that the

discrepant results were related to the ages of the children treated in that Doleys et al.'s (1977) subjects were younger on average than the subjects in the Azrin et al. (1974) study, and they may therefore have had more difficulty coping with the demands of the procedure.

The second study to appear, by Bollard and Woodroffe (1977), examined the effectiveness of DBT with two important modifications to the original procedure. The first modification was to instruct parents to administer the intensive all-night training, rather than introducing an outside trainer into the child's home. The second modification involved administering the Dry-Bed procedure without the adjunct of a urine-alarm device. Thirty-four subjects were divided into three groups. Fourteen children, whose ages ranged from four to 14 years, were assigned to the Dry-Bed procedure outlined by Azrin et al. (1974), with the modification that the parents and not a professional trainer conducted the initial night of intensive training. Ten children underwent the same procedure except that no alarm was used at any stage. The remaining 10 children formed the Control Group which received no treatment at all. All children who received parent-administered DBT with the adjunct of a urine-alarm reached the success criterion of 14 consecutive dry nights, the median time to attainment of dryness being just less than four weeks. Two of the 14 children relapsed during a six month follow-up period although, as it was left to the parents to contact the experimenter if bedwetting recurred, this figure may underestimate the actual relapse rate. Of the 10 children who received parent-administered DBT without the adjunct of a urine-alarm, none reached the dryness criterion within a 13 week treatment period. However, there appeared to be a substantial drop in wetting frequency in this group during the first week of training, followed by a plateau of reduced bedwetting. Parents of the 10 children in the Control Group reported that the bedwetting frequency of their children was unchanged over the 13-week experimental period.

Nettelbeck and Langeluddecke (1979) used a similar design to the Bollard and Woodroffe study, treating eight children by DBT with the adjunct of a urine-alarm and seven children by the Dry-Bed procedure without an alarm. Subjects ages ranged from four years to 13 years (mean = 8 years). In both treatment groups the intensive all-night session was conducted in the child's home by the second author. Seven of the eight children with a machine attained 14 consecutive dry nights. For the remaining child in this group, treatment was terminated soon after its commencement due to the mother's inability to cope with the programme. Of the successful children, treatment time ranged from 17 to 53 days with a median of 20 days. However, in the Nettelbeck and Langeluddecke study, the Dry-Bed procedure without the adjunct of an alarm was ineffective in reducing bedwetting frequency compared with a control group over a 10-week period. Furthermore, Nettelbeck and Langeluddecke (1979) correctly criticised the claim of reduced bedwetting frequency following the Dry-Bed procedure without an alarm in the Bollard and Woodroffe (1977) study, on the grounds that baseline measures and control data had not been collected during the study but assumed, on the basis of parents' reports, to be seven wet nights per week throughout the course of the study. This may therefore have exaggerated the effectiveness of the 'no-machine' treatment.

In more recent articles, Azrin and Thienes (1978), Azrin et al. (1979), Besalel-Azrin et al. (1980) have claimed that with some modifications to the Dry-Bed procedures, bedwetting can be eliminated effectively without an alarm, although results are still not as good as the original, machine-based method. The results of the modified Dry-Bed procedure without an alarm, developed by Azrin and his colleagues, are discussed in more detail in Chapter 3, Section 3.5.2.

1.6 AIMS OF THE PRESENT PROGRAMME OF RESEARCH

It would appear from the studies by Azrin et al. (1973, 1974), Bollard and Woodroffe (1977), Doleys et al. (1977) and Nettelbeck and Langeluddecke (1979), that DBT, when used in conjunction with a urine-alarm device is very effective in arresting nocturnal enuresis and is possibly the most effective of the treatments reviewed here.

However, further research into DBT is indicated for several reasons. Firstly, it is a complex procedure and the relative contribution of the various training components to the overall effectiveness of the programme, have not yet been systematically investigated. Secondly, to date there are only a handful of studies which have employed DBT and there is consequently a need for further replication. Thirdly, because the complicated and demanding nature of the training schedule is likely to restrict its widespread use, there is a need for simplification of the training protocol, or alternatively, development of strategies that would facilitate its implementation. Fourthly, the long-term effects of DBT are yet to be established.

The primary aims of the studies reported in this thesis were to systematically examine the various features of DBT, which would have relevance for the current theoretical debate about the conditioning processes underlying the effectiveness of behavioural treatments for nocturnal enuresis, and, by so doing, possibly overcoming some of the practical limitations of DBT noted earlier. These aims were attempted by:

(a) examining the effectiveness of DBT when the initial all-night training is administered by the child's parents or by a professional trainer and comparing these procedures with the standard conditioning method;

(b) comparing the effectiveness of DBT with and without the adjunct of a urine-alarm device;

(c) examining the efficacy of DBT when initial instruction and subsequent follow-up is done in small group settings, as opposed to individual administration;

(d) delineating the specific components of DBT that account for its apparent effectiveness. In addition to having theoretical value such a delineation might suggest modifications to the DBT procedure in the direction of increased simplicity;

(e) providing long-term follow-up data on enuretic children treated by DBT and comparing this with commensurate data following treatment by standard conditioning.

CHAPTER 2.

A: THE SIGNIFICANCE OF PATIENT THERAPIST CONTACT IN THE TREATMENT OF NOCTURNAL ENURESIS BY CONDITIONING METHODS

2.1. EXPERIMENT 2.1.

2.2. INTRODUCTION

Azrin et al. (1974) have claimed that DBT is a more effective and rapid treatment of nocturnal enuresis than the standard urine-alarm conditioning procedure (Mowrer & Mowrer, 1938). Azrin et al. (1974) attributed the apparent superiority of DBT over the standard conditioning method to the additional training features of DBT, such as regular nighttime awakenings, practice at withholding urination, and positive practice and cleanliness training in response to bedwetting accidents.

DBT also required a professional trainer to conduct an intensive training programme in the child's home throughout the first night. It is possible, therefore, that this additional therapist contact contributed in part to the success of DBT reported by Azrin et al. (1974) when compared with results commonly reported following standard conditioning. Experimenters and clinicians have long been aware of the importance of patient/therapist contact in the treatment of bedwetting (Collins, 1973; Dische, 1973; Doleys, 1977; Lovibond, 1964). Thus, more therapist contact may enhance motivation directed towards correct alarm usage on the part of parents and child.

An initial experiment involving three groups was conducted in order to examine the significance of patient/therapist contact in the treatment of bedwetting by conditioning methods. Two groups of children underwent the standard urine-alarm procedure - one with close supervision and

follow-up, and the other without supervision after initial instruction of the procedure. The third group served as a no-treatment control. This experimental design permitted: (i) comparison of the effectiveness of urine-alarm conditioning treatments with a no-treatment control; and (ii) comparison of the effectiveness of closely supervised conditioning treatment with unsupervised conditioning treatment.

2.3. METHOD

Subjects

Subjects were 45 children (32 males and 13 females) referred for treatment of nocturnal enuresis as outpatients of the Adelaide Children's Hospital. Ages ranged from five to 14 years (mean age = 9 years 8 months). All children appeared, on the basis of an interview with the author and from parents' reports, to be within normal limits of intelligence and mental health. All subjects had been examined by a medical practitioner in order to rule out the possibility of underlying organic pathology. This procedure involved a thorough physical examination, micro-urine analysis and blood pressure check. All children had a regular long-term bedwetting frequency of at least one wet bed per week. While many of the parents had previously sought medical and/or psychological assistance with respect to the child's enuresis, none of the children was undergoing any form of enuresis-related drug or psychotherapy at the time for the study.

Apparatus

The urine-sensitive recessed electrode pad was that available from Ramsey-Coote Instruments (Aust.) and described by Coote (1965). Alarm units were constructed at the Adelaide Children's Hospital in accordance with the requirements of the British Ministry of Health Performance Specifications for Enuresis Alarms. Details of the alarm's circuit are described in Pfeiffer and Lloyd (1978).

Procedure

Children were selected from a waiting list* in accordance with hospital policy that those waiting longest should be treated first and that older children be given priority. They were assigned at random to one of three groups of 15 children; two were experimental (treatment) groups and the remaining group a no-treatment (control) group. Sample characteristics of the three groups are presented in Table 2.1.

TABLE 2.1. Experiment 2.1. Sample characteristics of subjects assigned to treatment and control groups

VARIABLES	GROUP		
	Standard urine-alarm with follow-up	Standard urine-alarm without follow-up	No Treatment
Number	15	15	15
Mean Age (years and months)	9-10	9-9	9-5
Ratio males to females	11:4	11:4	10:5
Mean wet nights per week during four week baseline	5.1	5.3	4.7

*All children referred to the Adelaide Children's Hospital for treatment of enuresis are seen with their parents at an initial interview during which a detailed history of the child's bedwetting is taken, along with information relating to the family history of the problem, and previous treatment attempts and attitudes towards the problem. Children's names are then placed on a waiting list for treatment which, depending on their age and circumstances, could be delayed for as long as 12 to 18 months.

(i) Treatment Group 1

Parents were sent a letter informing them that their child's name was approaching the top of the waiting list for treatment. They were requested to record the child's bedwetting frequency on an enclosed calendar for four weeks. This record constituted the child's baseline. An appointment at the hospital with the author was arranged for four weeks hence. The parents were instructed not to alter their method of managing the child's bedwetting during the baseline period.

After baseline data had been collected, the mothers and children all attended an interview with the author at the hospital. Fathers were also invited to attend but in many cases did not, presumably because of employment committments. The author demonstrated the equipment by pouring a small amount of sterile saline on to the detector pad thereby triggering the alarm. The child subsequently repeated this with one hand placed on the pad, thus being reassured that there is no electric shock and nothing to fear. The standard urine-alarm procedure was then described in detail and the child was required to role-play the various steps, using a demonstration bed, in order to ensure that the method was understood. Written instructions for the procedure were issued together with a calendar to continue recording bed wets. This procedure involves placing the urine-alarm in the child's bed such that when the loud alarm is triggered by a wetting accident the child is awakened and required to go quickly to the toilet in order to finish voiding. After returning to the bedside, the wet sheet is removed, the detector pad dried thoroughly and the alarm re-set. Then the child gets back into bed and returns to sleep. The child is encouraged to take full responsibility for this process but the parents are required to assist if the child is unable to manage alone.

Instructions for the use of the apparatus and the standard conditioning procedure appear in Appendix 2.1 and 2.2 respectively.

The parent (or child if mature enough) was required to contact the author weekly by telephone and report on progress and a specific time for reporting was arranged. Parents were encouraged to make contact immediately if difficulties arose before the designated weekly time. Any cases not reporting at the designated time were contacted by telephone, or by letter if they could not be reached by telephone.

Treatment continued until the child achieved 14 consecutive dry nights, at which time the alarm was returned to the hospital. The parents were encouraged to contact the hospital if the child relapsed, i.e. if he resumed wetting the bed more than once per week during a four week period. In order to monitor relapse more thoroughly, the first author contacted the family at three months, six months and 12 months intervals after the success criterion had been reached.

(ii) Treatment Group 2

This group underwent the same procedure as Treatment Group 1, except that no weekly follow-up was arranged after issuing the machine. That is, the parent and child attended the hospital receiving the same instructions regarding the alarm procedure and recording of progress on the calendar, but thereafter were not required to make weekly reports. Instead, they were instructed to return the alarm after the child achieved 14 consecutive dry nights. Relapses were monitored in the same way as for the previous group.

(iii) Control Group

Parents of children in this group were interviewed at the time of referral to the Adelaide Children's Hospital clinic and a detailed history

of the child's bedwetting taken in the same manner as for the two treatment groups. The parents were informed that it would be some time before their child's bedwetting could be attended to. They were asked to keep a daily record of the child's bedwetting on the calendar provided. During this period parents were instructed not to alter their method of managing the child's bedwetting in any way. To ensure a good response, a return paid envelope was sent to the parents each month. The record was kept throughout a six month period, after which these children were treated as soon as an alarm became available.

2.4. RESULTS

A summary of the data for all subjects appears in Appendix 2.3.

Figure 2.1 shows the mean number of wet nights per week for each group of children over the 20 week experimental period. Two curves have been plotted for Group 2 (standard urine-alarm procedure without supervision). This was done because three subjects discontinued after five weeks, six weeks and eight weeks respectively. In curve (a) the average bedwetting frequency of the three children at the point of dropping out was retained in the calculation of mean scores for the remainder of the 20 week experimental period. Curve (b) represents the group's average bedwetting frequency when these children are excluded. Since the dropouts were among the poorest responders to treatment, excluding their scores from subsequent data, as in curve (b), obviously exaggerates improvement in this group. It can be seen from the curve (a) that when adjustment for dropouts is made this group did much less well.

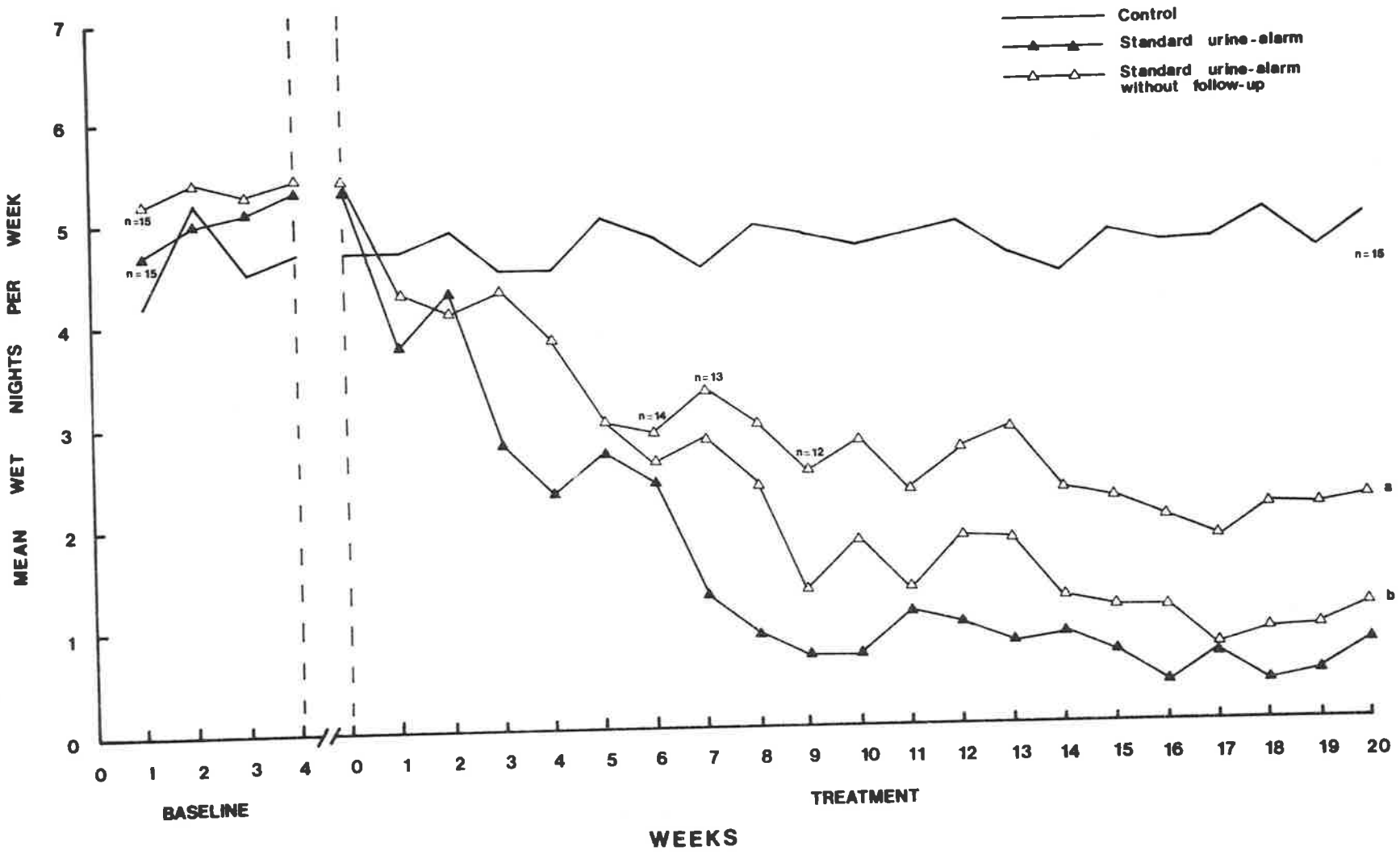
Results were examined by planned comparisons incorporated in analysis of covariance with baseline wetting frequency as the covariate. When data from the three drop-out subjects were excluded from the

FIGURE 2.1.

Mean wet nights per week for three groups throughout four weeks of baseline and 20 weeks of treatment:

(a) average bedwetting frequency of three drop-out cases retained,

(b) three drop-out cases excluded.


Control
Standard urine-alarm
Standard urine-alarm without follow-up
MEAN WET NIGHTS PER WEEK
n=15
n=15
n=14
n=13
n=12
n=15
a
b
BASELINE
TREATMENT
WEEKS

analysis [curve (b)], planned comparison between the two treatment groups combined, and the control group, at the end of the 20-week experimental period, yielded a statistically significant difference with respect to the number of wet nights ($t(38) = 7.53$, $p < .001$), and the number of days taken to reach dryness ($t(38) = 5.55$, $p < .001$). However, the two treatment groups did not differ significantly with respect to the number of wet nights or the number of days to dryness ($t(38) = 0.91$, $p > .05$; $t(38) = 1.29$, $p > .05$) [see Appendix 2.4.] When average data for drop-out subjects were retained in the analysis, as described above, planned comparison between the two treatment groups and the control at the end of 20 weeks again yielded a statistically significant difference with respect to the number of wet nights ($t(38) = 5.73$, $p < .001$) and days to dryness ($t(38) = 5.07$, $p < .001$). Furthermore, with the data for drop-outs included, the two treatment groups also differed significantly in respect of the number of wet nights ($t(38) = 2.12$, $p < .05$) and the number of days taken to dryness ($t(38) = 2.12$, $p < .05$). [See Appendix 2.4.]

Thus, the results demonstrate the superior effectiveness of supervised conditioning treatment compared with unsupervised conditioning treatment of bedwetting. When data from all subjects were retained in the analysis, children who underwent supervised training recorded significantly fewer wet nights during treatment and were significantly quicker to attain the dryness criterion of 14 consecutive dry nights.

The outcome of the respective groups is summarized in Table 2.2. None of the 15 children who underwent the standard procedure with supervision dropped out of treatment during the 20-week period, whereas three out of 15 undergoing the standard urine-alarm procedure without supervision failed to persist with treatment. With respect to the proportion of cases reaching dryness, and the proportion of relapses during a 12-month

TABLE 2.2. Experiment 2.1. Summary of results from three groups in terms of subjects attaining the dryness criterion, number of relapses during 12-month follow-up, average time to last wet night, and mean number of wet nights.

GROUP	N	Cases reaching dryness criterion	Relapses during 12-month follow-up	Mean number of days to last wet night	Mean number of wet nights
Control	15	0	N.A.	N.A.	95
Standard urine-alarm with supervision	15	12	4	66	29
Standard urine-alarm without supervision	15	9	5	(a)83 (b)96	38 57

(a) excluding data from subjects who dropped out
(b) including data from subjects who dropped out

follow-up period, the standard procedure with supervision also produced marginally better outcomes, as shown in Table 2.2, but these differences were not statistically significant.

2.5. DISCUSSION

There are several possible reasons to account for the finding from this experiment that supervised training enhanced the effectiveness of treatment. Psychologists have long been aware of placebo effects in psychological therapies and such an effect is commonly thought to be an appreciable component in the effective treatment of bedwetting, though usually not sufficient to result in a cure. Thus, greater patient/therapist contact possibly increases the effect of these non-specific treatment agents. However, it is likely that the major benefits of greater

patient/therapist contact are by way of increasing the family's motivation to persist with the urine-alarm procedure, thereby increasing the likelihood of correct alarm usage. It was readily apparent when questioning parents in the non supervised group upon return of the apparatus and record forms, that some had not implemented the procedure correctly. Some parents had not always checked that the machine was switched on at night, some were lax in supervision of the toileting regimen following the detection of wet beds and in some cases the batteries of the returned machines were so flat as to indicate that they had not been operating efficiently during the latter stages of treatment.

Thus, patient/therapist contact appears to be an important factor in the effective treatment of nocturnal enuresis in children when the treatment is based on the use of an urine-alarm device. In the light of this, DBT could have an advantage over the standard conditioning method because of the greater therapist contact associated with the former treatment during the initial all-night training session. This issue was considered further during Experiment 2.2.

B: A COMPARISON OF DRY-BED TRAINING AND STANDARD URINE-ALARM CONDITIONING TREATMENTS OF NOCTURNAL ENURESIS

2.6. EXPERIMENT 2.2

2.7. INTRODUCTION

It was noted in Chapter 1, Section 1.5.2 that in comparing the effectiveness of standard conditioning with DBT, Azrin et al. (1974) did not control for experience with the urine-alarm prior to treatment by the DBT procedure, so that treatment effects by standard conditioning and DBT procedures were confounded. Further, a comparison of DBT with standard conditioning was limited to two weeks. No other study has yet compared the effectiveness of these two procedures over a longer period of time while controlling for the effects of prior experience with the urine-alarm device.

Azrin et al. (1974) have also regarded the urine-alarm as a convenient device for organising social and motivational consequences of bedwetting, rather than affording direct conditioning of the bladder sphincter. This analysis therefore implies that it may be possible to devise an effective modification of the DBT schedule which did not include a urine-alarm.

In Experiment 2.2, six groups were compared. Three of these were given DBT with the adjunct of a urine-alarm device, administered under different conditions: (a) by a professional trainer in the child's home; (b) by a professional trainer in hospital; (c) by the child's parents at home. The fourth group was given the DBT schedule without the adjunct of a urine-alarm, administered by the parents at home. The fifth group was treated by the standard urine-alarm conditioning procedure and the sixth served as a no-treatment control. This experimental design permitted: (i) a comparison of DBT with the standard urine-alarm procedure;

(ii) comparison of the relative effectiveness of treatments utilizing the urine-alarm with no-alarm treatments; (iii) comparison of the alarm-based DBT procedure administered under varying conditions of therapist involvement. The design also enabled further consideration of the issue of patient/therapist contact in accounting for the relative effectiveness of DBT and the standard conditioning treatments, together with consideration of the relative importance of various situational variables which could be controlled more effectively in the hospital ward than in the home.

2.8. METHOD

Subjects

One hundred and twenty children referred to the Adelaide Children's Hospital for treatment of nocturnal enuresis served as subjects. As in Experiment 2.1 they had all undergone a thorough medical examination, and were of apparently normal intelligence. At the time of the study none of the children was undergoing any form of drug or psychotherapy for bedwetting. The sample consisted of 82 males and 38 females whose ages ranged from four to 15 years with a mean age of nine years. All children included in the study had a regular bedwetting frequency of at least one wet night per week.

Apparatus

The urine-alarm apparatus was as described for Experiment 2.1.

Procedure

Subjects were selected from a waiting list according to their time of referral, and assigned at random to one of six groups numbering twenty. Of the five treatment groups, four underwent variants of DBT (Azrin et al., 1974). The DBT schedule is outlined in Table 2.3. The initial training night for Dry-Bed groups was carried out under four different conditions:

TABLE 2.3. Dry-bed procedure (from Azrin, Sneed & Foxx, 1974).

1. Intensive training (one night).
   (A) One hour before bedtime
      1. Child informed of all phases of training procedure.
      2. Alarm placed on bed.
      3. Positive practice in toileting (20 practice trials)
         (a) child lies down in bed
         (b) child counts to 50
         (c) child arises and attempts to urinate in toilet
         (d) child returns to bed
         (e) steps (a), (b), (c) and (d) repeated 20 times
   (B) At bedtime
      1. Child drinks fluids.
      2. Child repeats training instructions to trainer.
      3. Child retires for the night.
   (C) Hourly awakenings
      1. Minimal prompt used to awaken child.
      2. Child walks to bathroom.
      3. At bathroom door (before urination) child is asked to inhibit urination for one hour (omit for children under 6).
         (a) if child could not inhibit urination
            (i) child urinates in toilet
            (ii) trainer praises child for correct toileting
            (iii) child returns to bed
         (b) if child indicated that he could inhibit urination for one hour
            (i) trainer praised child for his urinary control
            (ii) child returns to bed
      4. At bedside, the child feels the bed sheets and comments on their dryness.
      5. Trainer praises child for having a dry bed.
      6. Child is given fluids to drink.
      7. Child returns to sleep.
   (D) When an accident occurred
      1. Trainer disconnects alarm.
      2. Trainer awakens child and reprimands him for wetting.
      3. Trainer directs child to bathroom to finish urinating.
      4. Child is given Cleanliness Training.
         (a) child is required to change night clothes
         (b) child is required to remove wet bed sheets and place it with dirty laundry
         (c) trainer reactivates alarm
         (d) child obtains clean sheets and remakes bed
      5. Positive Practice in correct toileting (20 practice trials) performed immediately after the Cleanliness Training.
      6. Positive Practice in correct toileting (20 practice trials) performed the following evening before bedtime.
2. Post training supervision (begins the night after training)
   (A) Before bedtime
      1. Alarm is placed on bed.
      2. Positive Practice given (if an accident occurred the previous night).
      3. Child is reminded of need to remain dry and of the need for Cleanliness Training and Positive Practice if wetting occurred.
      4. Child is asked to repeat the parent's instructions.
   (B) Night-time toileting
      1. At parents' bedtime they awaken the child and send him to toilet.
      2. After each dry night, parent awakens child 30 minutes earlier than on previous night.
      3. Awakenings discontinued when they are scheduled to occur within one hour of child's bedtime.
   (C) When accidents occurred, child receives Cleanliness Training and Positive Practice immediately upon wetting and at bedtime the next day.
   (D) After a dry night
      1. Both parents praise child for not wetting his bed.
      2. Parents praise child at least 5 times during the day.
      3. Child's favourite relatives are encouraged to praise him.
3. Normal routine initiated after 7 consecutive dry nights.
   (A) Urine-Alarm is no longer placed on bed.
   (B) Parents inspect child's bed each morning.
      1. If bed is wet, child receives Cleanliness Training immediately and Positive Practice the following evening.
      2. If bed is dry, child receives praise for keeping his bed dry.
   (C) If two accidents occur within a week, the Post-Training Supervision is reinstated.

by a professional trainer in the child's home; by a professional trainer in hospital; by the child's parents at home; by the child's parents at home but without the adjunct of a urine-alarm device. The remaining treatment group underwent the standard urine-alarm conditioning procedure, described in Experiment 2.1, while the sixth group served as a non-treatment control. Sample characteristics of the six groups are presented in Table 2.4.

TABLE 2.4. Experiment 2.2. Sample characteristics of subjects assigned to treatment and control groups.

Variables	TREATMENT GROUPS					
	DBT (home)	DBT (hospital)	DBT (parents)	Dry-Bed procedure without machine	Standard urine-alarm procedure	Control
Number of subjects	20	20	20	20	20	20
Mean age (years and months)	9-3	8-11	9-7	8-6	8-8	8-10
Ratio males to females	14:6	13:7	16:4	14:6	14:6	11:9
Mean bed-wetting frequency per week during four week baseline	5.6	5.3	5.5	5.4	5.8	5.3

In all cases undertaking treatment the parents presented at the hospital for an initial interview with the author, at which time a detailed history of the child's bedwetting was taken. They were then required to keep a record of the child's bedwetting frequency for the next month, after which treatment began. Demonstration of the apparatus was the same as for Experiment 2.1. The need to keep regular contact with the author during treatment was emphasized and a specific time was arranged for the parent or child to call weekly and report on progress. Treatment

continued until the child achieved 14 consecutive dry nights at which point the apparatus was returned. Progress was monitored at three months, six months, and 12 months after reaching the success criterion, although parents were advised to contact the author immediately if the child had clearly relapsed beforehand.

Group 1 - DBT by a trainer in the child's home

After baseline data were obtained, the author visited the home, arriving about two hours before the child's usual bedtime. After explaining the full procedure he conducted the initial all-night training programme. The procedure calls for hourly awakening on the first night which the trainer did until about 1.00 a.m. at which time the parents took over. Detailed instructions were left for the post-training supervision phase of treatment which the parents conducted.

Group 2 - DBT administered by trainer in hospital

After establishing baseline bedwetting frequency, children in this group were admitted to hospital overnight for the all-night training programme. Children came into the hospital with their parents after school, being met by the author who explained the procedure in detail. After a brief examination by the Ward doctor, the children had a meal and played until bedtime. At bedtime the author began the all-night procedure, continuing the hourly awakenings until about 1.00 a.m., at which point a nurse trained in the procedure took over. The child was discharged the next morning and progress was monitored weekly.

Group 3 - DBT administered by the child's parents at home

Children in this group underwent DBT at home, with their parents administering the initial all-night training schedule according to prior instruction. This instruction took place after the preliminary interview

and collection of baseline data, children and their parents meeting with the author to discuss the treatment. The urine-alarm apparatus was demonstrated and the Dry-Bed procedure described in detail, including the rationale for each step. Care was taken to ensure that the procedure was understood by the parent and child during this session. Thus, the room in which instruction was given was equipped with a bed to enable the steps involved to be role played. Subsequently parents were given an instruction sheet outlining the sequence of steps, which they took home for reference.

It was suggested that the training be commenced on a Friday or Saturday night so that the parents and child had the following day to recover from the all-night session. Both parents were encouraged to share the responsibility of supervising training. The importance of following the instructions closely was emphasized as was the need to maintain regular contact with the first author during the post-training night phase of treatment.

Group 4 - DBT by the parent without use of a urine-alarm device

This group underwent the same procedure as Group 3, except that no alarm was used at any stage and reference to the enuresis machine was deleted from instructions. Some modification of the original Dry-Bed procedure was necessary in order to manage bedwetting accidents. Without the alarm parents could not know exactly when wettings occurred. Bedwetting could only be detected in this group at the time of a scheduled awakening by the parents or the next morning, or if the child happened to wake himself during the night. In these situations the procedure that followed an accident was: (i) fully awakening the child to finish voiding in the toilet; (ii) cleanliness training and positive practice trials as soon as the wet bed was detected.

Instructions for the four groups given variants of DBT appear in Appendix 2.6.

Group 5 - Standard conditioning

Children in this group underwent the standard urine-alarm conditioning treatment with supervision, described in Experiment 2.1. The parents attended an initial interview, established a baseline for one month and returned with the child for a detailed description of procedure. Regular weekly contact was required until the success criterion had been reached. Follow-up occurred at three months and six months intervals to monitor relapse.

Group 6 - Control

Children in this group received no treatment for their bedwetting and were managed in the same way as described for Experiment 2.1.

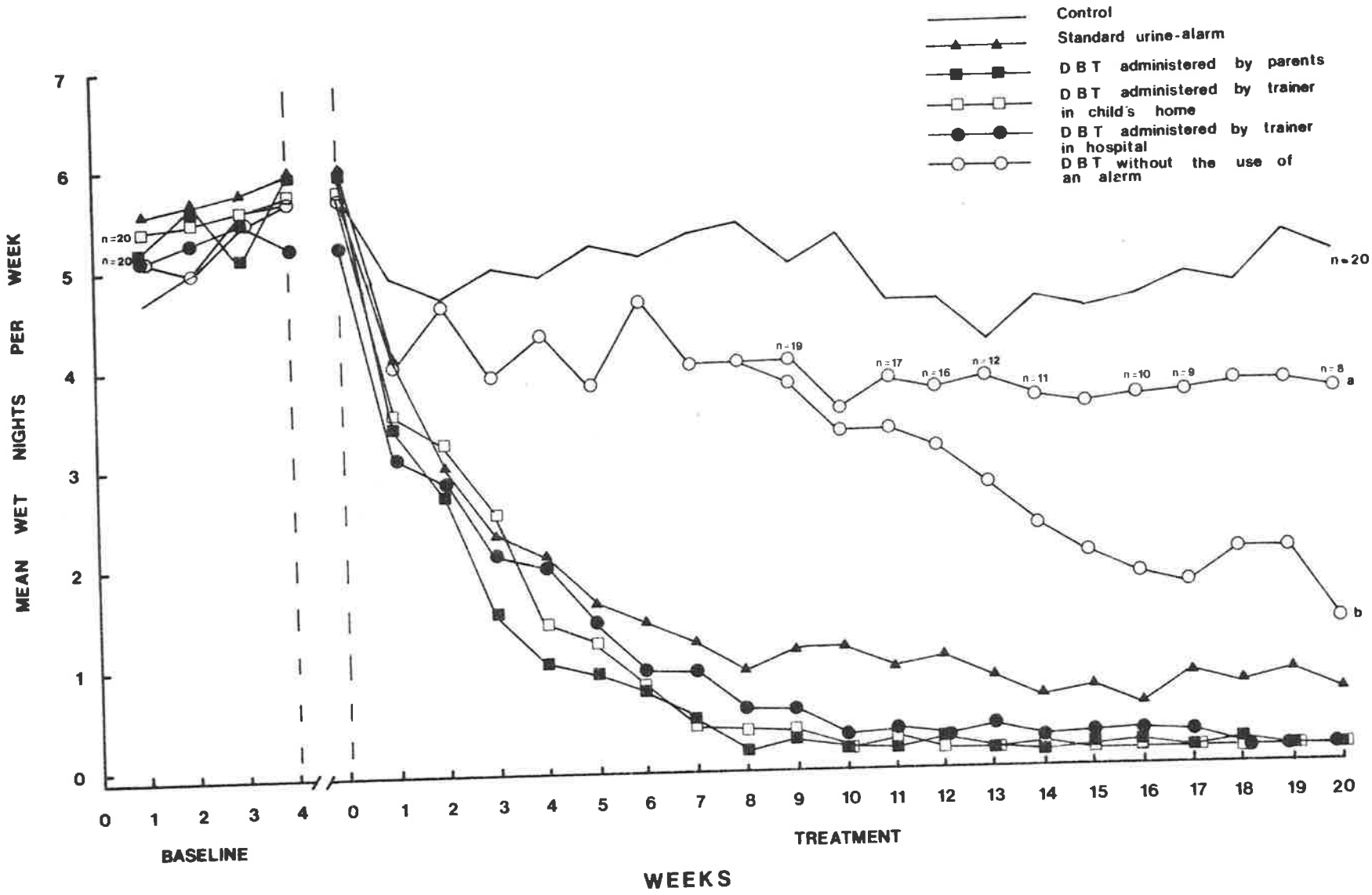
2.9. RESULTS

A summary of the data for all subjects appears in Appendix 2.7.

Figure 2.2 shows the mean number of wet nights per week throughout the 20 week experimental period for each group of children. Altogether, 12 of the 20 children undergoing DBT without the adjunct of an enuresis alarm discontinued treatment at the points indicated on curve (a) in Figure 2.2. In curve (a) the average weekly bedwetting frequency of the dropout subjects at the time of ceasing treatment has been retained when calculating means for the remainder of the 20 week experimental period. This was done because, as in Experiment 2.1, the dropouts tended to be those children whose response to treatment was poorest. Curve (b) excludes data from the dropouts from the calculation of mean weekly bedwetting frequency after the point at which treatment was discontinued.

FIGURE 2.2.

Mean wet nights per week for six groups throughout four weeks of baseline and 20 weeks of treatment: (a) average bedwetting frequency for all dropout cases retained: (b) dropout cases excluded.


Control
Standard urine-alarm
D B T administered by parents
D B T administered by trainer in child's home
D B T administered by trainer in hospital
D B T without the use of an alarm
MEAN WET NIGHTS PER WEEK
n=20
n=20
n=19
n=17
n=16
n=12
n=11
n=10
n=9
n=8
n=20
a
b
0 1 2 3 4
BASELINE
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
TREATMENT
WEEKS

It can be seen from Figure 2.2 that DBT incorporating an enuresis alarm was very effective in eliminating bedwetting, irrespective of whether it was administered by parents, by a trainer in the child's home, or by a trainer in hospital. The standard urine-alarm procedure was also effective in reducing bedwetting frequency although not as successful as DBT. On the other hand, the Dry-Bed procedure without a urine-alarm device was markedly less effective than any form of machine-based treatment. The control group's bedwetting frequency remained virtually unchanged throughout the 20 week experimental period.

Data from the six groups at the end of eight weeks of treatment (i.e. before any subject had discontinued) were examined by planned comparisons incorporated in analysis of covariance, with baseline wetting frequency as the covariate. The Dry-Bed procedure without an alarm, and the control group differed significantly in terms of the number of wet nights ($t(113) = 2.67$, $p < .01$), but not in terms of the number of days to dryness ($t(113) = .43$, $p > .05$). Comparison between all four groups receiving alarm-based treatments and the two no-alarm groups confirmed the effectiveness of alarm treatment in respect of wet nights ($t(113) = 13.84$, $p < .001$), and days to dryness ($t(113) = 6.47$, $p < .001$). The difference between the standard conditioning group and the sum of the DBT groups using an alarm was not statistically significant for either the wet nights factor or days to dryness factor. The three DBT groups with alarm did not differ significantly from one another on either factor ($p > .05$ in all instances). Summary tables for these data appear in Appendix 2.8.

At the end of eight weeks of treatment, significantly more children in the DBT groups with alarm had achieved the criterion of 14 consecutive dry nights when compared with the standard urine-alarm group ($\chi^2 = 3.89$, $p < .05$) or the group treated by the Dry-Bed procedure without an alarm

($\chi^2 = 15.17$, $p < .001$). However, the success rate in the standard conditioning group was higher than in the group trained by the Dry-Bed procedure without an alarm ($\chi^2 = 5.50$, $p < .05$). These results are summarised in Table 2.5.

TABLE 2.5. Experiment 2.2. Summary of results for six groups of subjects attaining dryness at the end of eight weeks, average time taken to last wet night, and mean number of wet nights.

GROUP	N	Cases reaching dryness at the end of eight weeks	Mean number of days to last wet night	Mean number of wet nights
Control	20	2	53	40
DBT by therapist in home	20	16	29	13
DBT by therapist in hospital	20	13	34	13
DBT by parents at home	20	17	30	11
DBT procedure without alarm	20	4	51	32
Standard urine-alarm	20	10	38	16

Similar analyses of data were carried out at the end of the 20-week experimental period, but excluding the Dry-Bed procedure without an alarm because of the large attrition rate in this group. The difference between the alarm-based treatment groups and the control was highly significant with regard to wet nights ($t(94) = 19.08$, $p < .001$) and the number of days taken to dryness ($t(94) = 10.58$, $p < .001$). Planned comparison of the three

DBT groups with the standard conditioning group established that DBT was more effective in arresting bedwetting, both with respect to the number of wet nights during 20 weeks of treatment and the number of days taken to achieve dryness ($t(94) = 2.29$, $p < .05$; $t(94) = 2.79$, $p < .01$, for each measure respectively). Summary tables for these data appear in Appendix 2.9.

Of the 60 children consigned to DBT with an alarm, all achieved the success criterion. The combined average number of wet nights was 13 and the combined average time taken to the last wet night was 36. There was a total of 15 relapses over a 12-month follow-up period. These results attest to the greater success of DBT with an alarm, when compared with the alternative procedures examined. Thus, only five of the 20 children trained by the Dry-Bed method without an alarm reached the success criterion of 14 consecutive dry nights and 12 dropped out of treatment during the experimental period. Of the five successful subjects, three relapsed subsequently. Sixteen of the 20 children in the standard conditioning group reached criterion, the average number of wet nights being 26. The average number of days to the last wet night was 63 and six cases relapsed during the 12 months follow-up. Two of the 20 children in the control group were dry for 14 consecutive dry nights during the course of recording. Both subsequently resumed wetting the bed at about their initial frequency. A summary of these results is presented in Table 2.6.

At the end of the 20 week experimental period the three DBT with-alarm groups achieved significantly greater success with respect to arrests of bedwetting than was the case in the standard urine-alarm group ($X^2 = 8.77$, $p < .01$) or in the group undergoing the Dry-Bed procedure without

a machine ($\chi^2 = 50.57$, $p < .001$). The standard procedure was in turn superior to the Dry-Bed procedure without an alarm ($\chi^2 = 10.40$, $p < .01$). Examination of the relapse rates revealed no significant differences between any of the treatment groups.

TABLE 2.6. Experiment 2.2. Summary of results for six groups in terms of subjects attaining dryness at the end of 20 weeks, relapses during follow-up, average time to last wet night, and mean number of wet nights.

GROUP	N	Cases reaching dryness criteria at end of 20 weeks of treatment	Relapses during 12-month follow-up	Mean number of days to last wet night	Mean number of wet nights
Control	20	2	2	129	96
DBT by therapist in home	20	20	5	33	14
DBT by therapist in hospital	20	20	6	40	15
DBT by parents at home	20	20	4	34	11
DBT without urine-alarm	20	5	2	116	78
Standard urine-alarm	20	16	6	63	26

2.10. DISCUSSION

2.10.1. The effectiveness of DBT with alarm

Results of this experiment showed that DBT when used in conjunction with a urine-alarm was consistently more effective than standard conditioning in arresting bedwetting, both in terms of the proportion of children who can be treated successfully and the overall speed of treatment. Furthermore DBT appears to be equally effective, whether the initial all-night training programme is administered by the child's parents or by a professional therapist in the child's home or in hospital. The group given DBT by parents did not have more therapist contact than the standard conditioning group.* The other two DBT groups had significantly more therapist contact but did no better than the parent-trained DBT group, results for all three DBT groups being very similar. Thus, while a certain degree of patient/therapist contact seems to enhance treatment by alarm-based methods, increasing the amount of the therapist time beyond the level in the parent trained group did not result in a commensurate improvement in the child's response. A more salient point, however, is that the success of the parent-administered group indicates that the improved effectiveness of DBT over the standard urine-alarm procedure cannot simply be attributed to the increased therapist time. Presumably the reasons for the effectiveness of DBT are related to the additional training features, such as the positive practice following accidents, the nightly waking schedule and practice at withholding urination.

---

*The group given DBT by parents did receive slightly more therapist contact during the initial instruction of the procedure since the DBT schedule is more complicated to describe than the standard conditioning procedure, requiring about 30 minutes of additional instruction time for each case treated. Thereafter, both groups received the same amount of time during each weekly contact with the therapist. However, since the average duration of treatment for the standard conditioning group was significantly longer than the DBT group, on balance the total amount of therapist contact was, if anything, slightly greater for the standard conditioning group.

The hospital trained DBT group was included because it seemed possible that any placebo effects during the initial training night might be maximized in this condition. However, the results for this group were not significantly different from the other two DBT groups and indeed the response of children in this group was marginally poorer. This may have been due to anxiety evoking effects of hospitalization, as noted in several previous studies (Belmont, 1976; Fagin, 1969; Vernon et al., 1965), since some of the children admitted to hospital for training were observed to suffer mild anxiety reactions.

2.10.2. The effectiveness of DBT without alarm

The Dry-Bed procedure without an alarm was only partially effective in reducing bedwetting frequency. While the reduction in the number of bed wets was statistically significant after eight weeks of training, this procedure resulted in only five out of 20 children attaining the success criterion of 14 consecutive dry nights. If one accepts that the major goal of treatment is to achieve complete arrest of the symptoms then this outcome is not satisfactory. Furthermore, 12 of the 20 children in this group discontinued treatment before the 20 week experimental period had expired. The major reason given by parents for discontinuing was discouragement as a consequence of the child's lack of progress, coupled with the demands of the complicated procedure. Thus, the Dry-Bed schedule without an alarm appears to be of limited practical use in the treatment of bedwetting.

There are several possible reasons for the difference between the DBT with alarm and DBT without alarm groups. Firstly, the alarm enabled the aversive consequences (e.g. positive practice, cleanliness training) to be administered immediately following a bedwetting event. It is likely that the negative reinforcement contingent upon bedwetting may have lost its reinforcing value for the no-alarm group because of the delay between the

bedwetting act itself and the detection of the accident. Secondly, the aversive consequences following bedwetting were probably more noxious for children who were woken by the alarm and required to carry out the training at a time when they would have preferred to be sleeping, than the no-alarm situation in which children did not have to face the consequences of bedwetting until they woke in the morning. Thirdly, it is also possible that the adjunct of the alarm enabled direct conditioning of the bladder sphincter. While the design of the experiment permits speculation only on this point, it is reasonable to suggest that the specific stimulus effects of the alarm were involved since: (i) each of the alarm-based treatments were very effective in arresting bedwetting whereas the Dry-Bed schedule without an alarm was only marginally effective, and (ii) the differences between groups attributable directly to the influence of the alarm (e.g. the difference between standard conditioning and the control, and the difference between DBT with and without the alarm) were far greater than the differences between groups attributable to social reinforcement factors (e.g. the difference between the no-alarm treatment and the control, and the difference between DBT with alarm and the standard conditioning procedure).

These results provide some support for the claim by Azrin et al. (1974) that the additional training features of DBT, aimed at maximizing the social consequences of bedwetting, contribute to this procedure's effectiveness in arresting bedwetting. At the same time, however, the results question the emphasis Azrin et al. (1974) place on the relative contribution of the alarm as opposed to social reinforcement factors. It would appear that the urine-alarm, whatever its actual role might be, is of primary importance in accounting for the success of the DBT programme.

2.10.3. Practical problems associated with DBT

While the DBT procedure with the adjunct of the urine-alarm device was found to be very effective in arresting nocturnal enuresis, it was readily apparent to the author that there are two important drawbacks with this form of therapy which would limit its widespread application. Firstly, the programme involves a complicated schedule of tasks and is therefore time-consuming to administer. The original procedure required a professional trainer in the child's home to conduct the all-night session. This is not only time consuming and therefore costly, but poses the additional problem of getting trained people to work such hours on a regular basis. Results of Experiment 2.2, together with a previous study by Bollard and Woodroffe (1977) have shown that the child's parents can be trained to administer the entire programme without reducing its effectiveness, thereby removing the need for an outside trainer in the child's home. However, training parents is in itself time-consuming. Experience from Experiment 2.2 suggests that instructing parents in DBT requires between an hour and one and a half hours, which is considerably longer than the time required for commensurate instruction of the standard conditioning procedure. Furthermore, it was found that despite this careful initial explanation, backed up by written instructions for home reference, some parents still found the DBT schedule difficult to comprehend, which required additional clarification by the therapist during treatment in order to ensure that training was implemented correctly.

Secondly, DBT requires that the enuretic child perform a demanding schedule of exercises. It was evident from weekly contact during treatment, and from subsequent discussions with parents and children, that many of them had trouble coping with these exercises. Most children found it very difficult to perform 20 positive practice trials following bedwetting

accidents during the night. Enforcement of this procedure often tended to evoke hostility on the part of the child and to increase family tension. The child sometimes manifested his/her anger by sabotaging the training programme (e.g. refusing to carry out the 20 positive practice trials, refusing to drink extra fluids during the initial training night, and, on a few occasions, by switching off the alarm or removing the pad from the bed during the night. In addition many parents expressed concern about having to administer such aversive procedures to their children. In cases where the demands of training became excessive, the overall effect was to undermine both the parents and the child's motivation to persist with the DBT programme.

These problems are addressed in Experiment 3.1 in the following chapter.

CHAPTER 3.

A COMPARISON OF GROUP WITH INDIVIDUALLY ADMINISTERED INSTRUCTION IN DRY-BED TRAINING

3.1. EXPERIMENT 3.1.

3.2. INTRODUCTION

Results of Experiment 2.2 support the claim of Azrin et al. (1974) that DBT with an alarm is more effective in arresting bedwetting than the standard conditioning procedure. However, there are two important limitations to the large scale use of DBT in clinical practice that do not apply to the same degree to the standard conditioning method; viz. the time required for instruction of the DBT, and the difficulty in maintaining both parents' and children's motivation to persist with the demanding schedule of exercises involved in DBT.

Experiment 3.1 was designed to address these limitations by instructing parents within small group settings to administer the Dry-Bed procedure. Group treatment is economical in terms of the time required to explain the programme and for subsequent weekly follow-up of the child's progress. Furthermore, the group situation provides an opportunity for people with a common problem to share experiences and engage in joint problem-solving, so that such meetings might facilitate the motivation of parents and children to persist with the demands of the programme, thereby resulting in quicker response to treatment.

In addition to the above, both DBT and the standard conditioning method rely on the use of a urine-alarm device to achieve maximum effectiveness. This is a problem in clinics where the demand for such devices far outweighs their availability. An attempt to use the Dry-Bed procedure without an alarm in Experiment 2.2 did not meet with much success as was the case in

previous studies by Bollard and Woodroffe (1977) and Nettelbeck and Langeluddecke (1979). However, despite the unimpressive outcome of previous research attempting DBT with the alarm omitted, and with the parent as therapist, it is possible that this version of treatment resulted in lower motivation of parents' and child to persist than was the case with the alarm-based programme. Reports from parents during Experiment 2.2 support this suggestion, since premature drop-outs from the no-alarm treatment group were common, the major reason appearing to be discouragement about the child's slow progress. Thus, it was considered possible that if parents' motivation was enhanced by conducting parent instruction in small group settings, then the effectiveness of DBT without an alarm might be improved. Furthermore, although past results from attempts to use DBT without an alarm have indicated fewer complete cures than with the alarm-based programme, DBT without an alarm may still provide a worthwhile initial method of treatment, reducing bedwetting somewhat and familiarizing parents and children with the training schedule. If this were the case, then children having had the benefit of this experience should progress quickly if an alarm were subsequently introduced into the programme. Finally, experience with the DBT exercises prior to introducing the alarm might lead to a more permanent cure, i.e. result in fewer relapses.

3.3. METHOD

Subjects

Subjects were 30 children (19 males and 12 females) referred for treatment of nocturnal enuresis as outpatients of the Adelaide Children's Hospital. Ages ranged from 7 to 13 years (mean = 8 years 9 months). Two children had significant psychological problems in addition to enuresis - one had been diagnosed as autistic and the other as mildly mentally retarded (WISC IQ = 67). All others appeared from observation and on the basis of

parents' reports to be within normal limits of intelligence and mental health. All subjects had a regular bedwetting frequency of at least one wet night per week. As in the previous two experiments, each child had been examined by a medical practitioner in order to rule out the possibility of underlying organic pathology, and none of the children was undergoing any form of enuresis-related drug or psychotherapy at the time of the study.

Apparatus

Apparatus was the same as that described for Experiments 2.1 and 2.2.

Procedure

Children were selected from a waiting list in the same manner as for Experiments 2.1 and 2.2 and then assigned at random to one of three groups. Two were treatment groups and the third served as a control group. Sample characteristics of the three groups are presented in Table 3.1.

TABLE 3.1. Experiment 3.1. Sample characteristics of subjects assigned to treatment and control groups.

VARIABLES	TREATMENT GROUP		
	1: DBT with alarm	2: DBT without alarm	Control Group
Number	10	10	10
Mean age (years and months)	8-5	9-4	9-5
Mean wet nights per week during 4-week baseline	5.0	4.8	5.0

Treatment Group 1: DBT with alarm

The 10 children assigned to this condition were divided randomly into two groups of five so that the group meetings during treatment were of a manageable size.

Parents were sent a letter requesting them to record their child's bedwetting frequency on an enclosed calendar, for four weeks. This constituted the child's baseline. Parents were informed that during treatment they would be meeting with a small group of children and parents with similar problems.

The first meeting was designed to foster a group feeling in a warm and friendly atmosphere with parents comparing experiences about their child's bedwetting patterns and attempts at management in the past. The therapist described and demonstrated DBT in detail, group members learning the various steps of the procedure through role-play with the therapist. An instruction sheet outlining the sequence of steps in the procedure was given to parents for home reference (as in Experiment 2.2), together with a calendar to continue recording bedwetting frequency. It was suggested that training commence on a Friday or Saturday night, leaving the following day to recover from the all-night session. The importance of following the instructions closely was emphasized, as was the need to attend the weekly follow-up group meetings.

Weekly meetings during the post-training phase of treatment involved parents only. In these sessions each child's progress for the week was recorded and discussed. The group was encouraged to praise improvement but care was also needed to support slower responders. Parents reported on the performance of the apparatus and any malfunctions were dealt with on the spot. Any general problems were put to the group for discussion. The therapist encouraged all group members to persist with the programme, attendance at meetings being presented as an integral part of treatment. Where parents were unable to attend they were expected to telephone

beforehand and relevant feedback from such contacts was passed on to the group. Parents continued attending the group meetings until their child had reached the success criterion of 14 consecutive dry nights.

Both parents were encouraged to share the responsibility of training and to attend meetings. Attendance by fathers was not always possible, since some meetings were held during day-time working hours. However, reports indicated that training responsibilities at home were shared.

Treatment Group 2: DBT without alarm

The 10 children assigned to this condition were also divided into two groups of five and underwent the same procedure as Treatment Group 1, except that no alarm was used for the initial eight weeks. Thus, parents recorded baseline for four weeks and attended the initial meeting with their children at the hospital. DBT was demonstrated but reference to the urine-alarm was deleted from instructions.

After the initial session small groups met weekly, the same emphasis being placed on group discussion and problem-solving as in Treatment Group 1. Parents were advised that treatment would continue until the child achieved 14 consecutive dry nights, or for a maximum of eight weeks. Children still wetting at that time were issued with an enuresis alarm to incorporate into DBT. Attendance at weekly group meetings continued after the introduction of the machine until the child reached the success criterion.

Control Group: No Treatment

Parents of the 10 children assigned to this condition were sent a letter requesting that they record their child's nightly bedwetting frequency on an enclosed calendar for a 12 week period, mailing results to the hospital by return-paid envelope each month. Parents were instructed not to alter their method of managing the child's bedwetting in any way while recording.

On completion of 12 weeks recording these children were treated by DBT with an alarm, parent instruction being carried out in small groups.

Figure 3.1 shows the design of the investigation, the arrangement of recording letters and instructions, and weekly group meetings throughout the course of the study.

Assessment of the motivating effects of these small-group instruction procedures compared with individual instruction was based on the author's clinical judgement of subjects' responsiveness during treatment, and on subsequent discussions with the parents and children involved about their ability to cope with the training programme. A more objective measure of the motivating effects of small-group instruction could have been achieved by the inclusion of an additional control group given individually administered DBT and by requiring all subjects to rate, on pre-determined scales, the degree of difficulty they encountered on the various aspects of training. This was not done however, because of practical limitations at the time, not the least of which included restrictions on the number of urine-alarm devices available for treatment, which would have rendered the inclusion of an additional group difficult, and the author's reluctance to place extra requirements on subjects in addition to the heavy demands of DBT, since this might have interfered with their ability to implement the procedure correctly.

3.4. RESULTS

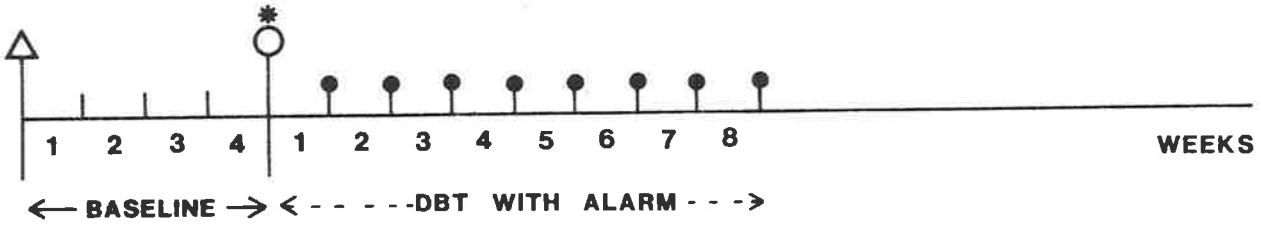
A summary of the data for all subjects appears in Appendix 3.1. Figure 3.2 shows the mean number of wet nights per week for each group of children.

It can be seen that in Treatment Group 1, DBT with the adjunct of an alarm was very effective in eliminating bedwetting. DBT without an

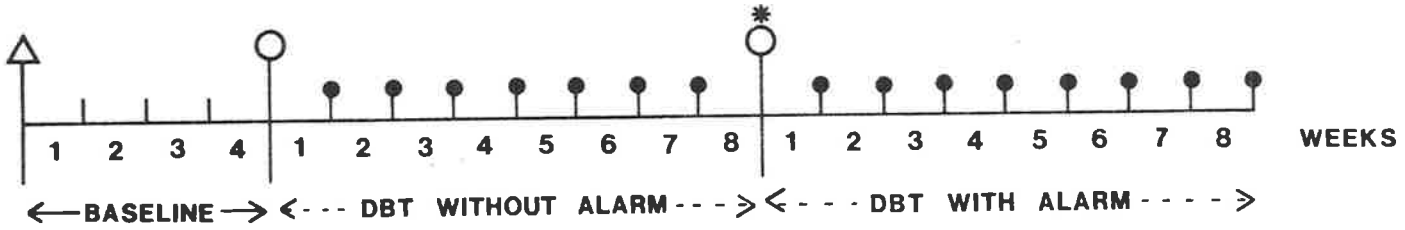
FIGURE 3.1.

Treatment scheme showing timing of letters, instruction clinics, and weekly group meetings. A broken line indicates that treatment would terminate once the criterion for dryness was achieved.

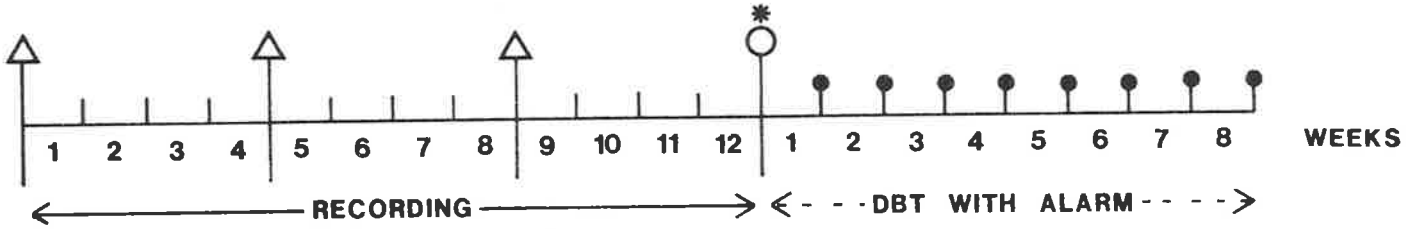
TREATMENT GROUP 1



TREATMENT GROUP 2



CONTROL GROUP



△ LETTER

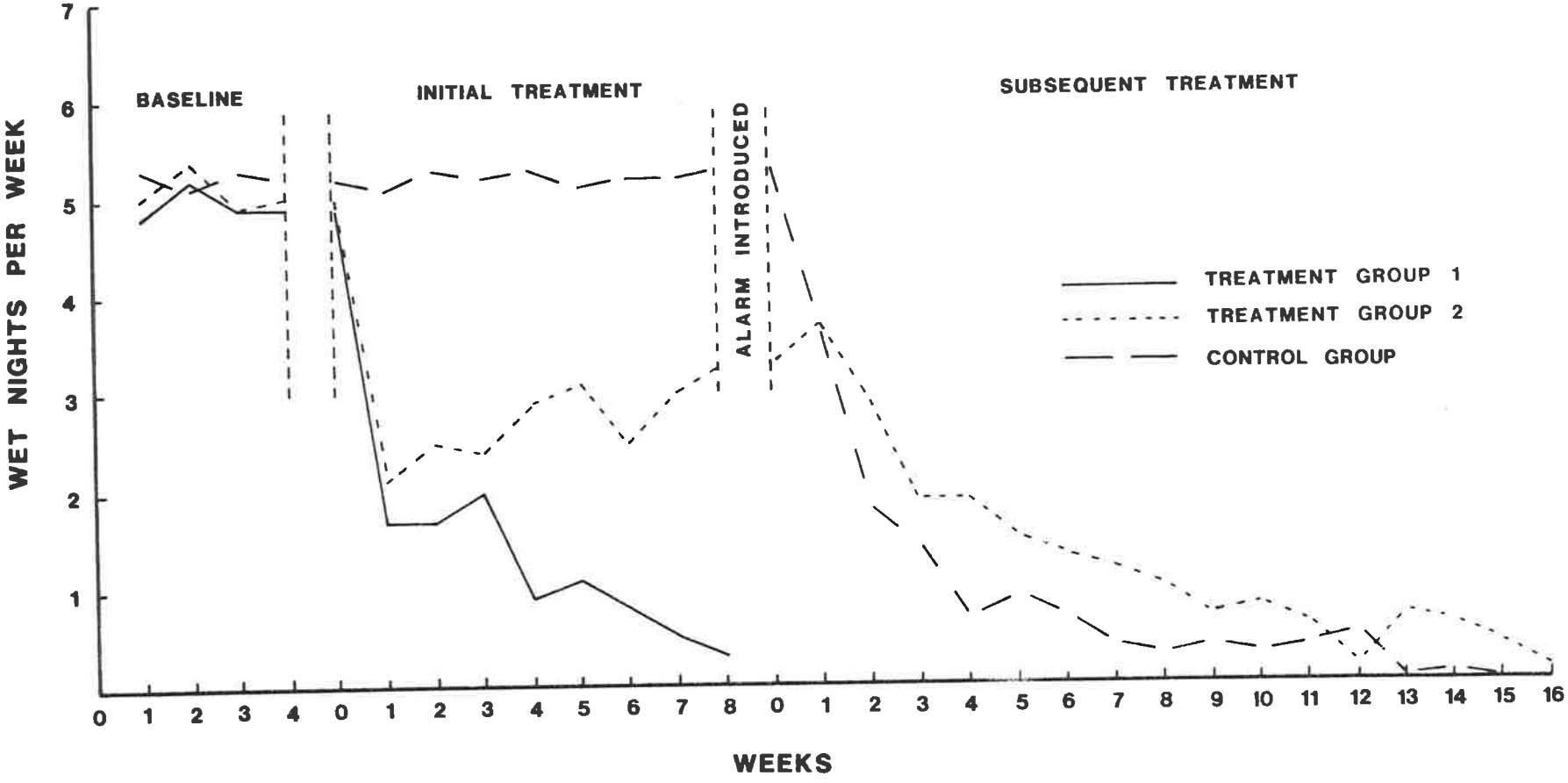
○ DBT INSTRUCTION

✱○ DBT INSTRUCTION WITH ALARM

● GROUP MEETING

FIGURE 3.2.

Mean wet nights per week for three groups throughout four weeks of baseline, eight weeks of treatment, and a subsequent treatment phase in the case of two groups.


WET NIGHTS PER WEEK
7
6
5
4
3
2
1
BASELINE
INITIAL TREATMENT
ALARM INTRODUCED
SUBSEQUENT TREATMENT
TREATMENT GROUP 1
TREATMENT GROUP 2
CONTROL GROUP
0 1 2 3 4 0 1 2 3 4 5 6 7 8 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
WEEKS

alarm (Treatment Group 2) also reduced bedwetting frequency but less effectively than the alarm-based treatment. The control groups bedwetting frequency remained virtually unchanged throughout the initial eight week experimental period. Planned comparisons with adjustment for baseline wetting established that DBT without an alarm and the control group differed significantly in terms of the number of wet nights ($t(26) = 4.95$, $p < 0.001$) but not in respect of the number of days to dryness ($t(26) = 1.35$, $p > 0.05$). Comparison of the alarm-based treatment with the no-alarm and control groups combined, confirmed the effectiveness of the former treatment in respect of wet nights ($t(26) = 7.55$, $p < 0.001$) and days to dryness ($t(26) = 4.25$, $p < 0.001$). [See Appendix 3.2.]

At the end of eight weeks of treatment nine out of 10 children in Treatment Group 1 had reached the dryness criterion compared with two out of 10 in Treatment Group 2 ($p < 0.001$, two-tailed, Fisher Exact Probability Test). Three children in Treatment Group 1 relapsed within a few weeks after reaching the dryness criterion. (A relapse was defined as at least one bed-wet per week over a four week period.) Both children who were successful in Treatment Group 2 relapsed almost immediately after reaching the dryness criterion.

At the end of the initial eight weeks of treatment, children in the Control Group and Treatment Group 2 who were all still wetting at that stage, underwent DBT with an alarm. It can be seen from Figure 3.2 that the introduction of the alarm quickly reduced bedwetting frequency in both groups, the rate of progress being similar to that seen in Treatment Group 1. Comparison by one-way analysis of variance of the response for all three groups under DBT with an alarm, irrespective of when that treatment commenced, found no evidence for a difference in terms of the number of wet nights ($F(2,27) = 1.63$, or the number of days to dryness ($F(2,27) < 1.0$). [See Appendix 3.3.]

Altogether, 30 children ultimately underwent DBT with an alarm and 29 achieved the success criterion of 14 consecutive dry nights within 16 weeks of starting treatment. The remaining child was still wetting the bed about two nights per week after 18 weeks.* The combined average time taken to the last wet night of the 29 successful children was 30 nights and the combined average number of wet nights before achieving dryness was 11. There was a total of 10 relapses over a six month follow-up period. Examination of the relapse rates revealed no significant differences between any of the treatment groups. A summary of these results is presented in Table 3.2.

TABLE 3.2. Summary of results from three groups in terms of subjects attaining dryness, number of relapses during six-month follow-up, average time to last wet night and mean number of wet nights.

GROUP	N	Cases reaching success criterion	Relapses at 3-month follow-up	Mean number of nights to last wet	Mean number of wet nights
DBT with alarm following 4-week baseline	10	10	3	29	10
DBT with alarm following 8 weeks of no-alarm treatment	10	9#	4	26	12
DBT with alarm following 12 weeks without treatment (Control Group)	10	10	2*	36	12

* 1 case relapsed twice during the follow-up period

\# Data are for the 9 cases reaching dryness. The remaining case has continued to wet about 2 times a week after 18 weeks of treatment.

*This child was not handicapped. The autistic child and the mildly retarded child achieved the success criterion in 23 and 87 nights respectively.

3.4.1. Comparisons of results with Experiment 2.2

Subjects in the present experiment were selected according to the same criteria and from the same hospital population as subjects in Experiment 2.2. The respective sample characteristics are very similar, as can be seen from Table 3.3. This permits comparison between DBT administered in small groups and on an individual basis.

TABLE 3.3. Sample characteristics of subjects in the present study compared with those from Experiment 2.2.

VARIABLES	Present Study	Experiment 2.2
Number	30	60
Mean age (years and months)	9-1	9-3
Ratio males to females	18:12	43:17
Mean wet nights per week during 4-week baseline	4.9	5.5

Two comparisons were made:

(i) The performance of the 30 children in this study treated by DBT with an alarm where parents were instructed in the small group situation, with the 60 children from the previous study - i.e. treatment by the same procedure, but with parent instruction administered individually;

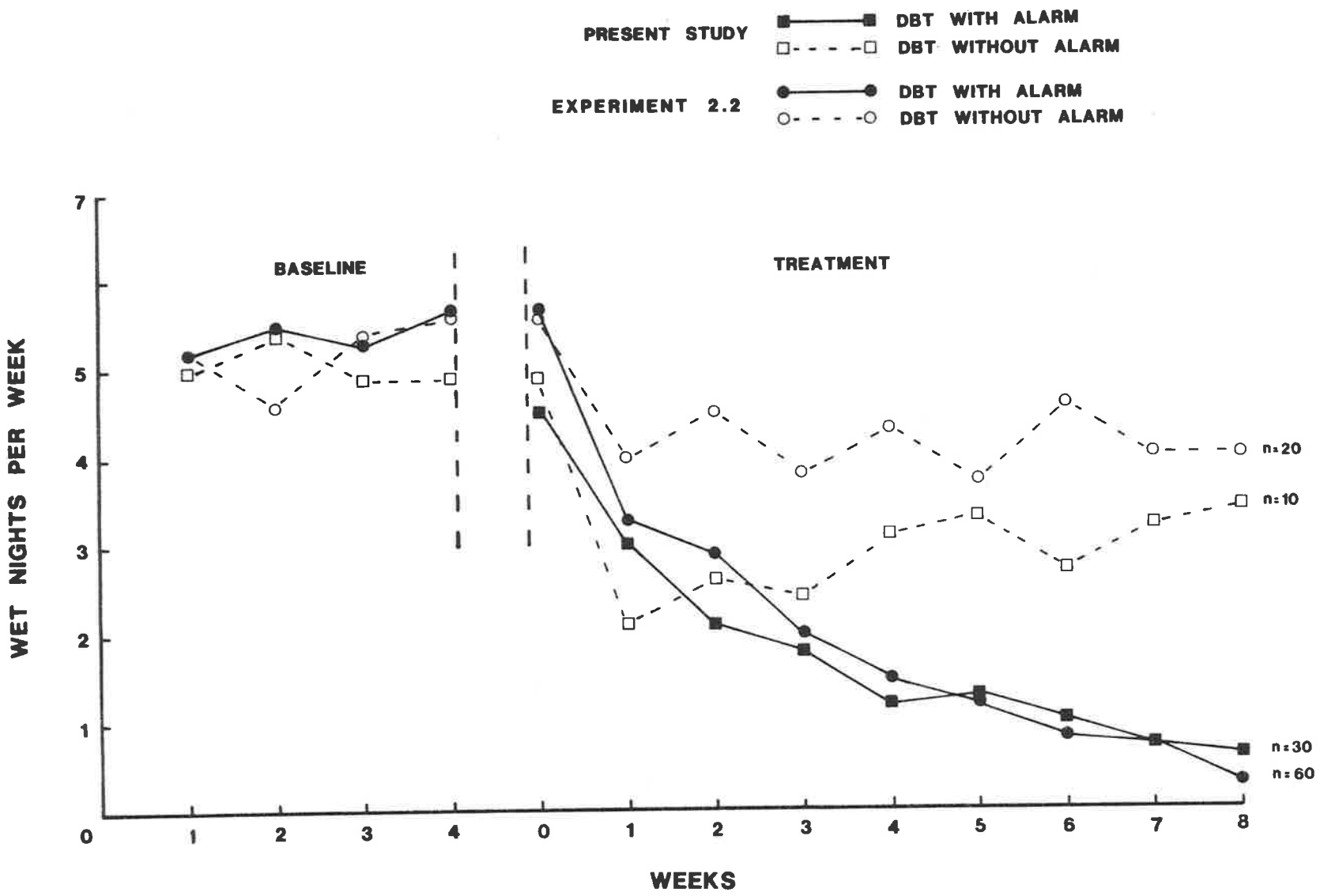
(ii) the performance of the 10 children in this study treated by DBT without an alarm where parents were instructed in the small group situation, with the 20 children from the previous study - i.e. treatment by the same procedure, but with parent instructions administered individually.

Figure 3.3 shows the mean number of wet nights per week for each group of children after eight weeks of treatment. Planned comparisons incorporated

FIGURE 3.3

Mean wet nights per week for DBT with and without alarm, and (a) supported by a group parent-training scheme (present study), compared with the same procedures when (b) directed by either a professional therapist, or the child's parents following training on an individual basis (Experiment 2.2).

Note: Baseline for DBT with alarm from the present study is omitted since 10 subjects had been treated previously by DBT without alarm; (refer to Figure 3.2, Initial Treatment Phase).


PRESENT STUDY
DBT WITH ALARM
DBT WITHOUT ALARM
EXPERIMENT 2.2
DBT WITH ALARM
DBT WITHOUT ALARM
BASELINE
TREATMENT
WET NIGHTS PER WEEK
WEEKS
n=20
n=10
n=30
n=60
0
1
2
3
4
5
6
7
8

in analysis of covariance, with average bed-wetting frequency over the four weeks immediately prior to final treatment as the covariate* revealed that for DBT with an alarm there was no difference between parent group instruction and individual instruction in terms of the number of wet nights ($t(115) = 0.84$, $p > .05$) or in terms of the number of nights to dryness ($t(115) = 0.24$, $p > .05$). However, for children undertaking DBT without an alarm it was established that parent group instruction resulted in significantly fewer wet nights ($t(115) = 2.93$, $p < 0.01$) but no difference in the number of nights to dryness ($t(115) = 0.24$). Comparison of both groups undertaking DBT with alarm (i.e. group plus individual instruction) with the two no-alarm groups confirmed the effectiveness of the former treatment in respect of wet nights ($t(115) = 8.12$, $p < 0.001$) and nights to dryness ($t(115) = 5.14$, $p < 0.001$). [See Appendix 3.4 for statistics summary tables).

Instruction of parents within a group and individual instruction, using DBT with an alarm, produced similar results in terms of the total number of subjects attaining dryness and the speed with which this was achieved. Thus, all 60 children treated following initial individual instruction reached the dryness criterion within 20 weeks. This compared with 29 out of 30 children treated over the same period in small groups following instructions to parents. The 29 successful children in the group treatment programme were slightly quicker to reach criterion, taking an average of 30 nights to the last wet night compared with an average of 36 nights for the group of children followed individually.

---

*No baseline is shown in Figure 3.3 for the 30 subjects ultimately treated by DBT with alarm in the present study. This is because the group includes Treatment Group 2, which, as may be seen from Figure 3.2, achieved an average of about 3 wet nights per week during initial treatment. The average performance of this group under DBT without an alarm is also included in Figure 3.3.

3.4.2. Attendance at group meetings

The overall attendance rate for Treatment Group 1 (DBT with alarm from the outset) was 89 percent. This was markedly higher than attendance when children in the Control Group were treated with an alarm (65 percent), or in either phases for Treatment Group 2 (60 percent and 55 percent for treatment without and with an alarm respectively). The reasons for the low attendance rates in the latter two groups appeared to be related to the requirement that parents record and communicate bedwetting frequency for an extended period of time before entering treatment (Control Group) and to parents' and children's discouragement as a result of moderate gains achieved by the no-alarm treatment (Treatment Group 2). The differences in attendance rates cannot account for differences in progress during the treatment phase, since the overall progress of the three groups was much the same once DBT with an alarm had been introduced. However, when the data for all subjects were combined, a weak association was found between attendance at group meetings and the effectiveness of treatment, suggesting that attendance was nevertheless an important factor. Thus, among all 30 subjects following the introduction of DBT with an alarm, significantly more of the children of those parents attending every meeting reached the dryness criterion in less than the median number of nights ($p < .05$, two-tailed, Fisher Exact Probability Test). An implication of this result is that it would seem highly desirable to employ the urine-alarm with the DBT schedule from the outset and to commence this treatment regimen immediately following establishment of baseline.

3.5. DISCUSSION

3.5.1. Group instruction in DBT with alarm

Results of this experiment indicate that DBT with an alarm is at least as effective when administered by parents who have been trained in small groups, as it is when administered by parents trained individually. Indeed, subjects who were given DBT with an alarm immediately following establishment of baseline were slightly faster on average in achieving the dryness criterion in this study, when compared with Experiment 2.2 in which either parents were trained individually beforehand, or initial training was done by a professional therapist. It is suggested therefore that training parents to administer DBT in small groups is a more economical and efficient method for large-scale clinical treatment of bedwetting, because of the reduced therapist time required for instruction and supervision of the complicated procedure. Thus, the primary aim of this study was achieved.

3.5.2. Group instruction in DBT without alarm

A second aim of the current study was to examine the effectiveness of the parent-group training for DBT without the adjunct of a urine-alarm device. Results showed that this method significantly reduced bedwetting frequency, but it did not eliminate bedwetting symptoms completely. Although the group DBT programme without an alarm was shown to be more effective when compared with the outcome of Experiment 2.2, in which parents were individually trained in the DBT procedure, it was still less effective than the alarm based programme under either group or individual training conditions. The suggestion that the no-alarm procedure might familiarize families with the DBT schedule, thereby speeding up the child's progress following introduction of the alarm, was not supported by the results. Children who underwent DBT without an alarm for an initial eight week

period took just as long to achieve dryness after the alarm was introduced, with as many relapses, as the two groups having no previous experience with the DBT exercises. Indeed, overall attendance at group meetings was lowest in the no-alarm group and more effort was required by the therapist to maintain the motivation of parents and children to persist with the training schedule even after the alarm was introduced. Thus, at least some parents and children were discouraged by the moderate results after eight weeks of considerable effort and they showed scepticism about the programme.

It was apparent to the author, who acted as therapist in all cases, that instruction of DBT, both with and without an alarm, in the small group setting increased parents' and children's motivation during treatment, compared with the individual instruction procedure of Experiment 2.2. Parents and children in the group training situation generally demonstrated more compliance and a greater willingness to persist with the demands of treatment. It seems reasonable to suggest that this motivational effect accounts for the slightly improved response to treatment in the case of subjects given DBT with an alarm and the significantly improved response for children given DBT without an alarm, in this experiment compared with subjects in Experiment 2.2. However, even with the increased motivational effects of small-group instruction, and the possibility that other motivational stragegies would further enhance the effectiveness of treatment, the overall results of this study seriously question the practical efficacy of the DBT schedule when the alarm is omitted.

These findings differ substantially from recent reports by Azrin and his colleagues that bedwetting can be eliminated effectively by a training programme similar to the original DBT schedule, but without the adjunct of a urine-alarm device (Azrin & Thienes, 1978; Azrin et al., 1979; Besalel-Azrin et al., 1980).

The format of the programme described by Azrin and Thienes was similar to the original DBT procedure, in that it involved one intensive day of training followed by a regimen of parental supervision. In addition, the major components of the original procedure such as, nighttime awakenings, retention control training, positive practice and cleanliness training in respose to bedwetting accidents, were retained in the new programme. The principal modifications to the original DBT procedure were to the intensive training session and they included:

(i) omitting the urine-alarm device altogether;

(ii) beginning the initial intensive training during the late afternoon and extending this till 1.00 a.m. the following morning rather than throughout the first night;

(iii) the addition of a "strain-and-hold" procedure whereby the child was instructed to try to inhibit urination but as soon as he felt he was about to urinate, to hold it back;

(iv) training the child to inhibit urination until a large volume had accumulated;

(v) having the child engage in behavioural and thought rehearsal during the day, of the toileting action he would take at night;

(vi) increased emphasis on encouragement and praise coupled with tangible rewards for specific periods of dryness.

The initial training session was conducted by an outside trainer with the parents observing. The remainder of training was conducted by the parents and this phase of treatment was very similar to that of the DBT without alarm schedule described in the current experiments.

Azrin and Thienes (1978) claimed that the modified operant procedure resulted in significantly fewer bedwetting accidents compared with a group

which received standard conditioning, during the initial two weeks of treatment. Ultimately 51 subjects were treated by the modified DBT programme without an alarm and 92 percent of these achieved the initial success criterion of 14 consecutive dry nights. The time taken to attain the dryness criterion was not reported but there was an average of seven bedwetting accidents before the criterion was reached. Over a 12-month follow-up period, 10 out of 47 children (21 percent) relapsed, this being defined as more than three consecutive nights of bedwetting.

Two subsequent studies employed the same operant procedure with the exception that the child's parents were instructed in an office interview to conduct the intensive day of training rather than a special trainer (Azrin et al., 1979) and eventually instruction of the complete procedure was done with a training manual (Besalel-Azrin et al., 1980). In both cases, the effectiveness of the operant training programme was found to be similar to that in the Azrin and Thienes (1978) study. The authors did concede however, that the new treatment method does not seem to be as effective as the original DBT procedure (Azrin et al., 1974) which had included the urine-alarm device but not the day time training.

The treatment outcomes of the above studies with the 'no-alarm' training are generally much superior to the results of Experiment 2.2 and the current experiment which employed the original DBT schedule without an alarm. One explanation for this difference is likely to be that the various additions to the original DBT schedule do in fact increase its effectiveness although the basic training features of both programmes are much the same. Another reason could be that the subjects treated by Azrin and Thienes (1978), Azrin et al. (1979) and Besalel-Azrin et al. (1980) were generally younger than subjects treated in Experiment 2.2 and this study. It was apparent for example, that there was a high proportion of three year olds

treated by the modified operant procedure and these children were likely to have been more responsive to most forms of therapy. Nevertheless, the impressive results reported by the above authors are difficult to reconcile with the results of the current research. In the light of the present author's experience with the no-alarm schedule, it is felt that even though further research might substantiate the effectiveness of the modified operant programme, this procedure still has significant practical limitations since it involves the addition of more procedures to an already complicated and demanding training regimen.

Putting aside the practical considerations for the time being, the results of the no-alarm treatment group in this experiment again raises interesting theoretical issues in respect of the role of operant variables in reducing bedwetting. Procedures such as training in rapid awakening, practice in withholding urination, massed practice in correct nighttime toileting behaviour, and differential social reinforcement for wet or dry nights, appear to contribute to the overall effectiveness of the DBT programme, in addition to the specific stimulus effects of the urine-alarm. The effect of such operant strategies may be increased by raising the subjects' motivation to apply the various exercises more diligently, but this effort does not seem sufficient to completely arrest bedwetting. The relative therapeutic value of these training features is a topic for further examination in Experiment 4.1.

3.5.3. A note of caution about the overall effectiveness of the DBT with alarm programme

While group instruction did appear to facilitate subjects' motivation to persist with the DBT programme, the problems with training observed in the individual instruction situation in Experiment 2.2 were still evident, albeit to a lesser extent. Most families still found the DBT procedure quite demanding, and in some cases they experienced difficulty implementing the full training regimen, the 20 positive practice trials being the specific exercise with which most problems were encountered. Thus, it would appear that there is a need to reduce the inherent demands of the DBT programme. This issue is also addressed in the following chapter. Secondly, while DBT with an alarm is highly effective in bringing about the initial arrest of bedwetting, the procedure is apparently hampered by a significant relapse rate. At six-month follow-up, the present study found that nine children relapsed out of 29 initially successful treatments. Relapse following DBT is examined further in Chapter 5 of this thesis.

CHAPTER 4.

A COMPONENT ANALYSIS OF DRY-BED TRAINING

4.1. EXPERIMENT 4.1.

4.2. INTRODUCTION

DBT with the adjunct of a urine-alarm device is a complex training programme and it is therefore difficult to assess which aspects contribute most heavily to the success of the procedure. Differentiation of the therapeutic value of the various aspects of DBT would raise the possibility of simplifying the procedure and this was the principal aim of Experiment 4.1.

In addition to the procedures involved in the standard urine-alarm conditioning treatment, three major components of the DBT schedule can be identified - the nighttime waking schedule, retention control training, and positive practice in response to bedwetting accidents. These training features are the logical consequence of Azrin et al.'s (1974) conception of the nature and aetiology of nocturnal enuresis. According to Azrin et al., bedwetting is a complex problem involving such diverse factors as ease of arousability from sleep, ability to inhibit urination, social motivation to become continent, and the strength of alternative responses to bedwetting. The various behavioural procedures upon which DBT is based have been used in other studies to treat bedwetting and to shape behaviour necessary for correct nighttime toileting. A summary of evidence for the effectiveness of these procedures (apart from the urine-alarm conditioning procedure) follows.

4.2.1. Waking Schedules

Young (1964) noted that it is common practice among parents during the toilet-training period to awaken the child during the night and encourage it to urinate in the toilet. He reasoned that this aids the training process because the association of a particular bladder pressure with awakening

and a reward, such as parental approval, ensures that the desired stimulus-response association is learned. With the enuretic child however, this procedure may not be adopted, or when it is no associated learning occurs and the enuresis persists. The rationale of a "staggered-wakening" procedure was therefore as follows: "If children are wakened regularly at or about the same time each night it is possible that they learn to relate only a small range of bladder pressures with the wakening response. If, however, a wakening schedule could be devised to operate over a period of time it would be feasible that a greater range of bladder pressures would be perceived by the child, and these different bladder pressures would be associated with a wakening response. By the principle of 'stimulus-generalization' this learning pattern would summate, resulting in bladder pressure, waking response, and reflex inhibition of micturition becoming acquired or learned behaviour." (p. 142). Young tested this theory, employing a staggered-waking procedure over a four week period with 58 enuretic children. The ages of the subjects ranged from four to 14 years with the majority falling between four and eight years. The children were woken by the parents once each night according to a pre-determined schedule. Results showed that 67 percent were "improved" (i.e. bedwetting frequency reduced by at least 50 percent) during the period of the trial. Ten children became completely continent after repeating the programme two or three times. Young concluded that the staggered-waking schedule is not as successful for the treatment of nocturnal enuresis as the urine-alarm conditioning method; however, he considered it to be a useful and convenient method for health visitors to recommend when they give advice for toilet-training young children, and for clinics where there is a long waiting list for urine-alarm devices.

Creer and Davis (1975) used a variation of Young's (1964) staggered awakening procedure with nine bedwetters (ages not given) in an

institutionalized setting. Initially subjects were woken three times each night according to a pre-determined variable interval schedule and allowed to void in the toilet. Two weeks later a fading operation was initiated by having attendants awaken subjects on a variable interval schedule only twice per night for a two-week period. Following this, for the next two weeks, subjects were woken once only each night and this stage was in turn supplemented by a final one-month period when subjects were allowed to sleep undisturbed at night. Results indicated a decrease in bedwetting frequency in all subjects, although only three became continent, using the criterion of 14 consecutive dry nights, by the end of the final no-awakening period. No quantitative follow-up data were provided. Creer and Davis (1975) speculated that it was the aversiveness of being woken regularly at night which led to the improvement in nocturnal bladder control.

Singh, Phillips and Fischer (1976) successfully treated a 13 year old enuretic girl by waking her two hours after falling asleep. The interval between falling asleep and awakening was reduced by 30 minutes each time she achieved seven consecutive dry nights. At eight months follow-up no instance of bedwetting had occurred but the total duration of treatment was 15 months.

Samaan (1972) combined an operant conditioning programme with a waking schedule for a seven year old child, eliminating bedwetting after eight weeks of training. Initially the parents repeatedly awakened the child at night, directed her to the toilet, and reinforced each correct voiding. Nighttime awakening was gradually faded out and reinforcement delivered on a gradually expanded schedule. The subject reportedly remained dry at night during a two-year follow-up.

The authors in the latter two studies did not speculate on the reasons for the effectiveness of the waking schedules. However, in each case the

procedure appeared to be directed at 'catching' the child before voiding at night, thereby increasing the opportunities for positive reinforcement as a consequence of maintaining a dry bed.

Evidence for the effectiveness of waking programmes as a therapeutic strategy for bedwetting is limited by the small number of studies reported and, with the exception of Young (1964), by the small number of subjects in each study. In addition, the procedures employed have differed in terms of the scheduling of nighttime awakenings. Nevertheless, it does appear from the above studies that bedwetting can be reduced by systematically waking the child during the night for toileting. This finding is consistent with evidence from several studies noted in Chapter 1, section 1.4.2 (iii) which have highlighted an association between bedwetting and a disorder of the enuretic's sleep-arousal system. However, these data are much less impressive than the results usually achieved with the standard urine-alarm conditioning procedure.

The waking schedule employed in DBT involves the enuretic child being woken hourly for toileting during the intensive training night, and thereafter being woken once only each night (at about the parents' bedtime) until seven consecutive dry nights have been achieved. Azrin et al. (1974) believe that this procedure helps develop the enuretic child's ease of arousability from sleep by providing regular practice at having to rouse quickly during the night. The DBT schedule also includes a requirement that the parents progressively reduce the amount of prompting necessary to rouse the child, thereby shaping self-initiated waking.

4.2.2. Retention Control Training

There is evidence that enuretic children have smaller functional bladder capacities than non-enuretic children the same age (Esperanca & Gerrard, 1969; Hallman, 1950; Starfield, 1967; Troup & Hodgson, 1971;

Zaleski et al., 1973). Hallman (1950) for example, assessed the bladder capacity of 192 children by means of a water load test. He administered a large quantity of water (500-1000 ml.) to the children and urged them to refrain from voiding for as long as possible. Each child's voidings in the ensuing four to six hours were measured, the largest single measure serving as an index of bladder capacity. Hallman found that the enuretic subjects generally had smaller functional bladder capacities than the non-enuretic subjects.

In the Troup and Hodgson (1971) study, bladder capacity was gauged by measuring the amount of urine passed at each voiding, and from the frequency of micturition over a 48-hour period. No difference was found between enuretics and non-enuretics with respect to the total amount of urine passed, either during the day or at night, for the entire 48-hour period. However, among the enuretic children, the number of voidings per 24 hours was significantly higher, and the average volume of urine at each voiding therefore significantly lower. Troup and Hodgson also found that the bladder volume of enuretic children under general anaesthetic was comparable to that of normal children, so that while the enuretic children had smaller functional bladder capacities, there was no intrinsic abnormality in the bladder that prevented the accommodation of normal quantities of urine.

Increases in functional bladder capacity have been shown to correlate positively with decreased bedwetting (Starfield & Mellits, 1968). That increasing functional bladder capacity might be a useful treatment for nocturnal enuresis appears to have been suggested initially by Highnam (1953). Vincent (1964) described a mechanical device to raise the neck of the bladder, thereby improving bladder capacity, but most treatments have used increased fluid intake to achieve this end. Muellner's method was to increase the child's fluid intake and then require the child to withhold voiding for as long as possible (Muellner, 1960a, 1960b). Kimmel and Kimmel (1970)

followed this procedure but in addition,requiring that the withholding time be increased gradually by two to three minutes daily until a retention interval before voiding of 30 to 45 minutes had been reached. Positive reinforcement was given for increasing fluid intake and immediately following each successful attempt at increasing the retention interval.

Several studies have shown a reduction in bedwetting following retention control training procedures similar to that described by Kimmel and Kimmel. Three children (two aged four years and one aged 10 years) were placed on this regimen by Kimmel and Kimmel (1970). Bedwetting ceased within seven days for two of the children and within 14 days for the third child. Nighttime continence was maintained over a 12-month follow-up.

Paschalis et al. (1972) replicated the above procedure with 35 enuretic children for a 20-day treatment period. Fourteen subjects (40 percent) were reported to have reached the success criterion of seven consecutive dry nights within the treatment period, seven children (20 percent) showed significant improvement (between two and six dry nights per week) and ten (29 percent) showed no improvement. Four of the subjects were reported as cured during the collection of baseline wetting frequency. Two who did not respond initially were given intensive continuation treatment beyond the 20-day treatment period, which resulted in one achieving the dryness criterion and the other being significantly improved. No relapses occurred over a 90-day follow-up period.

Stedman (1972) used retention control training to treat a 13 year old enuretic. In contrast with the previous two studies, no reinforcement was provided following the retention interval, the subject was given total responsibility for data collection, and bladder distention discrimination was incorporated, this latter exercise requiring the subject to discriminate between weak, medium and strong cues associated with the desire to void.

Bedwetting was arrested after 12 weeks of this treatment regimen and four accidents were reported during a further three-month follow-up. P. Miller (1973) treated two children (aged 13 years and 14 years) by retention control training. Following Stedman (1972), the subjects recorded their own data and no reinforcement was provided after retention intervals. However, Miller did not use the bladder distention discrimination exercise. The two subjects became dry after 14 and 16 weeks of treatment respectively and remained dry over a seven-month follow-up for one subject and a four-month post-treatment period for the other.

Other studies however, have reported less favourable results than the above. Rocklin and Tilker (1973) randomly assigned 22 enuretic subjects aged between three years and 14 years to one of three groups, the first of which received retention control training for a 30 day period while the remaining two groups served as 'time-contingent' and 'base-rate' controls. Positive reinforcement was delivered at fixed three-hour intervals in the time-contingent group to match the total number of reinforcers given to the experimental group. In the base-rate group, the child's parents recorded bedwetting frequency. There were no statistically significant differences among the groups in terms of decreased wetting at the end of treatment. No remission rate or follow-up was reported.

Doleys and Wells (1975) demonstrated that the bladder capacity of a 42 month old girl was improved by retention control training over a 21-day period. However, bedwetting frequency was not associated with the increase in bladder capacity and dry nights occurred only after the parents began to awaken the child and place her on the toilet twice a night.

Doleys et al. (1977) applied retention control training to nine children, aged between four and 14 years, over a six week period. Forced fluids were terminated after the first three weeks of treatment. During the final three

weeks of treatment, the children were required to perform 10 trials of positive practice (i.e. practice at going to the toilet in the correct manner) at the end of each retention interval. No changes were noted in the frequency of wet nights following treatment. Doleys et al. (1977) also measured subjects' functional bladder capacity before and after treatment. Four subjects showed an increase in bladder capacity of 25 ml. or more whereas two subjects showed a decrease in bladder capacity of similar magnitude.

Harris and Purohit (1977) used a similar procedure to that of Kimmel and Kimmel (1970) for nine enuretic children (mean age = nine years) over a period of 35 days. The retention control training in this case was found to result in a significant increase in mean bladder capacity of the experimental group, however, there was no significant reduction in bedwetting frequency.

Fielding (1980) randomly assigned 45 children with night wetting only and 30 children with day and night wetting to two treatment groups: standard conditioning with a urine-alarm, and urine-alarm treatment preceded by four weeks of retention control training. The urine-alarm was far superior to retention control training in reducing bedwetting in both enuretic groups. Children who became dry in the night wetting group did not show changes in functional bladder capacity. Although changes in functional bladder capacity were seen in the day and night wetting group who became dry, changes were only noticeable after dryness had been achieved.

Overall, these data provide only weak support for retention control training as a treatment procedure for nocturnal enuresis.

The retention control training component of DBT is similar to the procedures used in the above studies, in that it involves increasing the child's fluid intake, and giving positive reinforcement for holding on to urine before voiding. However, an essential difference concerns the total amount of retention control training given. In the DBT programme, retention

control training is practised hourly, only during the initial intensive training night, whereas in the above studies the procedure was practised daily over several weeks. Thus, on balance, the overall amount of training in retention control during DBT would be considerably less than that usually given to treat bedwetting.

4.2.3. Positive Practice

The positive practice component of DBT is derived from a response-deceleration technique called overcorrection which is generally recognised as having first been described in detail by Foxx and Azrin (1972). The goal of overcorrection is to punish an undesirable behaviour, while simultaneously providing instruction in a more adaptive form of response. The rationale is to educate the subject by way of 'restitutional' procedures which require that he/she restore the disturbed situation to a vastly improved state, and massed practice of appropriate modes of behaviour in the situations in which the undesirable behaviour occurred. Comprehensive reviews by Marholin et al. (1980) and Murphy (1978) show that over the past decade numerous studies employing overcorrection have appeared in the literature, and in most of the published reports, the procedure has been highly effective in modifying behaviour. The types of target behaviour studied have included aggression, self-stimulation, self-injury, vomiting, public disrobing, stealing, nervous habits and tics, and encopresis. Overcorrection has also been used successfully as part of daytime toilet-training programmes for profoundly retarded adults (Azrin & Foxx, 1971; Foxx & Azrin, 1973a) and later, non-retarded young children (Foxx & Azrin, 1973b; Azrin & Foxx, 1974).

Overcorrection in the DBT programme consists of 'cleanliness training' (the requirement that the child change the wet sheets and deposit them in the laundry, and re-make the bed, in response to wetting accidents), and 'positive practice' (the requirement that the child practises going to the

toilet 20 times once the cleanliness training has been performed). However, since the standard urine-alarm conditioning treatment also involves cleanliness training, and this experiment was concerned with examining the training features of DBT that are additional to standard conditioning, the third identified component of DBT involved positive practice only.

The specific effects of positive practice on bedwetting have yet to be established, since this procedure has to this time only been employed for the management of bedwetting within programmes involving other training strategies. Thus, it is included as part of DBT and the regimen described earlier by Doleys et al. (1977), which combined positive practice with retention control training. However, it has been argued by several authors (e.g., Marholin et al., 1980; Murphy, 1978) that positive practice is essentially a punishment procedure. An indirect appraisal of the potential therapeutic value of positive practice may therefore be made by consideration of studies which have employed operant aversive contingencies for bedwetting. Only a handful of such studies have been reported during the past decade, a probable consequence of ethical objections to the use of punishment in therapy, given the option of highly effective treatment using the urine-alarm.

Tough et al. (1971) has reported a punishment procedure following bed-wetting accidents, combined with positive reinforcement for dry nights. This method was found to be effective in arresting enuresis in an eight year old multi-handicapped boy and his younger brother. The punishment consisted of 'dipping' the child into a tub of cold water immediately following each wetting accident. Suppression of wetting followed 22 and 16 nights of treatment for the two children respectively. One child remained dry but the other relapsed and did not respond to reinstatement of these contingencies, due, according to the authors, to inconsistencies on the part of the parents in implementing the procedure.

Nordquist (1971) employed a behaviour modification procedure to reduce non-compliant behaviour in a five year old child, and found that the child's nocturnal enuresis was arrested as well. The child was placed in a 'time-out' situation, following episodes of non-compliance and given increased parental attention for compliant behaviour. The frequency of both non-compliant behaviour and bedwetting decreased, the latter requiring 14 weeks (including two weeks return to baseline conditions) to be eliminated. No bedwetting accidents were reported during a 16-week follow-up. Nordquist claimed to have demonstrated a response-response relationship between two classes of behaviour (nocturnal enuresis and non-compliance).

Allgeier (1976) used a 'response-cost' procedure combined with fluid restriction after 6.00 p.m. to eliminate bedwetting in two sisters aged eight and 11 years. Each morning the girls reported whether or not they had wet the night before. They were penalised one tenth of their allowance if they wet the bed and one half of the allowance if they did not tell the truth, which could be determined by having the parents periodically check the state of the children's bedding. The parents were instructed to enforce strictly the record keeping but not to comment to the children whether the beds were wet or not. After the first five weeks, any incontinence was directly confronted by withdrawal of other privileges, the girls not being allowed any liquid intake after 6.00 p.m. until they had been continent for 21 days. Treatment lasted for 20 weeks, at which time the eight year old had been dry for 44 consecutive nights and her sister (11 years) had been dry for 65 nights.

Lassen and Fluet (1979) combined a token economy and punishment procedure with the urine-alarm device to treat bedwetting in a 10 year old girl. The child earned points for dry nights, points being convertible to tangible rewards according to a pre-determined schedule. Wetting

accidents were followed by a requirement that the child wash her face with cold water, void in the toilet and change the wet sheets. Bedwetting was arrested within 13 weeks.

As is the case for waking schedules, an evaluation of the effectiveness of negative reinforcement contingencies for bedwetting is limited by the small number of studies reported to have used these procedures. Furthermore, these studies have involved only one or two subjects and long-term follow-up data are generally not available. Nevertheless, it would appear that punishment for bedwetting accidents, when used in conjunction with positive reinforcement for dry nights, can have a significant effect on arresting nocturnal enuresis.

The aim of Experiment 4.1 was to examine the relative contribution of the three identified components of DBT to the procedure's overall effectiveness. This was done by comparing the effectiveness of each component, and the various combinations of these, when used in conjunction with the standard urine-alarm conditioning procedure. On the basis of the literature reviewed, it was considered that there were insufficient grounds to warrant specific predictions about the effectiveness of these components and the experiment was therefore designed to enable post hoc examination of differences between the respective groups. Nevertheless, a number of general outcomes were anticipated. Firstly, it was anticipated that the therapeutic contribution of the waking schedule should be substantial, this procedure being likely to develop ease of arousal from sleep, thereby facilitating responsiveness to the alarm. Secondly, a small gain was expected from retention control training, since previous studies do not provide strong support for this procedure and in addition, the DBT schedule incorporates only a limited amount of retention control training. Thirdly, it was

anticipated that the therapeutic gain from positive practice would also be small, since the standard conditioning procedure already provides for aversive consequences in response to bedwetting accidents, and it was thought likely that more negative reinforcement would have limited additional effect.

4.3. METHOD

Subjects

One hundred and twenty seven children, 88 males and 39 females who were outpatients of the Adelaide Children's Hospital referred for treatment of nocturnal enuresis, served as subjects. Ages ranged from five to 17 years (mean age 9 years 7 months). All subjects had a regular bedwetting frequency of at least one wet night per week. As in the previous experiments, each child had been examined by a medical practitioner in order to rule out the possibility of underlying organic pathology and none of the children was undergoing any form of enuresis-related drug or psychotherapy. All children appeared to be of normal intelligence and mental health.

Subjects included 55 children from Experiments 2.1 and 2.2. The inclusion of these subjects was valid since they were selected according to the same criteria set out above, from the same hospital population as the remaining 72 subjects, and, methods of instruction, treatment and follow-up were identical to those described below. A summary of the respective sample characteristics is presented in Table 4.1.

TABLE 4.1. Sample characteristics of subjects, comparing new subjects with those included from Experiment 2.1 and 2.2.

VARIABLES	New subjects	Subjects from Experiments 2.1 and 2.2
Number	72	55
Mean age (years and months)	9-10	9-4
Ratio males to females	47:25	41:14
Mean wet nights per week during 4-week baseline	5.6	5.5

Apparatus

The urine-alarm apparatus was the same as that described in Experiments 2.1., 2.2., 3.1.

Procedure

The various combinations of the three major components, viz. the waking schedule, retention control training, and positive practice, yielded six groups for comparison. Seventy-two subjects were selected from a waiting list in accordance with the hospital policy that older children and those waiting longest be given priority. Twelve subjects were assigned at random to one of the six groups to be treated under a component or combination of components from DBT.

Two groups from Experiments 2.1 and 2.2 were added for subsequent comparisons; i.e. 35 subjects treated by the standard conditioning procedure with close supervision and 20 subjects treated by the full DBT programme in which parents were instructed to administer the initial all-night training session in the child's home. These groups were included as representing the extreme ends of the spectrum of components which comprise DBT; i.e., standard conditioning represents the effectiveness of the urine-alarm alone and DBT represents the complete integration of the alarm with all of the training components designated above. Thus, to summarize, a total of eight treatment groups participated in the study.

For each treatment procedure, the parents were contacted in the same manner as described in previous chapters for Experiments 2.1., 2.2., and 3.1. After collecting baseline data for four weeks, the child attended the hospital with the parent. The setting up and use of the urine-alarm apparatus to be used in all subsequent treatment groups was demonstrated by the author. The respective procedures were also described in detail and written instructions (see Appendices 4.1 to 4.6) were supplied for home reference,

together with another calendar to continue recording bedwets.

The need to keep regular contact during treatment was emphasized and a specific time was arranged for the parent or child to call weekly and report on progress. Following the initial instruction, all treatment was conducted at home by the parents. Treatment continued until the child achieved 14 consecutive dry nights, at which time the apparatus was returned.

The eight treatment groups were:

Group 1: Standard Conditioning (n = 35).

Subjects were treated by the standard conditioning (with supervision) procedure, as described in Chapter 2 for Experiments 2.1 and 2.2.

Group 2: Standard Conditioning plus Waking Schedule (n = 12).

Treatment involved the urine-alarm device, in conjunction with the night-time awakening schedule from DBT. This procedure was as follows: Throughout the first night the child was woken each hour using minimal prompts, and directed to void in the toilet. Immediately following urination, the child was praised for having kept the sheets dry and encouraged to keep them dry during the next hour. The following night the child was woken once - about three hours after falling asleep - and again directed to the toilet. After each dry night the parents awakened the child for toileting a half-hour earlier on the following night, each time taking the opportunity to praise the child for maintaining a dry bed. Night-time awakenings were discontinued when the interval between going to sleep and a scheduled awakening was one hour. Subsequently, if two bedwettings occurred within one week, the waking schedule was re-introduced, beginning with the 3 hour awakening and decreasing the interval between sleep and awakening by a half hour following each dry night. This regimen continued until the child recorded 14 consecutive dry nights. No other features of the DBT programme were employed.

Group 3: Standard Conditioning plus Retention Control Training (n = 12).

The urine-alarm apparatus was set up and bedwetting accidents manage in the same manner as for Group 1. However, children were given a large drink of water or soft drink (at least 500 ml.) immediately before retiring, according to the DBT schedule. Every hour thereafter the child was woken by the parent and directed to the toilet. At the toilet door the child was asked whether he/she could inhibit urination for another hour and, if so, was praised for bladder control before returning to bed. If the child could not inhibit urination for an hour, the parent encouraged him/her to hold on for a few minutes, after which the child was praised for control and allowed to void. Immediately following voiding the child was praised for correct toileting and allowed to return to bed. At the bedside the child's attention was drawn to the dry sheets, was again praised for this, and encouraged to keep them dry. Finally the child was given another large drink and allowed to return to sleep. This hourly procedure was discontinued after the first night.

Group 4: Standard Conditioning plus Positive Practice (n = 12).

The urine-alarm apparatus was set up in the usual manner. About a half-hour before the child's usual bed-time, the child was required to perform the positive practice component of DBT. For this, the child lay in bed with the lights off and silently counted to 50, at which time he/she went to the toilet and attempted to urinate. This procedure was repeated until 20 such trips had been made. Children younger than 10 years counted to 20 and repeated the procedure 10 times. The parent remained out of the room and counted the trips. The child then retired to bed.

Following the detection of every bedwetting accident the child was reprimanded and sent to the toilet to finish voiding. Upon returning to the

bed-side the child was required to change pyjamas, remove the wet sheets, dry the detector pad and deposit the soiled linen in the laundry. The child then had to re-make the bed with clean sheets and re-set the alarm. Before returning to bed the child was again required to perform the 20 positive practice trials. On the night following an accident the child was required to perform positive practice again before going to bed.

Group 5: Standard Conditioning plus Waking and Retention Control Training (n = 12).

Children were treated by a combination of the procedures described for Groups 2 and 3.

Group 6: Standard Conditioning plus Waking, Positive Practice (n = 12).

Procedures for Groups 2 and 4 were combined. The treatment therefore involved the complete DBT programme, with the exception that no retention control training was given.

Group 7: Standard Conditioning plus Retention Control Training, Positive Practice (n = 12).

Treatment procedures for Groups 3 and 4 were combined.

Group 8: DBT (n = 12).

The full DBT procedure was administered by the child's parents, as described for Experiment 2.2 in Chapter 2.

4.4. RESULTS

A summary of the data for all subjects is presented in Appendix 4.7.

Table 4.2 shows the number of children in each group who achieved the dryness criterion, together with the mean number of wet nights during the 20-week experimental period. Data from the eight groups at the end of

TABLE 4.2. Numbers of children (N) in the eight different treatment groups, those cases achieving dryness criterion, and the mean number of wet nights during the 20-week treatment period.

GROUP	N	Number of cases becoming dry	Mean number of wet nights during treatment
1. Standard conditioning	35	28*	27
2. Standard conditioning plus waking schedule	12	12	13
3. Standard conditioning plus retention control training	12	11	24
4. Standard conditioning plus positive practice	12	10	23
5. Standard conditioning plus waking and retention control training	12	12	14
6. Standard conditioning plus waking, positive practice	12	12	10
7. Standard conditioning plus retention control training, positive practice	12	11	21
8. DBT	20	20	11

*A further three children achieved the success criterion within a few weeks after the 20-week experimental period expired, bringing the eventual total number of initial cures in this group to 31.

20 weeks of treatment were examined by one-way analysis of variance.* Groups differed significantly with respect to the number of wet nights [$F(7,119) = 2.39$, $p < .05$]. Duncan post hoc comparisons established that the standard conditioning group resulted in significantly more wet nights than all other groups ($p < .05$). Group 6 (Waking and Positive Practice) and Group 8 (DBT) resulted in significantly fewer wet nights than the other groups ($p < 0.05$). No significant differences were found between any of the other groups. [See Appendix 4.9.]

All four groups which had the waking schedule as part of their treatment regimen responded more quickly than those groups without the waking schedule. Table 4.3 summarizes the frequency distribution of the number of wet nights

TABLE 4.3. Numbers of subjects categorized according to the number of wet nights during treatment and whether treatment included the waking schedule or not.

Number of wet nights during treatment	Treatments including the waking schedule	Treatments excluding the waking schedule	Totals
0-24	53	51	104 (82%)
25-49	3	7	10 (8%)
50-74	0	9	9 (7%)
75-99	0	4	4 (3%)

*Statistical examination of the difference between groups in the previous experiments involved planned comparisons within convariate analysis of variance (with baseline wetting frequency as the covariate) using the SPSS programme MANOVA (Cohen et al., 1977). However, the MANOVA programme does not permit 'a posterior' contrasts and a modified method of analysis was devised for the data in this experiment. In order to control for the effects of individual differences in baseline wetting frequency, the dependent variable (number of wet nights during treatment) was adjusted by (i) regression of baseline against wets during treatment, and (ii) establishment of a new dependent variable according to the formula; New dependent variable = Wets during treatment - (regression slope x baseline) [see Appendix 4.8]. The new values were then subjected to one-way analysis of variance followed by a posteriori contrasts using the SPSS programmes ONEWAY and DUNCAN respectively (Nie et al., 1975).

for subjects within groups for which treatment included or excluded the waking schedule. It can be seen from Table 4.3 that all 56 subjects in groups which included the waking schedule had less than 50 wet nights, whereas 13 out of 71 subjects in the groups which did not include the waking schedule had between 50 and 99 wet nights. Chi-squared analysis established that the difference between groups including and excluding the waking schedule was statistically significant ($X^2 = 13.04$; df = 3, $p < 0.01$). Thus, the data highlighted the effectiveness of the waking schedule as an important single component of the DBT schedule, in addition to the urine-alarm. However, it can also be seen from Tables 4.2 and 4.3 that all treatment regimes were effective in arresting bedwetting for the vast majority of children. Ninety percent of subjects had fewer than 50 wet nights during treatment, irrespective of the particular form of treatment. The remaining 10 percent who had more than 50 wet nights all came from groups without the waking schedule. Thus, the significance of the waking schedule, appeared to be that it arrested the bedwetting of subjects who were otherwise slow to respond to the forms of treatment which did not contain the waking component.

A weak association was found between baseline wetting frequency and the number of wet nights recorded during treatment, for all groups combined (Pearson r = 0.30; df = 125; $p < 0.001$). However, although statistically significant, this correlation was too small for baseline wetting frequency to be regarded as a reliable predictor of response to treatment. It was apparent that many subjects who were 'heavy' bedwetters during baseline (i.e. wet every night) responded rapidly to treatment; conversely many 'light' wetters during baseline responded slowly to treatment.

4.5. DISCUSSION

Results suggested that the effectiveness of the standard conditioning (alarm-only) treatment of bedwetting could be increased to a slight degree by the addition of any one of the three major components of DBT (i.e. the waking schedule; retention control training; positive practice). However, the reduction in bedwetting frequency following the addition to the alarm-only treatment of any one of these components on its own was not sufficient to reach statistical significance. In general, the effect of the components was cumulative - the more components added to the alarm-only procedure, the greater the therapeutic response. The combination of the waking schedule and positive practice with the alarm, and the combination of all three components with the alarm (i.e. the full DBT procedure) did result in significantly fewer wet nights during treatment than the standard conditioning procedure. While these differences were sufficient to achieve statistical significance, the advantages of the full DBT programme, or a procedure that combines the waking schedule and positive practice with the urine-alarm, do not appear to be marked from a practical point of view. The standard conditioning method ultimately resulted in 31 out of 35 children successfully reaching the dryness criterion, compared with all 32 children becoming dry following the above two procedures. Thus, standard conditioning was almost as effective in achieving complete arrest of bed-wetting, the primary aim of treatment. It is, moreover, considerably less complicated and demanding for both therapist and patient than the other two procedures.

The advantage of DBT or the combination of waking, positive practice and the alarm compared with standard conditioning, must be weighed against the relative practical difficulties associated with the administration of these treatment procedures. This issue is discussed further in Chapter 6, Section 6.2.

The most effective single component of DBT appeared to be the waking schedule. Several explanations for the role of the waking schedule can be offered. Firstly, it is possible that waking the child with minimal prompts on a regular basis, increases ease of arousability from sleep, thereby facilitating the development of nocturnal bladder control. The employment of an independent measure of arousability from sleep in future studies would help clarify the role of this aspect of DBT. Additionally, data on the number of self-initiated awakenings and associated wet or dry nights would be valuable.

Secondly, if one accepts that the waking schedule does have a general effect by increasing the child's readiness to rouse from sleep, it is possible that this would facilitate waking in response to the alarm. Several authors have noted an association between poor response to conditioning treatment and the child's failure to awaken to the alarm (Browning, 1967; Taylor & Turner, 1975; Turner et al., 1970; White, 1968; Young & Morgan, 1973). Indeed, a variety of strategies have been employed to overcome this problem, such as the use of central nervous system stimulant drugs to raise the level of sleep (Young & Turner, 1965), pairing the alarm with faradic stimulation (Crosby, 1950), increasing the intensity of the alarm (Finley & Wansley, 1977), and operantly conditioning subjects to awaken to the alarm as a pre-requisite to conditioning (Browning, 1967).

However, the necessity for the child to awaken in response to the alarm for conditioning to occur has been rejected by Lovibond and Coote (1970). These authors have observed that in any series of enuretics treated by the standard conditioning method, there are some who never at any stage waken to urinate but go straight to sleeping dry. This observation has also been made by Taylor and Turner (1975). Furthermore, Lovibond (1964) has successfully treated some bedwetters by a brief auditory stimulus without the child ever being awakened by the stimulus.

While waking in response to the alarm is not essential to the success of the conditioning procedure, presumably a certain degree of cortical arousal by the alarm is necessary for conditioning to occur. To the extent that the DBT waking schedule does lower the enuretic child's sleep arousal threshold, it may facilitate responsiveness to the alarm.

A third possible reason for the effectiveness of the waking schedule may be that it creates more opportunities for positive reinforcement as a consequence of maintaining a dry bed. Positive reinforcement is given at the time of each scheduled awakening when the child is required to feel the sheets and praised for keeping them dry. In addition, requiring the child to empty his bladder at each awakening increases the probability of his remaining dry throughout the night, thereby receiving further reinforcement on the following morning.

The effect of the waking schedule appeared to be that it prevented treatment from becoming prolonged. Slow responders could not be predicted reliably on the basis of baseline wetting frequency. In view of the results of this experiment, however, it is speculated that a 'common denominator' of the slow responders could be an elevated arousal threshold from sleep.

It was not possible to isolate retention control training completely from the other components, since so as to provide this training, subjects were woken hourly during the initial night. In addition, the specific effects of retention control training are not separable from those of positive reinforcement which was delivered following each attempt by the child to inhibit urination. Thus, the slight benefits noted in this group might have been due to the effects of a brief awakening schedule and positive reinforcement, rather than retention control training.

Notwithstanding these problems, in the present study, the addition of retention control training to the standard urine-alarm procedure, as

anticipated,resulted in only a very slight reduction in bedwetting frequency. A possible reason for this result is that the amount of retention control training given within the DBT schedule was insufficient to effect a change in bladder control. Studies which have shown retention control training to be effective have all involved training over a much longer period of time. However, it is also possible that even over longer periods, retention control training may be of limited therapeutic value since an overall appraisal of the data from studies using retention control training does not provide strong support for this procedure's effectiveness in arresting bedwetting.

Positive practice, according to Azrin et al. (1974) was included into the DBT programme because it has the dual effect of punishment for wet nights while simultaneously being 'educative' in the sense that it is said to strengthen the appropriate toileting response by 'massed practice'. There are at least two possible explanations for the anticipated finding that this procedure did not singly add significantly to the effectiveness of the standard urine-alarm procedure. Firstly, it is doubtful whether positive practice has the same educative role in the treatment of bedwetting as it has in other behaviour modification programmes. In the daytime toilet training programmes developed by Azrin and his colleagues, for example, the subjects had not previously acquired the response of using the toilet correctly for voiding, whereas in the case of the nocturnally enuretic children treated in the present series of studies, the appropriate use of the toilet was already part of their behavioural repertoires. In addition, the response to be learned in order to achieve nocturnal continence is not so much going to the toilet during the night, but rather it is acquiring the ability to hold on to urine sufficiently in order to sleep dry through the night. Thus, in the case of nocturnal enuresis, the educative function of positive practice may be pointless since it is aimed at teaching children a skill they already have, and it is not one they need to maintain a dry bed at night.

Secondly, it is always possible that the positive practice exercise is insufficiently aversive and that more than 20 trials are necessary to effect significant improvement in nocturnal bladder control. However, this seems unlikely and it is very doubtful whether more stringent requirements in response to bedwetting would be tolerated by families. It was clear from subsequent discussions with parents and children that they found positive practice to be the most tedious and demanding component of treatment. Negative reactions to this requirement were common and were similar to those encountered during Experiments 2.2 and 3.1. It is noteworthy that difficulties associated with the administration of similar procedures outlined by Azrin and Foxx (1974) for daytime toilet-training of young children have been reported by Butler (1976) and Matson (1975). The standard urine-alarm conditioning method also involves aversive consequences for bedwetting such as the noxious sound of the alarm, and being woken during the night and required to change wet sheets and pyjamas. In the light of results from the present study, it would appear that the addition of further negative reinforcement, by way of positive practice, to that already provided in standard conditioning, is of very limited therapeutic value.

In conclusion, results from this study suggest that a large proportion of the DBT schedule, namely retention control training, positive practice and cleanliness training can be eliminated from the programme without sacrificing much of its overall effectiveness. A combination of the waking schedule with the urine-alarm was almost as effective in arresting bedwetting as the complete DBT programme. For practical purposes, this finding is of considerable advantage because of the demands of the full DBT programme. The waking schedule itself presents additional demands to the standard conditioning method but this is only substantial on the initial training night when the child is awakened hourly for toileting. Following the intensive

all-night session, the child is awakened once only during the night and most parents and children appear to cope with this requirement. Indeed, prior to treatment most parents reported that they had previously employed the practice of regular lifting during the night in an attempt to manage the child's bedwetting.

The relative success of the waking schedule combined with the alarm points to a possible relationship between 'deep-sleep' and bedwetting. While the topic of depth of sleep and enuresis has attracted considerable research to date, it is felt that this is still a fruitful direction for further study. This issue is pursued in Chapter 6, Section 6.4.1.

CHAPTER 5.

A TWO YEAR FOLLOW-UP OF BEDWETTERS TREATED BY DRY-BED TRAINING AND STANDARD CONDITIONING

5.1. EXPERIMENT 5.1.

5.2. INTRODUCTION

This study was conducted in order to examine the outcome of subjects treated by standard conditioning and DBT in Experiments 2.1 and 2.2 at two years follow-up. A review of previous research into the long-term treatment effects of these procedures is presented below.

5.2.1. Long-term effects of standard conditioning treatment

While the standard conditioning method is a well established thereapeutic strategy for arresting nocturnal enuresis in children, the high probability of subsequent relapse remains a fundamental shortcoming of this procedure. Doleys' (1977) review of 12 studies since 1966 notes that relapse rates following successful initial treatment by standard conditioning have ranged from 13 percent (Young & Turner, 1965) to 69 percent (Taylor & Turner, 1975) with the average relapse rate from the 12 studies being in the order of 40 percent. It is necessary to outline the reasons for the wide variability of reported relapse rates.

(i) There is no general consensus as to what constitutes a relapse. Young and Morgan (1972b), for example, have used the criterion of a return to bedwetting sufficient to cause the parents to seek re-treatment, whereas other definitions include more than one wet per two weeks during follow-up, or one wet in the final week of follow-up (Collins, 1973), three or more wet nights per week (Finley et al., 1973), one wet in each of two consecutive two-week periods during follow-up (Turner et al., 1970), and the occurrence

of any renewed wetting (Novick, 1966). Lovibond and Coote (1970) suggested that relapse should be defined as a renewal of wetting with a frequency greater than once per week. This definition was based on follow-up after two years which revealed that when bedwetting recurs, it is usually clear-cut. Thus, the majority of children either experience only very occasional accidents or resume wetting more than once per week. In the present author's opinion, the definition proposed by Lovibond and Coote is satisfactory because for renewed bedwetting to be regarded as a relapse it should be regular and of sufficient frequency to constitute a management problem.

(ii) The methods of collecting follow-up data in the studies reviewed by Doleys varied from telephone contact (Novick, 1966), mail (Young & Morgan, 1972b; Young & Turner, 1965), and return visits to the therapist (Dische, 1971). Allied to the different methods of collecting data, was variation in the percentage of subjects who were followed up, and indeed these figures were not always given. De Leon and Sacks (1972) reported on 11 of 21 subjects (i.e. 52 percent) whose bedwetting was arrested during treatment. Novick indicated he was able to follow-up 26 of 32 successful patients (i.e. 80 percent). Thus, since incidence of relapse may on occasions be derived on the basis of incomplete follow-up data, the figures quoted in some reports may provide an over-optimistic representation of the outcome of treatment. In the present author's experience, when attempts at mail and/or telephone contact have failed to elicit a response, a home visit is necessary in order to collect sufficient follow-up data.

(iii) In Doleys' review, follow-up periods ranged from three months (Finley et al., 1973) to three years (Turner et al., 1970). Lovibond (1964) reported a correlation of 0.7 between relapse and the duration of follow-up with longer follow-ups being associated with higher rates of relapse. Dische (1973) pointed out that if a child remained dry for six months then

the probability of relapse was greatly reduced although some relapses do occur as long as two years after treatment. For this reason it was suggested that a two year follow-up would be necessary to declare a child "cured" (Dische, 1971).

5.2.2. Prediction of relapse

Various attempts have been made to develop predictors of response to conditioning therapy including subsequent relapse. Lovibond (1964) and Young and Morgan (1973) have between them examined a variety of clinical and treatment variables among successfully treated subjects but found none to be significantly associated with probability of relapse. Lovibond (1964) did, however, suggest the possibility of a positive correlation between higher relapse and faster conditioning. Evidence supporting this claim is found in studies by Young and Turner (1965) and Turner and Young (1966). In the Young and Turner (1965) study, central nervous system stimulants (Methedrine and Dexedrine) were administered during conditioning treatment and results showed that the initial arrest of bedwetting occurred significantly earlier in the drugs plus conditioning groups than conditioning alone. A long-term follow-up by Turner and Young (1966) revealed that the frequency of relapse was significantly higher for the subjects to whom Dexedrine had been administered, compared with the conditioning-alone subjects. Whether the higher relapse rate was a function of the use of the drug or the facilitated conditioning is not clear but Turner and Young (1965) noted the parallel between their own results and those of Lovibond (1964).

Lovibond and Coote (1970) found that if the child wet the bed frequently, and particularly if he also suffered from diurnal urgency and/or frequency of micturition, he was more prone to relapse. Support for this finding has been provided by Fielding (1980) who noted that improvement from nocturnal wetting associated with standard conditioning was slower

among children who had diurnal symptoms. In addition, there was some indication that these children relapsed earlier than children with no day-time problems (Fielding, 1980).

5.2.3. Countermeasures to relapse

Countermeasures to relapse have generally followed two strategies; an intermittent schedule of alarm presentation (e.g. an alarm following 50 percent or 70 percent of bedwets on a variable ratio schedule) and over-learning (i.e. increasing the child's fluid intake towards the end of treatment).

(i) Intermittent reinforcement

In accordance with his theoretical formulation of the standard conditioning treatment following an avoidance learning paradigm, as opposed to classical conditioning, Lovibond (1964) proposed that an intermittent reinforcement procedure be employed to reduce the likelihood of the extinction of thereapeutic responses, which constitute relapse. Some studies (Lovibond, 1963b; Taylor & Turner, 1975; Turner et al., 1970) have reported a nonsignificant trend towards reduced relapse following an intermittent reinforcement schedule. Others, (Abelew, 1972; Finley et al., 1977; Finley et al., 1973) have shown intermittent procedures to produce significantly fewer relapses while at the same time being as effective as continuous reinforcement (standard conditioning) in arresting bedwetting. For example, Finley et al. (1973) found 4 out of 9 subjects successfully treated by continuous alarm reinforcement subsequently relapsed compared with 1 out of 8 treated by an intermittent schedule. Binomial test analysis revealed that the relapse rate for these two groups differed significantly ($p = .05$). With larger subject numbers ($n = 80$), Finley et al. (1977) found that the relapse rate following intermittent reinforcement to be 25 percent - significantly lower than the average relapse of 47 percent from eight studies between 1966 and 1976. Finley et al. (1973, 1977) attributed some part of

their better results to a higher intermittent schedule of alarm presentation (70 percent) compared with 50 percent used by Turner et al. (1970) and Taylor and Turner (1975). They also used a more sophisticated programmable alarm device which permitted the reinforcement schedule to be linked to individual wetting accidents rather than a whole night being designated as a 'trial'.

(ii) Overlearning

The procedure adopted by Young and Morgan (1972c) to ensure overlearning is to request patients to drink a maximum of two pints of extra fluid during the last hour before retiring for the night, once the initial success criterion of 14 consecutive dry nights has been achieved. Taylor and Turner (1975) requested a similar fluid increase after seven consecutive dry nights.

According to Morgan (1978) there are probably several principles behind overlearning. Firstly, it places increased demands upon newly acquired responses underlying nocturnal enuresis and thus either demonstrates a "margin of error" in the learning already acquired (when no further wets occur) or where wetting is renewed, affords further learning trials. Secondly, overlearning may increase the child's confidence to control the bladder at night through successively testing out this ability (Taylor & Turner, 1965), although simply extending the length of cure criterion without increasing fluids, which might also be seen as increasing confidence, does not seem to be as effective on its own (Lovibond & Coote, 1970; Taylor & Turner, 1975). Thirdly, overlearning possibly increases functional bladder capacity, which some authors (e.g. Zaleski et al., 1973) have suggested is a central factor in successful treatment of bedwetting, and this may in turn reduce the likelihood of subsequent relapse.

Morgan (1978) reviewed eight studies involving either intermittent reinforcement schedules and/or overlearning. He concluded that both

procedures are superior to standard conditioning with respect to reducing subsequent relapse and that as a single procedure overlearning is superior to intermittent reinforcement. However, both intermittent reinforcement and overlearning increase time to attain the dryness criterion. Finley et al. (1973) claimed that the number of days to achieve dryness was not significantly longer with intermittent as opposed to continuous reinforcement, although the trend was clearly in the direction of increased acquisition time for the intermittent schedule. The only study to directly compare the standard conditioning with intermittent reinforcement and overlearning (Taylor & Turner, 1975) showed a clear difference in acquisition time, the durations of treatment being 68, 113 and 86 days respectively for each of these procedures.

Thus, intermittent reinforcement and overlearning may decrease relapse but at the sacrifice of rapid treatment. This does not solve the problem in a large enuresis clinic when the time spent in treatment (and consequent availability of alarms) is the critical factor. In addition, there are no apparent advantages over standard conditioning from intermittent reinforcement or overlearning in the initial arrest rate. From the results of Finley et al. (1973), intermittent reinforcement and overlearning would appear, if anything, to be slightly less effective in achieving initial arrest of bedwetting.

5.2.4. Long-term effects of DBT

It has been demonstrated in Experiment 2.2 that DBT is more effective in achieving the initial arrest of bedwetting than the standard conditioning method. There is some reason to suggest that DBT might also result in a lower rate of subsequent relapse than standard conditioning since the various training features of DBT, in addition to the urine-alarm, could operate in combination with one another to facilitate a more permanent learned response (i.e. nocturnal bladder control).

In Experiment 4.1, three major components of DBT were identified - the waking schedule, retention control training, and positive practice. The waking schedule according to Azrin et al. (1974) was designed to increase the enuretic child's readiness to rouse from sleep. It is plausible that the development of this ability would increase the probability of nocturnal bladder control being maintained. Secondly, while the evidence relating to the long-term effects of retention control training is limited by the small number of subjects studied and short follow-up periods, studies by Doleys and Wells (1975), Kimmel and Kimmel (1970), Paschalis, Kimmel and Kimmel (1972), P. Miller (1973) and Stedman (1972) suggest that retention control training where successful in arresting bedwetting could result in a lower relapse rate than that commonly reported following standard conditioning. For example, Kimmel and Kimmel (1970) successfully treated three bedwetters by retention control training and reported that all three subjects remained dry over a 12-month follow-up period. P. Miller (1973) treated two children by the same method, reporting that nocturnal continence was maintained after seven and four months respectively. In the Pashalis et al. (1972) study, 14 out of 36 subjects reached the dryness criterion and no relapses were recorded during a three-month follow-up. Doleys and Wells (1975) successfully treated one child with a combination of retention control training and night-time awakenings after 50 days and reported no further accidents during a 14-week follow-up period. The only subject in the study by Stedman (1972) achieved dryness following retention control training and then recorded four wets in the next three months. Some support for the notion that retention control training might lead to a more permanent learned response can be found in a study by Fielding (1980) which employed this procedure in conjunction with the standard conditioning method. Fielding (1980) showed that of 14 children who were successfully treated by standard conditioning

alone, eight relapsed within a 12-month follow-up period compared with four relapses out of 11 successful initial treatments using retention control training in conjunction with the urine-alarm device.

The third component of DBT, namely positive practice, was claimed by Azrin et al. (1974) to help develop independent nighttime toileting behaviour. It is possible therefore that this training strategy could also contribute towards the maintenance of a dry bed at night.

To date, data on the long-term effects of DBT are limited to only a small number of studies. In addition, some of these studies have relatively short follow-up periods (up to six months) and have employed inadequate follow-up procedures, such as not contacting the parents in any way, leaving it to the parents to instigate further treatment.

Azrin et al. (1974) reported that none of the 24 children successfully treated by DBT relapsed to their pre-training level of bedwetting during a six-month follow-up period. However, following the initial arrest of bedwetting, there were seven instances (29 percent) in which children wet twice within a week thereby necessitating reinstatement of treatment. In this study the method of following up relapses was not reported.

Bollard and Woodroffe (1977) defined relapse as more than one wet bed per week after attainment of the initial dryness criterion (14 consecutive dry nights) and reported two relapses from 14 subjects (14 percent) successfully treated by DBT. However, in this study it was left to the parents to contact the authors regarding renewed bedwetting, so that the reported relapse rate may have been over-optimistic. Nettelbeck and Langeluddecke (1979) employed the same method of follow-up and criterion of relapse as that of Bollard and Woodroffe (1977) and they reported no relapses from seven children successfully treated by DBT during a two month follow-up period. In Experiment 2.2 of this thesis, relapse was defined as

more than one bed-wet per week over a one-month period. Subjects were contacted at three, six and 12 month intervals following treatment by DBT. Fifteen cases of relapse were detected from among 60 children (25 percent) who had successfully attained the dryness criterion at 12-month follow-up. Relapse was detected in nine children from 29 (31 percent) successfully treated by DBT in Experiment 4.1 at six-month follow-up, this study having employed the same definition of relapse and follow-up procedure as was used in Experiment 2.2. Only Williams et al. (1978) have reported a two-year follow-up of enuretic children treated by DBT. Of the eight children who achieved continence and were able to be followed up, five were found to average less than one bed-wetting per month. Of the other three, two were wetting four times per month and one at a rate of about six times per month. In the four cases not reaching the initial dryness criterion, a mean of 14.5 wet nights per month was reported.

The data described above do not provide strong support for the suggestion that DBT may result in a lower relapse rate than standard conditioning. However, in the light of the small number of studies reported, the relatively short follow-up periods in most instances and the variation in follow-up procedures, it is not possible to accurately assess the long-term effects of DBT other than to say that, as with standard conditioning, relapse appears to be a significant problem associated with DBT. The primary aim of the present study was therefore to examine the two year follow-up data on subjects in Experiments 2.1 and 2.2 of this thesis, directly comparing those children treated by DBT and those treated by the standard conditioning procedure. A second aim of the study was to examine possible predictors of relapse. A third aim was to provide data on the re-treatment of children who had relapsed.

5.3. METHOD

Subjects

Subjects were 95 children (68 males and 27 females) selected from Experiments 2.1 and 2.2. The sample was comprised of the 60 children treated individually by DBT with the adjunct of an enuresis alarm and the 35 children treated by the standard conditioning procedure with close supervision. Ages ranged from five to 15 years (mean = 9 years 3 months). Further details of the subjects, initial interview at the Hospital, placement on the waiting list for treatment and criteria for selection from the waiting list are described in Experiments 2.1 and 2.2.

Apparatus

The urine-sensitive recessed electrode pad and alarm device was that used in Experiments 2.1 and 2.2.

Procedure

The follow-up data from the 95 children were collected by contacting each child's parents at three month, six month, 12 month and 24 month intervals after the child had successfully reached the dryness criterion. This was done by telephone where possible, those families without a telephone being sent a questionnaire with a return paid envelope. If either of these procedures failed to elicit a response, a home visit was made. In addition, the parents were instructed at the time of each child's discharge from treatment to contact the author if relapse occurred in the interval between scheduled follow-ups. In this way follow-up data were collected in 89 cases (94 percent). Of the remainder, four had moved overseas to live and two had changed address within Australia and could not be traced.

In all cases the parents were asked to state whether the child's current bedwetting frequency was (a) practically every night; (b) more

than once per week on average; (c) just occasional accidents; (d) not at all. The criterion for relapse was defined as a renewal of bedwetting with a frequency of greater than once per week over a one month period.

When a relapse was detected, parents were offered re-treatment. If they accepted, they were asked to resume daily recording of the child's bedwetting frequency for a four week period before the urine alarm was again introduced. Children who had undergone DBT resumed this procedure at the "post-training supervision" phase of treatment, i.e. the night immediately following the intensive all-night training session. Children treated by standard conditioning repeated this procedure once an alarm became available. For both procedures, subjects were followed-up weekly until the success criterion of 14 consecutive dry nights had again been reached. Subsequent relapses were treated in the same way i.e. collection of a four week baseline of wetting frequency and resumption of the original treatment programme until again dry.

The data from the 95 subjects were divided into two groups for analysis, viz. DBT (n = 60) and Standard conditioning (n = 35).

Group 1: DBT

This group comprised the three groups of 20 children treated by DBT with an alarm in Experiment 2.2. In this study the treatment had varied slightly for each group in that the initial intensive training night was administered by the child's parents at home, or by a professional trainer in the child's home, or by a professional trainer in hospital. The subsequent training was conducted at home by the parents and followed up individually by the author. The data were combined into a composite group for several reasons. Firstly, the subjects in each experiment were selected according to the same criteria and from the same hospital population. Secondly, while

the administration of the initial treatment varied, all children underwent the complete DBT programme with the adjunct of an alarm. Thirdly, the outcome of the DBT groups was very similar in respect of the initial arrest of bed-wetting. All 60 subjects treated by DBT attained the dryness criterion. A summary of these characteristics is presented in Table 5.1.

TABLE 5.1. Summary of three groups treated by DBT under varying conditions of initial training, from Experiment 2.2.

Variables	DBT by parent at home	DBT by therapist at home	DBT by therapist in hospital
Number of subjects	20	20	20
Mean age (years and months)	9-7	9-3	8-11
Ratio males to females	16:4	14:6	13:7
Mean bedwetting frequency per week during 4-week baseline	5.5	5.6	5.3
Number reaching dryness criterion	20	20	20
Mean number of wet nights	11	14	15

Group 2: Standard Conditioning

This group of 35 comprised the 15 children treated by standard conditioning with close supervision in Experiment 2.1 and the 20 children treated in the same manner in Experiment 2.2. The data were combined since the sample characteristics were very similar, the treatment procedures in this case were identical and the outcome of standard conditioning treatment was very similar in Experiments 2.1 and 2.2.

It can be seen from Table 5.2 that from Experiments 2.1 and 2.2, 31 out of 35 children treated by standard conditioning attained the dryness criterion. The failures to reach dryness have been excluded from subsequent analysis of relapse.

TABLE 5.2. Summary of two groups treated by standard conditioning in Experiments 2.1 and 2.2.

Variables	Experiment 2.1	Experiment 2.2
Number of subjects	15	20
Mean age (years and months)	9-10	8-8
Ratio males to females	11:4	14:6
Mean bedwetting frequency per week during 4-week baseline	5.1	5.8
Number reaching dryness criterion	13*	18*
Mean number of wet nights	29*	28*

* These figures include one child in Experiment 2.1 and two children in Experiment 2.2 who achieved the dryness criterion while still using the alarm, soon after the 20-week experimental period expired.

5.4. RESULTS

5.4.1. Comparison of relapse rates

Using the definition of relapse as more than one wet bed per week over a four-week period, the total numbers of children who relapsed in each group at three, six, 12 and 24 months follow-up are summarized in Table 5.3.

TABLE 5.3. The numbers of children (with percentages in parenthesis) who relapsed after attaining the dryness criterion for both groups at 3, 6, 12 and 24 months follow-up, compared with those remaining dry.

Time of follow-up	Relapsed		Remained Dry	
	DBT	Standard Conditioning	DBT	Standard Conditioning
3 months	6(10)	6(19)	53(90)	25(81)
6 months	13(22)	7(23)	45(78)	22(77)
12 months	15(26)	10(34)	43(74)	19(66)
24 months	22(39)	12(41)	34(61)	17(59)

Fifty-six out of the sixty children who had been successfully treated by DBT were able to be followed-up over a two year period. It was found that 22 (39 percent) of these children had relapsed during the two year follow-up. Twenty-nine out of the 31 children who had been successfully treated by the standard conditioning method were able to be followed-up over two years. Twelve children (41 percent) in this group relapsed during the same follow-up period. This difference was not statistically significant ($X^2 = 0.04$, df 1, $p > 0.05$).

5.4.2. Comparison of children who relapsed with those who remained dry

Children who relapsed during the two-year follow-up were compared with those who remained dry for both groups in respect of bedwetting frequency prior to treatment and the acquisition of initial dryness following treatment. A summary of the data for these children appears in Appendix 5.2. Figure 5.1 shows the mean number of wet nights per week for each group during four weeks of baseline and twenty weeks of subsequent treatment.

It can be seen from Figure 5.1 that for both treatment groups (DBT and standard conditioning), children who subsequently relapsed wet the bed more frequently on average during the baseline period than children who remained dry. However, this difference was not statistically significant ($t = 1.75$, $df = 83$, $p > 0.05$).

Children who relapsed differed little from those who remained dry following the same treatment procedure, in respect of the initial acquisition of dryness. In the DBT group, children who subsequently relapsed took an average of 51 days and 14 bedwets before reaching the initial dryness criterion, compared with 45 days and 12 bedwets for those who did not relapse. In the standard conditioning group, children who subsequently relapsed took an average of 70 days and 19 bedwets to reach the dryness criterion, compared with 71 days and 21 bedwets for those who did not relapse. A summary of these results is presented in Table 5.4.

FIGURE 5.1.

Mean wet nights per week for four groups throughout four weeks of baseline and twenty weeks of initial treatment.

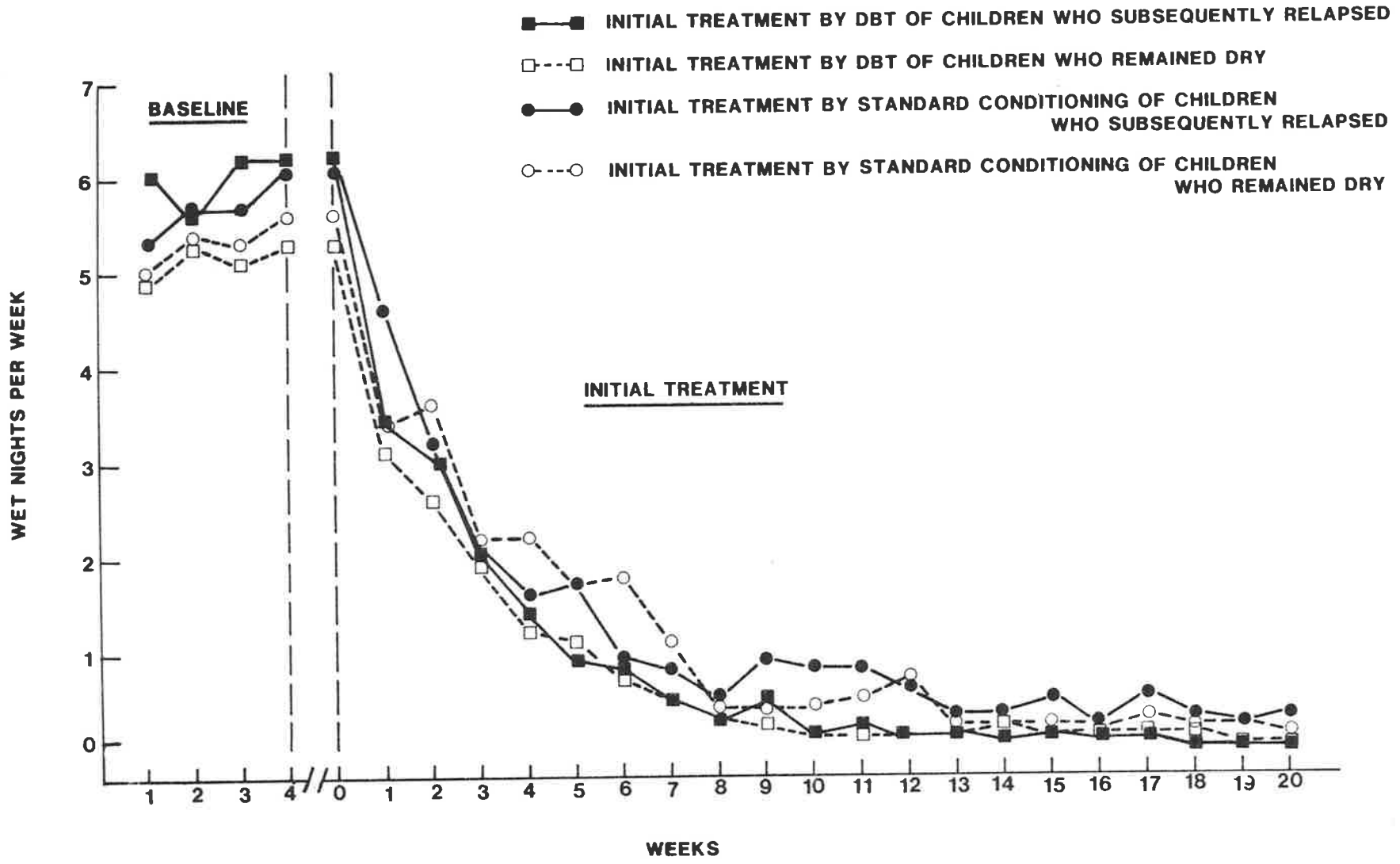

INITIAL TREATMENT BY DBT OF CHILDREN WHO SUBSEQUENTLY RELAPSED
INITIAL TREATMENT BY DBT OF CHILDREN WHO REMAINED DRY
INITIAL TREATMENT BY STANDARD CONDITIONING OF CHILDREN WHO SUBSEQUENTLY RELAPSED
INITIAL TREATMENT BY STANDARD CONDITIONING OF CHILDREN WHO REMAINED DRY
BASELINE
INITIAL TREATMENT
WET NIGHTS PER WEEK
WEEKS
0
1
2
3
4
5
6
7
1 2 3 4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

TABLE 5.4. Summary of results for two groups in respect of the number of days to reach the dryness criterion and the number of bedwets for initial acquisition of dryness.

Group	Relapse status	Days to reach dryness criterion: Initial acquisition	Number of wet nights: Initial acquisition
DBT	Relapsed	51	14
	Ramained Dry	45	12
Standard Conditioning	Relapsed	70	19
	Remained Dry	71	21

Children were also compared in relation to a history of diurnal micturitional difficulty, in addition to bedwetting. During the initial interview, prior to placing the child's name on the waiting list for treatment, the parents were asked whether the child had exhibited difficulties with frequency or urgency of urination or actual wetting accidents during the day, beyond the age of four years. Children with a history of diurnal wetting accidents were found to be more likely to suffer a relapse in bedwetting following either DBT or standard conditioning that those who had established diurnal urinary continence from an early age. Ten out of 15 children with day and night wetting relapsed compared with 24 relapses out of 70 children with night wetting only ($X^2 = 5.4$, df = 1, $p < 0.01$). A history of diurnal frequency or urgency of urination (without actual wetting accidents) was not found to be significantly associated with proneness to relapse in bedwetting following treatment.

Other variables examined in relation to prediction of bedwetting relapse included the child's age at commencement of treatment, sex of

subject and whether the child was a primary or secondary enuretic. None of these was found to be associated with proneness to relapse.

5.4.3. Re-treatment of relapses

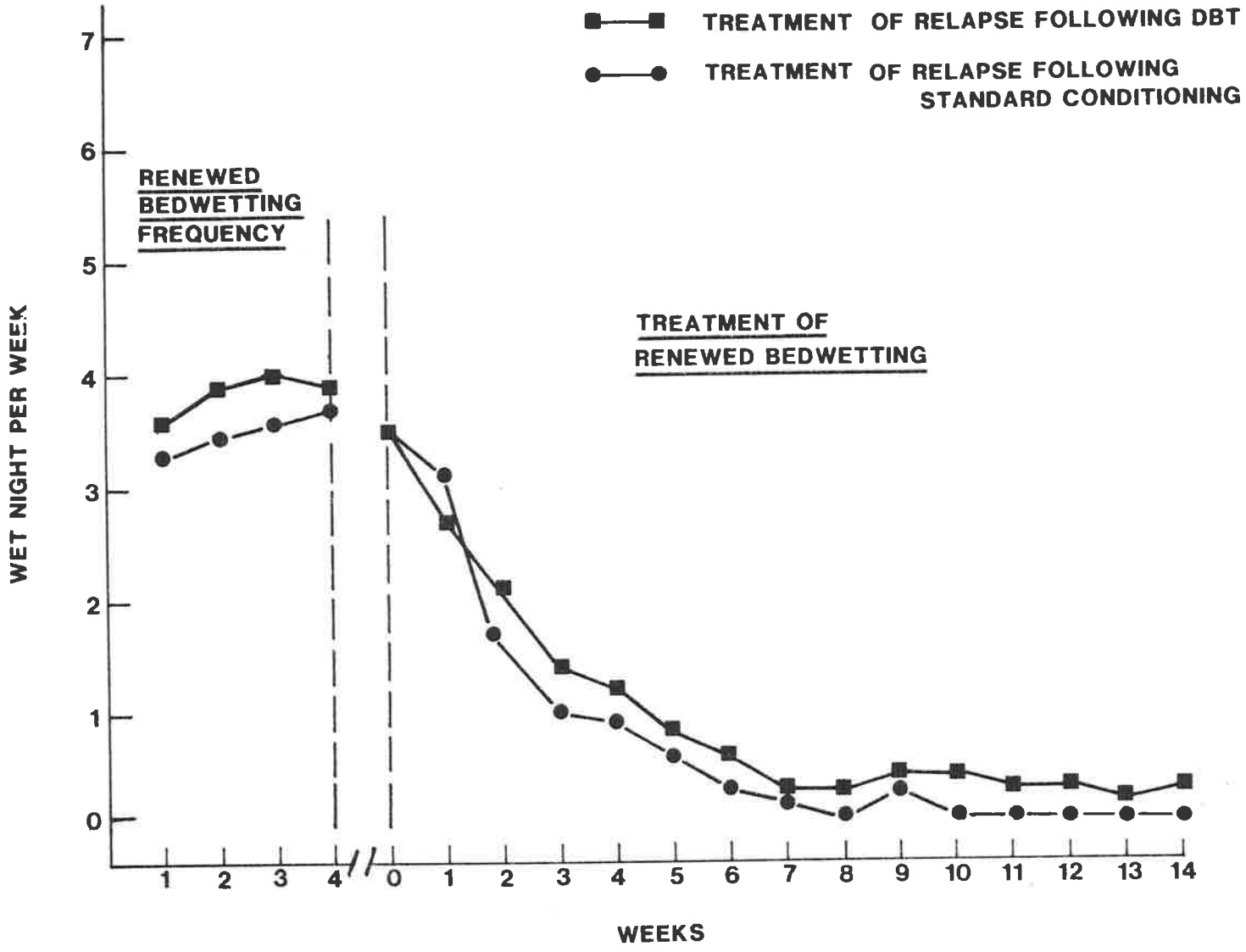
A second treatment was offered to all children as soon as a relapse was detected. This was accepted in 15 of the 22 cases who relapsed in the DBT group and 10 of the 12 cases of relapse in the standard conditioning group. The remaining children were either still awaiting re-treatment after the two-year follow-up or their parents chose not to have further treatment because the renewed bedwetting frequency was considered insufficient to warrant attention. In two cases (one from each treatment group) the parents were apparently disillusioned with the machine-based programmes and had sought help from their family doctor.

Figure 5.2 shows the mean number of wet nights per week for each group during the four weeks of recording renewed bedwetting and subsequent re-treatment.

Comparison of renewed bedwetting frequency with baseline wetting frequency prior to initial treatment (shown in Figure 5.1), was made for both groups and results subjects to analysis of variance with repeated measures. Results showed that renewed bedwetting frequency was significantly lower than original baseline wetting frequency ($F(1,23) = 30.48$, $p < 0.01$). There was no difference between DBT and standard conditioning groups ($F(1,23) < 1.0$) [see Appendix 5.3]. The number of bedwets during initial treatment was compared with the number of bedwets during subsequent treatment for both groups. Analysis of variance with repeated measures showed that while the number of bedwets during the second treatment tended to be lower than the number of bedwets during the first treatment, this difference was not sufficient to reach statistical significance ($F(1,23) = 2.75$, $p > .05$). Nor

FIGURE 5.2.

Mean wet nights per week for two groups throughout four weeks of renewed bedwetting and fourteen weeks of subsequent treatment.


TREATMENT OF RELAPSE FOLLOWING DBT
TREATMENT OF RELAPSE FOLLOWING STANDARD CONDITIONING
RENEWED BEDWETTING FREQUENCY
TREATMENT OF RENEWED BEDWETTING
WET NIGHT PER WEEK
WEEKS
0
1
2
3
4
5
6
7
1 2 3 4 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

was there any difference between DBT and standard conditions groups ($F(1,23) < 1.0$) [see Appendix 5.4). Altogether, 14 of the 15 children re-treated by DBT again reached the dryness criterion requiring an average of 39 days and 9 bedwets. The unsuccessful child dropped out of treatment after 14 weeks, at which time she was still wetting three to four nights per week. All 10 children re-treated by standard conditioning reached the dryness criterion for the second time, taking an average of 36 days and 8 bedwets.

Four children in the DBT group and two children in the standard conditioning group relapsed a second time, while one child relapsed a third time in the latter group. On each occasion, reinstatement of the original treatment programme again arrested bedwetting but re-treatment of these cases (i.e. more than one relapse) tended to take longer than initial treatment or re-treatment of first relapses.

5.5. DISCUSSION

The standard conditioning treatment of bedwetting since its introduction by Mowrer and Mowrer (1938) has been plagued by the problem of relapse following the initial acquisition of dryness. In this study, a two-year follow-up of children successfully treated by the standard conditioning method showed that some 41 percent subsequently relapsed. This is consistent with other reports of relapse after standard conditioning with similar follow-up periods (Lovibond & Coote, 1970; Doleys, 1977).

Attempts at curbing this problem (intermittent schedules of alarm presentation and over-learning trials) have been shown to reduce the relapse rate but apparently at the expense of increasing the time taken to attain initial dryness. In this study it was speculated that DBT might result in a lowered relapse rate because of the procedure's amalgamation of a variety of training techniques, in addition to the bell-and-pad apparatus.

This suggestion, however, was not supported by the data. Results showed that 39 percent of children treated by DBT subsequently relapsed, an outcome much the same as the relapse rate following standard conditioning.

It would seem that the training features of DBT, additional to the urine-alarm result in more rapid acquisition of initial dryness rather than permanence of cure. These results do not, however, preclude the possibility that the relapse rate following standard conditioning may be reduced by the adjunct of retention control training. It was predicted on the basis of evidence from retention control training studies and overlearning trials, that the requirement of DBT for children to drink large amounts of fluid and practise inhibiting urination during the initial training night could lead to a more permanent dryness response. However, according to the DBT schedule, this exercise is practised only on the initial training night and the level of training may therefore be insufficient to effect a significant change in bladder control. The evidence relating to the long-term effects of retention control training is limited, but studies which have shown this form of treatment to be effective have all involved training over a much longer time period. Thus, the combination of more extensive retention control training with the urine-alarm device, may yet be shown to reduce subsequent relapse significantly. This issue is discussed further in the following Chapter, Section 6.4.3.

In an attempt to delineate some predictors of relapse, children who relapsed following DBT and standard conditioning were compared with children who remained dry throughout the follow-up period in relation to a number of variables - age and sex of subjects, history of primary or secondary enuresis, baseline wetting frequency, response to initial treatment and history of diurnal micturitional difficulty in addition to bedwetting. The only variable found to be associated significantly with proneness to

relapse was a history of day-time wetting accidents after the age of four years. This is consistent with the findings of Lovibond and Coote (1970).

Another aim of the study was to examine quantitatively, the re-treatment of relapses. Fourteen out of 15 cases re-treated by DBT, and all 10 cases re-treated by standing conditioning again reached the dryness criterion. These figures are higher than those reported for other studies where specific re-treatment data following standard conditioning are available. In Doleys' (1977) review of 12 studies, re-treatment data were reported on 80 subjects and results indicated 54 (68 percent) were successfully re-treated.

To date, there are insufficient long-term follow-up studies on DBT with which to compare the current data although the results are fairly similar to those obtained by Williams et al. (1978) in a two-year follow-up of enuretic children treated by DBT. Clearly, further studies with at least a two-year follow-up are required. It would appear on the basis of the present study that DBT does not result in significantly fewer relapses than have been found in most studies of standard conditioning with a commensurate follow-up period. The main advantages of DBT over standard conditioning seem to lie in the rate of acquisition of initial dryness and the proportion of children who achieve initial dryness. Since the subsequent relapse rate is no greater, DBT therefore results in less overall time alarm usage. This finding is of considerable practical value to enuresis clinics where there are long waiting lists for alarms.

CHAPTER 6.

SUMMARY AND CONCLUSIONS

6.1. THE ROLE OF THE URINE-ALARM IN DRY-BED TRAINING

The theoretical explanation of conditioning treatments for nocturnal enuresis has been a subject of much debate. There has been a general move away from the classical conditioning model proposed by Mowrer and Mowrer (1938) to the theory that treatment involves an instrumental response (e.g. Azrin et al., 1974; Lovibond, 1964; Turner et al., 1970). However, while the consensus of opinion now supports the notion that treatment with a urine-alarm is best understood in terms of an operant conditioning paradigm, a contemporary point of contention relates to the relative emphasis placed on the role of the urine-alarm as opposed to the role of social reinforcement response consequences. Azrin et al. (1973, 1974) and Atthowe (1973) have strongly emphasized the role of social and motivational events in response to bedwetting accidents, whereas Yates (1975) has dismissed the need for this type of reinforcement. Others, such as Lovibond (1964), Turner et al. (1970) and Young and Morgan (1973), acknowledge the value of positive reinforcement for dry nights in the administration of the conditioning procedure, but emphasize an analysis based on aversive conditioning and stress the role of the alarm.

According to Azrin et al. (1974), the role of the urine-alarm in conditioning treatments is a very minor one. These authors have claimed that the alarm serves merely to ensure that the important social consequences of bedwetting, like the annoyance of the parent and child at being awakened, the requirement to toilet during the night, and the inconvenience of changing wet sheets, occur as close as possible in time to the bedwetting act.

The work presented in this thesis has not provided a critical test of Azrin et al.'s (1974) position, since within the framework of both the alarm-based treatment programmes examined (DBT and standard conditioning) there is opportunity for social factors to operate. However, results from the studies reported here do question the relative emphasis which Azrin et al. (1974) have placed on the importance of social factors as opposed to the urine-alarm. Results have shown a substantial difference between the rate of arrest in bedwetting obtained when following the alarm-based DBT and standard conditioning treatments, and that achieved when applying the schedule of DBT exercises without the use of an alarm. The magnitude of this difference is sufficient to suggest that the specific stimulus conditions provided by the alarm are primarily responsible for the effectiveness of treatments which employ this device.

At the same time, it is clear from the studies reported in this thesis that social reinforcement factors do play a role in conditioning treatments of bedwetting. DBT has a more intensive social reinforcement programme than standard conditioning; thus, the greater effectiveness of DBT in arresting bedwetting and the finding that the DBT exercises without the adjunct of an alarm do reduce bedwetting frequency somewhat, together demonstrate that social and motivational factors are significant thereapeutic agents. The effect of such operant factors may be increased by raising the motivation of the child and parents to apply the DBT exercises more diligently, for example, by way of small group instruction and regular contact throughout treatment between the therapist and the family. However, this effort on its own does not seem sufficient to arrest bedwetting completely. The actual conditioning paradigm underlying DBT is complex, but it would appear that the specific effects of the urine-alarm remain the most essential component of this procedure.

6.2. THE ROLE OF OPERANT FACTORS IN DBT

An attempt was made in Experiment 4.1 to delineate which specific aspects of the DBT schedule contribute most to the procedure's overall effectiveness. The three major components of DBT, in addition to the alarm, were identified as (i) the waking schedule, (ii) retention control training, and (iii) positive practice following bedwetting accidents. Of these, only the waking schedule was found to improve substantially the standard urine-alarm procedure. Explanations for the role of the waking schedule include the possibility that this procedure helps develop the enuretic child's ease of arousability from sleep thereby facilitating responsiveness to the alarm. In addition, requiring the child to empty his/her bladder in the toilet following nighttime awakenings increases the likelihood of the child sleeping dry during the night, thereby enabling more positive reinforcement to be delivered as a consequence of demonstrating nocturnal continence.

The retention control training component appeared to contribute little to the effectiveness of the DBT schedule. The reduction in bedwetting frequency was only slight following the addition of the retention control training component to the urine-alarm procedure, and this effect was confounded by the influence of the waking schedule, since retention control training in the DBT programme involves waking the child hourly during the intensive training night. A possible reason for the limited effectiveness of this component could have been that the amount of retention control training was insufficient to effect significant change to the enuretic child's bladder capacity, since according to the DBT schedule, this procedure is practised only during the intensive training night. However, as noted in Section 4.1.2, the data from studies using

retention control training over much longer periods of time do not provide strong support for this procedure's effectiveness in arresting bedwetting.

The third major component of DBT examined was positive practice. According to Azrin et al. (1974), the role of this procedure is to strengthen the nighttime toileting response by massed practice and to provide additional negative reinforcement for bedwetting accidents. Results of Experiment 4.1 showed that the positive practice exercise, when combined with the urine-alarm procedure, led to only a small addition reduction in bedwetting frequency. A possible explanation for this finding is that correct toileting behaviour is usually well established in nocturnally enuretic children, and in any case, going to the toilet at night is not a necessary response in order to maintain a dry bed. Secondly, the addition of further negative reinforcement to that already provided in the standard urine-alarm conditioning method may be redundant.

Although the role of positive reinforcement in the DBT schedule was not examined as a specific component in Experiment 4.1, this aspect of the training procedure should also be acknowledged. Positive reinforcement is delivered at each awakening, following attempts by the child to inhibit urination during the intensive training night. Emphasis is placed on the parents praising the child during the day following any dry night, and relatives and friends are asked to add their support and encouragement. However, it is difficult to evaluate the contribution of positive reinforcement as a separate component of DBT since it overlaps other aspects of training, such as the waking schedule and retention control training. In addition, it is difficult to estimate whether the amount of positive reinforcement delivered during DBT is significantly greater than that which presumably accompanies treatment by the standard conditioning procedure

since it is highly likely that parents and others heavily reward children for correct toileting during the night and for the achievement of a dry night, whether or not this is specifically stressed in any particular treatment programme. Nevertheless, it seems reasonable to assume that positive reinforcement plays an important role in the DBT programme.

6.3. SUMMARY OF THE PRACTICAL IMPLICATIONS

Results of the present series of studies clearly demonstrate that DBT with the adjunct of a urine-alarm device is a very effective treatment for nocturnal enuresis. The results support the claim by Azrin et al. (1974) that DBT is more effective in achieving the initial arrest of bedwetting than standard conditioning, the latter treatment having been shown previously to be superior to other modern day treatments such as medication and psychotherapy. However, while the difference between the effectiveness of DBT and standard conditioning has been shown to be sufficient to achieve statistical significance, the advantages of DBT do not appear to be as great from the practical point of view. The fact remains that standard conditioning is also very effective in eliminating bedwetting in the vast majority of cases and this procedure is considerably less complicated and demanding for both the therapist and patient than DBT. In addition, experience with DBT in these studies does not reflect the full extent of the practical difficulties likely to be associated with the widespread use of this form of therapy, since the sample did not represent the complete spectrum of enuretic children seen in normal clinical practice. All subjects were seen for an initial interview by the author, upon receipt of referral from a medical practitioner, and their names were subsequently placed on a waiting list for treatment. Subjects were then selected from the waiting

list in accordance with the hospital policy that those waiting longest be treated first, and that older children be given priority. However, in some cases, children who were referred had other problems in addition to enuresis, which required more urgent and additional forms of psychological management, and such children were not therefore included in the sample. It is likely that parents and children in these situations would have had even greater difficulty implementing DBT than the less demanding standard conditioning procedure. Such multi-problem children do, nevertheless, constitute a small but significant proportion of the overall enuretic population requiring treatment. Thus, the advantage of DBT compared with standard conditioning, in terms of the speed with which dryness is achieved, must be weighed against the relative practical difficulties associated with the administration of these two procedures.

One of the major practical problems encountered with the original DBT procedure was the reliance on a professional trainer in the child's home to conduct the intensive all-night training. It has been demonstrated in Experiment 2.2 that this problem can be overcome by instructing the enuretic child's parents to conduct the all-night training session without sacrificing the procedure's overall effectiveness. The time and expense involved in placing a professional trainer in the child's home can therefore be eliminated. However, instructing parents to administer the full DBT schedule on an individual basis is in itself quite time-consuming because of the complicated nature of the programme. Another problem with DBT is the requirement that the child perform a demanding and unpleasant schedule of exercises which many families found difficult to implement. Results of Experiment 3.1 showed that demands on therapist time can be reduced by training parents to administer DBT and for the therapist to

follow up progress in small group settings, rather than on an individual basis. Furthermore, group instruction appeared to facilitate parents' and children's motivation to persist with the demanding schedule of exercises. However, even with the advantages of small group instruction, significant practical difficulties in terms of parents' comprehension of the programme and the effort required to maintain compliance from children were still evident. From the therapist's point of view, instruction of DBT on a regular basis became very tedious indeed.

Analysis of the major components of DBT in Experiment 4.1 showed that a combination of the waking schedule with the standard conditioning procedure was about as effective in arresting bedwetting as the complete DBT programme. For practical purposes, this finding is of considerable advantage, the elimination of retention control training and the positive practice exercise simplifying the procedure substantially. For parents and children positive practice is by far the most demanding aspect of DBT. The waking schedule, on the other hand, presents little additional demand to the urine-alarm procedure, and in many cases parents were already regularly employing similar procedures to manage the child's bedwetting. Thus, it is concluded that a treatment regimen of the urine-alarm in combination with the DBT waking schedule, preferably administered in small groups, is a more efficient method for the large-scale treatment of bedwetting than the complete DBT programme.

There are still many strategies which might be employed to further improve the practical efficacy of bedwetting treatment. Firstly, the methods of instructing parents and children could be improved. In the experiments reported here, training was done by verbal instruction backed up by role-playing features of the programme, and written instructions for home

reference. In future, these procedures might be supplemented by other training devices such as video-taped demonstrations of the various procedures and/or illustrated training manuals. Separate manuals could be developed for parents and children. For parents the manual could involve a detailed outline of the treatment protocol together with the rationale for each step while for children a simplified description of the programme could be presented in cartoon form.

Secondly, there are many avenues for the delivery of positive reinforcement for dry nights apart from social rewards. For example, at the commencement of training, a tangible reward for ultimate dryness could be negotiated between the parents and the child. In the meantime, the use of tokens such as stars on a specially prepared calendar and rewards for intermediate goals could be employed. There is a related issue of developing strategies for 'reinforcing the reinforcers', i.e. rewarding the efforts of the parents for their efforts in the training programme. Here the support of the therapist is crucial.

Results of attempts to utilize the DBT schedule without the adjunct of an alarm have demonstrated that this is not a viable treatment procedure. The reason for persevering with this form of treatment was related to the desirability of a method not reliant on the use of a urine-alarm, the reduced availability of this device often leading to long waiting times for treatment in enuresis clinics. However, the DBT procedure without an alarm was not only markedly less effective than any of the alarm-based conditions, but also resulted in the greatest problems with families' motivation to persist with training. Furthermore, experience with the DBT exercises did not facilitate subsequent response to treatment when an alarm was eventually introduced into the programme.

It was noted that Azrin and his colleagues have claimed that with some modification and additions to the original Dry-Bed procedure bedwetting can be eliminated without the use of the urine-alarm. However, even if further research were to confirm this claim, the modified 'no-alarm' method would likely be of limited practical value because it appears to add more burden to an already demanding and complicated procedure.

DBT with an alarm did not reduce the likelihood of relapse, compared with the standard conditioning procedure. The high relapse rate associated with treatment by conditioning methods remains a fundamental problem, and it is possibly the most pressing issue to be investigated in future research on enuresis. This issue is discussed further in Section 6.4.3 below.

6.4. IMPLICATIONS FOR FUTURE RESEARCH

The following suggestions concern the areas indicated by the present series of studies to warrant further investigation.

6.4.1. The sleep-arousal system and enuresis

It was noted in Section 1.4.2 (iii) that there have been frequent anecdotal reports of bedwetters sleeping more deeply than non-enuretics and that there is a substantial body of empirical evidence for an association between enuresis and an impairment of the sleep-arousal system. In addition to these findings, the present author's attention is drawn to the notion of an association between bedwetting and arousal from sleep for essentially two reasons. Firstly, during the course of the present studies, it was observed that the majority of the subjects' parents reported their children to be very difficult to arouse from sleep prior to treatment; in fact, the children were generally reported to have had a life-long history of deep

sleep. Most parents reported a tendency for their children to arouse more quickly from sleep as treatment progressed, and for this ability to remain after continence had been achieved. While it is recognised that parental reports may be biased by the parents' preconceived ideas about the aetiology of enuresis, it is noteworthy that such observation of the sleep characteristics of children who wet the bed are very frequent. Secondly, there is the finding from Experiment 4.1 that the inclusion of the DBT waking schedule to the standard urine-alarm conditioning procedure, facilitated response to treatment, presumably by helping develop ease of arousability from sleep.

In order to explore further the sleep-arousal issue, sleep patterns might be monitored electroenephalographically under the following conditions: (a) just prior to and during the act of bedwetting; (b) throughout the course of treatment, comparing various adjuvant therapies to standard conditioning aimed at facilitating arousal from sleep; (c) following the achievement of nocturnal urinary continence; and (d) at the time of relapse, should this occur. EEG monitoring of sleep patterns could be supplemented by other measures of arousability from sleep, such as the degree of auditory stimulus required to achieve wakefulness, a procedure suggested by Finley (1971). In this way it would be possible to observe whether the development of bladder control is related to changes within the sleep-arousal system and, if so, whether such changes need to be permanent for sustained continence to be achieved. Such observations would also permit determination of the degree of cortical arousal caused by the alarm or other stimulus which was necessary for effective conditioning treatment.

Related issues are whether adjuvant therapies to the urine-alarm would facilitate necessary cortical arousal, and the relative effectiveness of such additional procedures. One of the more obvious possible adjuvant therapies

would seem to be the use of drugs. Lovibond (1964) noted that stimulant drugs such as amphetamine sulphate have been used in clinical practice as an adjunct to conditioning treatment of enuresis in difficult cases. Young and Turner (1965) found that CNS stimulant drugs (Methedrine and Dexedrine) administered during conditioning treatment resulted in more rapid initial arrest of bedwetting, although the frequency of relapse was particularly high for subjects to whom Dexedrine had been administered. However, to this date there has been very little systematic study of drug effectiveness as an adjunct to standard conditioning and further research of this kind is warranted.

Further research into the use of waking schedules as an adjuvant therapy is also necessary. In Experiment 4.1, it was assumed that the facilitatory effect of the DBT waking schedule was due to this procedure enhancing the enuretic child's ease of arousability from sleep, but this factor was not specifically tested. In addition, it may be possible to improve the effectiveness of the DBT waking schedule by staggering the time of the awakenings throughout the night as was done by Creer and Davis (1975) and Young (1964) and/or by the use of an intermittent schedule of awakenings (i.e. waking on some nights but not others).

Oswald et al. (1960) found that sleeping subjects can make discriminations between incoming stimuli on the basis of their meaningfulness (e.g. the sound of the subject's own name) compared with non-meaningful material. Furthermore, the possibility of a subject making such a discriminative response can be raised by contingent reinforcement such as monetary reward (Zung & Wilson, 1961). Thus, it might be possible to enhance the effectiveness of conditioning treatment when the child is difficult to arouse from sleep, by the use of a signal more meaningful than the alarm, such as the child's

name, and to reinforce arousal positively in response to the signal, as well as rewarding the attainment of a dry night.

6.4.2. Matching particular treatment procedures with the enuretic child's individual needs

The tendency of research into the treatment of bedwetting has been to develop procedures and to apply these routinely to all enuretic chidlren. However, in any large group of enuretic children one finds considerable variability in terms of bedwetting frequency, functional bladder capacity, the presence of diurnal symptoms, ease of arousability from sleep, motivation to become dry, and so on. Thus, if a single treatment programme is to accommodate these individual differences, it must combine a variety of training strategies. Essentially this is what has been attempted by Azrin et al. (1973, 1974) when developing DBT and the data show that this composite treatment 'package' approach is highly successful. A problem with such a comprehensive training programme however, is that the treatment becomes excessively burdensome. Furthermore, if the full 'package' is used routinely for all children treated, some of the training for some of the individuals will be unnecessary as shown by studies reported here to have been the case with the retention control training and positive practice components of DBT.

An alternative, and more efficient approach would be to comprehensively assess the enuretic child beforehand in terms of such characteristics as functional bladder capacity, ease of arousability from sleep, motivation to become dry, etc., and to match particular procedures with those training needs. In this way the complexities of treatment might be reduced to a minimum.

On the basis of the research described in this thesis, the standard urine-alarm procedure provides the most suitable 'core' treatment for bed-wetting. However, comprehensive assessment prior to treatment could indicate that in some cases additional forms of therapy would be beneficial. For example, children's functional bladder capacity could be measured quite easily by the water load technique described by Harris and Purohit (1977),* and where this was found to be significantly low, the conditioning procedure could be supplemented by daily retention control training. Ease of arousability from sleep could be assessed before treatment by having the parent measure the degree of auditory stimulus necessary to awaken the child from sleep, or by timing the interval between presentation of an auditory stimulus and the child awakening. It might not even be necessary to measure arousability from sleep beforehand, but rather make this assessment based on the child's response to the urine-alarm during the first few days of treatment. In any case, if the child was particularly difficult to rouse from sleep, the standard conditioning procedure could be supplemented by an adjuvant therapy such as a nightly waking schedule or even an appropriate drug as discussed in Section 6.4.1. Indeed the outcome of Experiment 4.1 suggests that a combination of the standard urine-alarm procedure with the DBT waking schedule is sufficient to meet the needs which the vast majority of bedwetters presumably have in common. If poor motivation was a feature before treatment, then the urine-alarm programme could be supplemented by more intensive differential reinforcement for wet or dry nights.

---

* This procedure involves the child refraining from drinking any fluid for a period of two hours. At the end of this period the child is required to void and is then administered an oral water load according to the following specifications: (i) Children weighing 25 kg receive 30 ml of water per kg of body weight to a maximum of 500 ml; (ii) Those weighing more than 25 kg receive 20 ml of water per kg of body weight to a maximum of 1000 ml. The children are urged to refrain from voiding as long as possible, and, when they can hold no longer, the resulting voided specimen is measured and serves as the index of bladder capacity.

Furthermore, as pointed out by Doleys and Ciminero (1976), a thorough behavioural history may also uncover other behaviours such as fear of the dark and toilet phobia, that may be related functionally to bedwetting, and that should be eliminated prior to commencing treatment of the bedwetting itself. Information relating to parental attitudes and the ability of parents to conduct the training would also be worthwhile.

6.4.3. The problem of relapse

In the clinical setting, there are at least two issues of concern in relation to the problem of relapse following conditioning treatments. One issue is the total amount of time required for alarm usage (i.e. time taken to achieve initial arrest of bedwetting plus the time for treatment of relapse) especially when urine-alarm devices are in short supply. The other problem concerns the possibility that parents and children will become disillusioned with the training programme following relapse and therefore be less motivated to seek re-treatment.

In addressing the first issue, one could adopt the view that the possibility of relapse is a shortcoming of conditioning treatments that will necessitate further therapy, and that the major aim is to achieve initial dryness as quickly as possible thereby minimizing the total time for alarm usage. From this viewpoint, DBT has advantages over the standard conditioning method. The initial arrest of bedwetting has been shown to be quicker following DBT than standard conditioning and there is little difference between the two methods in terms of subsequent relapse rate or re-treatment of renewed bedwetting. However, it has been noted throughout the course of the present series of investigations that DBT has a number of practical problems which limit its large-scale application. Furthermore, simply minimizing the total time for alarm-usage does not

overcome the significant problem that some parents and children will become disillusioned with the programme and therefore will not seek re-treatment. Thus, there is still a need to develop a treatment that arrests bedwetting quickly and has a lower relapse rate.

A starting point could be the incorporation of an intermittent schedule of alarm presentation and/or the introduction of overlearning trials into the standard conditioning procedure with the adjunct of the DBT waking schedule. Any decline in relapse rate resulting from these procedures would have to be weighed up against any increase in the initial treatment time.

A second possible strategy for reducing the relapse problem could be the combination of retention control training with the urine-alarm and waking procedure. The only factor found to reliably predict proneness to relapse following conditioning treatment is a child's history of diurnal micturutional difficulty. These proglems of diurnal urgency, frequency and wetting accidents are most likely explained by severely low levels of functional bladder capacity. The overall data from studies which have employed retention control training suggest that while this procedure is of limited value in arresting bedwetting, it can be quite effective in increasing functional bladder capacity. Thus, retention control training, when used in conjunction with the urine-alarm device may lead to a more permanent dryness response. It is likely that retention control training would need to be practised daily over several months in order for it to have a therapeutic effect and this would doubtless increase the demands of treatment. However, this problem could be attenuated by giving retention control training to only those children who have severely low functional bladder capacities as indicated by a pre-treatment water load test and/or a history of diurnal micturitional difficulty.

Until an effective method of significantly reducing relapse rate following conditioning treatment is achieved, it would seem desirable to warn parents and children beforehand, that there is a high likelihood of another period on the alarm some time in the future, being necessary to effect a complete cure.

LIST OF APPENDICES

LIST OF APPENDICES cont.

LIST OF APPENDICES cont.

APPENDIX 2.1. Instructions for use of the urine-alarm device.

The bedwetting alarm is run on a large torch battery and is electrically quite harmless even if the child touches contacts etc.

If the alarm is to work properly, however, you must follow the instructions carefully.

STEP 1.

Place alarm unit in firm position near head of bed. It is important to have the unit as near as practicable to the child's ear. Do not put the unit on a soft surface as this muffles the sound of the alarm.

STEP 2.

Make up the bed in this order:-

(a) Rubber sheet to protect mattress

(b) Rubber electrode pad - wire end pointing towards head of bed. The pad should cover the area where the child will wet. Make sure the pad is the right way up - the grooved side faces upwards.

(c) Bottom sheet. A draw sheet may be more convenient as it is more easily changed.

STEP 3.

Plug the wire leads into the front of the buzzer unit. It does not matter which lead goes in which hole; however it will help the pad last longer if the leads are switched over every two or so days.

STEP 4.

Turn the alarm switch on (red dot shows on switch). This means that the alarm is now ready - if it goes off at this point, the alarm is not working properly (see below).

STEP 5.

The child should sleep without pyjama pants - if he objects to this, try removing them after he is asleep.

STEP 6.

When the alarm goes off it means the child has wet the bed. The procedure that follows bedwetting is contained in the accompanying instruction sheet.

Cleaning the Pad

The pad is sterilized before it is loaned to parents, and no cleaning agent should be used on it. Before returning it, however, please wipe it over with warm water and soap. After drying it, please roll it up and pack it away according to the instructions printed on the underside of the pad.

APPENDIX 2.1. cont.

Alarm not working properly.

If the alarm does not sound following a bedwetting accident, or if it sounds without a bedwetting accident having occurred please contact Mr. J. Bollard (Psychologist) as soon as possible on 2674999 extension 227.

APPENDIX 2.2. Instructions for the standard conditioning treatment of bedwetting.

STEP 1.

Set up the urine-alarm device on the child's bed as described in the accompanying instruction sheet.

STEP 2.

Encourage the child to go to bed at a regular time and avoid letting him/her get too tired or excited. The best attitude to have during treatment is one of sympathetic help, that is, try to give the child the impression that you see the bedwetting as a problem that you are both going to work on.

STEP 3.

When the alarm is triggered in response to a bedwetting accident, go to the child and see that he/she is properly awake before switching off the alarm. Send the child to the toilet to finish urinating.

STEP 4.

Upon returning from the toilet, encourage the child to wipe the rubber electrode pad dry with the dry part of the drawsheet, and to replace the soiled drawsheet with a clean one. (Have clean sheets ready so you don't have to go looking for them during the night).

STEP 5.

Switch on the alarm again (if the alarm sounds it means that the electrode pad needs further drying) and allow the child to go back to sleep.

STEP 6.

Each morning note on the calendar whether the child was wet or dry the previous night. Please contact Mr. J. Bollard (Psychologist) on 2674999 extension 227 each week at the pre-arranged time in order to report on the child's progress.[1]

This procedure has to be repeated each night until the child reaches the target of 14 dry nights in a row. The child should be encouraged to take responsibility for the procedural steps outlined above. After the first few nights, older children will probably to able to manage the programme on their own, however, younger children may require assistance from the parents throughout the course of treatment.

[1] The requirement for weekly contact was deleted from the instructions given to parents of children in the standard conditioning without supervision group.

APPENDIX 2.3. Experiment 2.1.: Summary of data for subjects in each group.

Group 1. Standard conditioning with close supervision.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night	Follow-up 3	6	12 months
1	14-0	M	20	22	34			*
2	7-6	M	27	12	54			
3	12-8	M	18	11	45			
4	10-8	F	19	63	140			
5	10-1	M	15	34	78			
6	11-4	M	27	34	55			
7	9-7	F	28	18	42	*		
8	7-4	M	11	58	140			
9	5-6	F	28	11	45			*
10	10-8	M	26	15	37			
11	7-6	M	9	16	51			
12	9-6	M	28	102	140			
13	8-4	M	17	18	81	*		
14	11-5	F	16	8	14			
15	11-9	M	11	13	36			
Mean	9-10		20.2	29.0	66.1			

* relapse

APPENDIX 2.3. cont.

Group 2. Standard conditioning without supervision.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night	Follow-up 3	6	12 months
1	5-11	F	27	15	18			
2	12-0	M	18	15	25			
3	11-0	M	9	10	45	*		
4	12-8	F	10	28	100		*	
5	9-1	F	17	31	96			
6+	10-2	M	28	140	140			
7	9-0	M	20	31	140	*		
8	12-11	M	23	78	140			
9+	7-0	M	28	139	140			
10	9-1	F	22	103	140			
11	7-8	M	23	20	47		*	
12	10-11	M	18	14	45			
13	8-5	M	26	33	74			
14	13-0	M	24	74	140			
15+	7-6	M	22	127	140			
Mean	9-9		21.0	a) 37.7 b) 57.2	a) 82.5 b) 95.3			

* relapse

\+ subject dropped out

a) drop-outs excluded

b) drop-outs included

APPENDIX 2.3. cont.

Group 3. Control.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night
1	7-4	M	28	137	140
2	12-4	M	14	61	140
3	9-0	F	12	76	140
4	9-0	M	11	71	140
5	8-11	M	13	77	140
6	4-6	F	11	86	140
7	7-9	F	4	27	140
8	8-11	M	13	65	140
9	5-0	M	28	127	140
10	5-0	M	26	139	140
11	4-11	F	27	136	140
12	6-4	M	18	83	140
13	7-10	F	28	139	140
14	14-6	M	20	66	140
15	11-7	M	26	128	140
Mean	9-5		18.6	94.5	140

APPENDIX 2.4. Experiment 2.1: Summary of covariate analysis of variance with planned comparisons of groups after 20 weeks of treatment when data from children who dropped out were excluded.

VARIABLE	SOURCE	SS	df	MS	F RATIO	p
Wet Nights	Group	40797.28	2	20398.64	29.32	< .001
	Regression	11748.82	1	11748.83	16.89	< .001
	Error	26435.57	38	695.67		
	Total	78981.67	41			
	PLANNED COMPARISONS				t value (38 df)	p
	1. Control group versus combination of the two treatment groups				7.53	< .001
	2. Standard conditioning with supervision versus standard conditioning without supervision				0.91	NS
Number of days to last wet night	SOURCE	SS	df	MS	F RATIO	p
	Group	43646.38	2	21823.19	16.75	< .001
	Regression	.73	1	.73	< 1.00	NS
	Error	49504.67	38	1302.75		
	Total	93151.78	41			
	PLANNED COMPARISONS				t value (38 df)	p
	1. Control group versus combination of the two treatment groups				5.55	< .001
	2. Standard conditioning with supervision versus standard conditioning without supervision				1.29	NS

APPENDIX 2.5. Experiment 2.1: Summary of covariate analysis of variance with planned comparisons of groups after 20 weeks of treatment when data from children who dropped out were included.

VARIABLE	SOURCE	SS	df	MS	F RATIO	p
Wet nights	Group	37254.69	2	18627.34	18.77	< .001
	Regression	19182.73	1	19182.73	19.33	< .001
	Error	40696.73	41	992.60		
	Total	97134.15	44			
	PLANNED COMPARISONS				t value (41 df)	p
	1. Control group versus combination of the two treatment groups				5.73	< .001
	2. Standard conditioning with supervision versus standard conditioning without supervision				2.12	< .05
Number of days to last wet night	SOURCE	SS	df	MS	F RATIO	p
	Group	41893.96	2	20946.98	15.17	< .001
	Regression	374.28	1	374.28	< 1.00	NS
	Error	56612.79	41	1380.80		
	Total	98881.03	44			
	PLANNED COMPARISONS				t value (41 df)	p
	1. Control group versus combination of the two treatment groups				5.07	< .001
	2. Standard conditioning with supervision versus standard conditioning without supervision				2.12	< .05

APPENDIX 2.6. Instructions for dry bed training.*

This training in in 3 stages:-

Part 1 # is the All night training. This is done on one night only.

Part 2 starts the following night and tells how to wake the child on a special schedule.

Part 3 begins when the child has reached 7 consecutive dry nights.

PART 1: - ALL NIGHT TRAINING

STEP A: ½ Hour Before Bedtime.

1. Explain to child what will be happening, that is, that tonight she will be woken every hour to practise going to the toilet and that if she wets, she will have to change her bedsheets and practise going to the toilet several times.

2. Give child her favourite drink.

3. Place bedwetting alarm on bed according to instructions on enclosed sheet (see Appendix 2.1).

4. Positive Practise Training -

   a) child lies in bed with light off,

   b) child counts up to 50 slowly and silently,

   c) child gets up and goes to the toilet and tries to urinate,

   d) child returns to bed,

   e) child repeats setps a), b), c) and d) until she has done this 20 times.

   During this, the parent stays out of the room, but keeps a check of the number of trips to the toilet.

STEP B: At Bedtime

1. Child drinks as much as she can of her favourite drink.

2. Child repeats training instructions, i.e. that she will be woken hourly to practise going to the toilet and if she wets, she will have to change her sheets and practise going to the toilet several times.

APPENDIX 2.6 cont.

3. Child now goes to bed.

STEP C: Hourly Awakenings

1. Wake child, using as little prompting as possible, that is if you need, the first time, to sit the child up in bed and gently shake her; next time try just shaking her gently on the shoulder without sitting her up. The idea is to reduce each time the things you do to wake her up so that she will learn to get up by herself. Do not turn on the bedroom light unless this is really necessary. If the child does not go straight to the toilet on wakening, point towards the toilet and ask "Where do you go when I wake you up?" If the child still does not walk towards the toilet, take her quickly into the toilet saying, "You have to hurry to the toilet if you don't want to wet your bed".

2. Child walks to the toilet.

3. At the toilet door (before child goes in to urinate), ask child if she can go for one hour without urinating.

   a) if child could not do this -

      (i) see if child can hold back for a few minutes,

      (ii) child urinates in toilet,

      (iii) parent praises child for correct toileting,

      (iv) child returns to bed.

   b) if child says she can hold in urine for one hour -

      (i) parent praises child for good control,

      (ii) child returns to bed.

4. At bedside, ask child if her bedsheets are dry and get her to feel them and tell you that they are dry.

5. Parent praises child for having a dry bed and encourages her to keep it dry for the next hour.

6. Get child to repeat training instructions for the next hourly toileting and give her another drink

7. Child returns to sleep.

APPENDIX 2.6 cont.

STEP D: When Child Wets the Bed

1. Wake child and give brief reprimand.
2. Turn off bedwetting alarm.
3. Send child to toilet to finish urinating.
4. Child is given cleanliness training -
   a) child has to change pyjamas,
   b) child takes off wet draw sheet, wipes rubber sheet and puts wet sheet into laundry,
   c) child puts on dry draw sheet,
   d) parent switches bedwetting alarm on again.
5. Tell the child she needs more practise to stay dry. Child then immediately given Positive Practise in correct toileting (20 trials of lying on bed then going to the toilet as in A4).
6. The following evening before bedtime, the child is given another 20 trials of Positive Practise.

PART 2 - NIGHT AFTER INITIAL TRAINING

STEP A: Before Bedtime

1. Bedwetting alarm set.
2. Give child Positive Practise training if she wet the bed the previous night.
3. Remind child of need to remain dry and tell her that if she wets she will have to go through cleanliness training (remaking bed) and Positive Practise (20 trials).
4. Ask child to repeat your instructions so that you are sure she knows them.

STEP B: Night Toileting

1. Awaken child about 3 hours after she has gone to bed and send her to the toilet.
2. After each dry night, awaken the child 30 minutes earlier than on the previous night.

APPENDIX 2.6 cont.

3. Stop waking the child when you are down to within one hour from her bedtime.

STEP C: Accidents

If the child wets the bed, give her the cleanliness training and Positive Practise immediately after wetting and give her Positive Practise again at bedtime the next night.

STEP D: After a Dry Night

1. Family praises the child for not wetting her bed.

2. Family praises her again at least 5 times during the day, e.g. during meals, just before bedtime, etc.

3. Parents encourage other relatives to praise the child for not wetting.

PART 3 - NORMAL ROUTINE

1. After seven consecutive dry nights, stop using the bedwetting alarm.

2. Inspect child's bed each morning. If bed is wet, have child remake it immediately and before bedtime the same day, give her another 20 trials of Positive Practise.

3. If the child wets on 2 nights in one week, go back to II (Night After Initial Training) until the child again has 7 consecutive dry nights and then return to III (Normal Routine).

4. Treatment is regarded as completed when the child reaches 14 consecutive dry nights.

Please contact Mr. J. Bollard (Psychologist) each week at pre-arranged time in order to report on progress. (Phone 267 4999, Ext. 227)

For the DBT without alarm group, reference to the urine-alarm device was deleted.

* Part 1 of these instructions was deleted for groups receiving DBT administered by the therapist; (a) in hospital, and (b) in the child's home.

APPENDIX 2.7. Experiment 2.2: Summary of data for subjects in each group.
Group 1 - DBT administered by therapist in child's home.

Subject Number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights		Number of days to last wet night		Follow-up		
				After 8 weeks	After 20 weeks	After 8 weeks	After 20 weeks	3 months	6 months	12 months
1	8-5	M	24	10	10	16	16			
2	11-5	M	20	25	32	56	105			
3	8-0	F	27	4	4	4	4			
4	7-0	M	23	16	16	45	45			
5	9-10	M	17	4	4	7	7			
6	11-7	M	24	8	8	14	14			
7	8-10	M	15	6	6	39	39	*		
8	9-10	F	26	9	9	16	16	*		
9	7-9	M	28	32	41	56	84	*		
10	11-10	M	17	19	19	45	45			
11	4-2	M	28	24	24	33	33			
12	10-1	M	21	13	13	28	28			
13	8-6	F	27	9	9	17	17	*		
14	12-1	M	18	7	7	23	23			*
15	6-10	F	27	17	17	38	38			
16	11-4	M	26	7	7	13	13			
17	8-7	F	27	17	17	32	32			
18	11-9	M	11	8	8	37	37			
19	6-0	M	28	13	13	30	30			
20	10-7	F	11	10	10	31	31			
Mean	9-3		22.3	12.9	13.7	29.0	32.9			

* relapse

APPENDIX 2.7 cont.

Group 2 - DBT administered by trainer in hospital.

Subject Number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights		Number of days to last wet night		Follow-up
				After 8 weeks	After 20 weeks	After 8 weeks	After 20 weeks	3 6 12 months
1	9-2	F	15	21	22	56	63	
2	11-5	F	4	16	16	46	46	
3	10-3	F	4	0	0	0	0	
4	6-8	F	15	5	5	24	24	
5	7-10	M	27	21	29	56	103	*
6	9-3	F	26	14	14	24	24	*
7	8-3	M	21	4	4	14	14	
8	8-3	M	28	16	16	39	39	
9	6-3	M	27	15	15	40	40	*
10	8-5	M	22	15	15	47	47	
11	8-1	M	23	0	0	0	0	
12	7-4	M	15	10	10	25	25	*
13	5-11	M	28	18	18	49	49	
14	9-7	M	23	30	63	56	125	
15	8-10	F	27	13	13	48	48	
16	9-5	M	12	8	8	28	28	
17	9-6	M	28	22	22	35	35	
18	8-7	F	27	7	7	26	26	*
19	9-9	M	24	16	16	47	47	*
20	7-11	M	25	4	4	11	11	
Mean	8-11		21.1	12.8	14.9	33.6	39.7	

* relapse

APPENDIX 2.7 cont. Group 3 - DBT administered by the child's parents at home.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights		Number of days to last wet night		Follow-up 3 6 12 months
				After 8 weeks	After 20 weeks	After 8 weeks	After 20 weeks	
1	11-7	M	28	6	6	12	12	
2	9-4	M	28	10	10	16	16	*
3	9-3	M	14	9	9	37	37	
4	9-11	M	27	9	9	14	14	
5	11-8	M	25	10	10	38	38	*
6	10-2	F	20	6	6	31	31	
7	10-5	M	28	13	14	56	65	
8	10-6	M	19	6	6	40	40	
9	7-2	M	14	9	9	40	40	
10	10-0	M	24	7	7	16	16	
11	11-11	F	11	10	10	41	41	
12	9-8	M	23	12	12	47	47	
13	12-7	M	24	16	16	34	34	*
14	5-8	F	27	16	16	25	25	
15	8-7	M	28	23	37	56	127	
16	5-10	M	5	0	0	0	0	
17	8-8	M	23	12	12	39	39	
18	6-5	M	28	22	22	33	33	
19	15-0	M	23	4	4	6	6	
20	8-1	F	20	10	10	22	22	*
Mean	9-7		22.0	10.5	11.3	30.2	34.2	

* relapse

APPENDIX 2.7 cont. Group 4 - DBT without the adjunct of a urine-alarm device.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights		Number of days to last wet night		Follow-up		
				After 8 weeks	After 20 weeks	After 8 weeks	After 20 weeks	3 months	6 months	12 months
1	7-8	F	26	49	125	56	140			
2	9-3	M	28	44	109	56	140			
3	7-3	M	26	45	116	56	140			
4	5-8	M	22	37	99	56	140			
5	11-6	M	24	43	110	56	140			
6	7-11	M	22	40	102	56	140			
7	10-9	M	28	33	87	56	140			
8	7-1	M	28	53	136	56	140			
9	4-10	F	26	30	40	56	103	*		
10	6-10	F	21	3	3	3	3		*	
11	7-11	M	27	46	120	56	140			
12	10-6	M	28	53	137	56	140			
13	5-0	M	22	30	84	56	140			
14	10-0	F	14	10	10	32	32			
15	6-7	M	11	22	59	56	140			
16	8-5	F	28	39	39	42	42			
17	8-0	F	6	8	8	40	40			
18	9-3	M	11	14	42	56	140			
19	9-2	M	19	35	77	56	140			
20	12-7	M	17	27	60	56	140			
Mean	8-6		21.7	31.6	78.2	50.7	116.0			

* relapse

APPENDIX 2.7 cont. Group 5 - Standard urine-alarm conditioning.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights		Number of days to last wet night		Follow-up		
				After 8 weeks	After 20 weeks	After 8 weeks	After 20 weeks	3 months	6 months	12 months
1	6-9	M	27	3	3	14	14			
2	5-7	M	23	10	10	32	32	*		
3	7-7	M	26	25	27	56	78	*		
4	6-1	F	25	4	4	4	4			*
5	10-7	M	22	32	63	56	140			
6	8-7	M	28	45	54	56	89			
7	9-10	F	23	12	12	36	36			
8	9-3	F	24	6	6	14	14			
9	8-0	M	28	26	55	56	140			
10	12-5	M	23	9	9	9	9	*		
11	10-5	M	22	11	11	37	37			
12	10-10	M	22	35	74	56	140			
13	5-10	M	23	15	15	52	52	*		
14	11-11	M	15	4	4	31	31			
15	5-11	F	25	14	14	50	50			
16	9-7	M	25	17	55	56	140		*	
17	10-0	M	27	19	23	56	81			
18	5-10	M	28	24	65	56	140			
19	7-4	F	17	9	9	14	14			
20	12-2	F	17	6	6	13	13			
Mean	8-8		23.5	16.3	26.0	37.7	62.7			

* relapse

APPENDIX 2.7 cont. Group 6 - Control

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of set nights		Number of days to last wet night		Follow-up 3 6 12 months
				After 8 weeks	After 20 weeks	After 8 weeks	After 20 weeks	
1	8-1	M	15	32	76	56	140	
2	8-8	F	23	37	94	56	140	
3	6-8	M	24	44	108	56	140	
4	11-11	M	28	54	132	56	140	
5	8-6	F	15	22	47	56	140	
6	7-4	F	23	44	98	56	140	
7	8-11	M	24	42	115	56	140	
8	5-10	F	25	39	101	56	140	
9	8-4	M	28	55	125	56	140	
10	8-0	M	18	28	69	56	140	
11	8-4	M	8	9	38	20	20	*
12	8-11	M	22	34	84	56	140	
13	8-7	F	23	54	113	56	140	
14	4-9	M	17	39	80	56	140	
15	7-7	F	28	53	131	56	140	
16	7-6	F	26	54	124	56	140	
17	11-10	M	6	9	39	42	42	*
18	8-8	M	28	53	126	56	140	
19	9-7	F	28	54	124	56	140	
20	11-3	F	13	45	88	56	140	
Mean	8-10		21.1	40.1	95.6	52.5	129.1	

* relapse

APPENDIX 2.8. Experiment 2.2: Summary of covariate analysis of variance with planned comparisons of groups after eight weeks of treatment.

Wet nights

SOURCE	SS	df	MS	F RATIO	p
Group	16240.05	5	3248.01	40.33	< .001
Regression	4348.43	1	4348.43	54.44	< .001
Error	9100.22	113	80.53		
Total	29688.70	119			

PLANNED COMPARISONS	t value (113 df)	p
1. DBT without alarm versus Control group	2.67	< .01
2. Combination of four groups having alarm-based treatment versus combination of the two no-alarm groups.	13.84	< .001
3. Combination of DBT with alarm groups versus standard conditioning group	1.31	NS
4. DBT (parents) versus combination of the DBT (hospital) and DBT (therapist) groups.	1.06	NS
5. DBT (hospital) versus combination of the DBT (parents) and DBT (therapist) groups.	.84	NS

Number of days to last wet night

SOURCE	SS	df	MS	F RATIO	p
Group	10691.35	5	2138.27	9.17	< .001
Regression	1296.31	1	1296.31	5.55	< .05
Error	26354.74	113	233.23		
Total	38342.40	119			

PLANNED COMPARISONS	t value (113 df)	p
1. BBT without alarm versus Control group.	.43	NS
2. Combination of four groups having alarm-based treatment versus combination of the two no-alarm groups.	6.47	< .001
3. Combination of DBT with alarm groups versus standard conditioning group.	1.51	NS
4. DBT (parents) versus combination of the DBT (hospital) and DBT (therapist) groups.	.37	NS
5. DBT (hospital) versus combination of the DBT (parents) and DBT (therapist) groups.	1.20	NS

APPENDIX 2.9. Experiment 2.2: Summary of covariate analysis of variance with planned comparisons of groups after 20 weeks of treatment.

VARIABLE	SOURCE	SS	df	MS	F RATIO	p
Wet nights	Group	105843.36	4	26460.84	92.72	< .001
	Regression	8317.23	1	8317.23	29.15	< .001
	Error	26825.02	94	285.37		
	Total	140985.61	99			
	PLANNED COMPARISONS				t value (94 df)	p
	1. Control group versus combination of the four groups having alarm-based treatment.				19.08	< .001
	2. Standard conditioning versus combination of the three DBT with-alarm group.				2.29	< .05
Number of days to last wet night	SOURCE	SS	df	MS	F RATIO	p
	Group	134891.70	4	33722.93	30.21	< .001
	Regression	10218.78	1	10218.78	9.15	< .01
	Error	104934.52	94	1116.32		
	Total	260045.00	99			
	PLANNED COMPARISONS				t value (94 df)	p
	1. Control group versus combination of the four groups having alarm-based treatment.				10.58	< .001
	2. Standard conditioning versus combination of the three DBT with-alarm groups.				2.79	< .01

APPENDIX 3.1. Experiment 3.1: Summary of data for subjects in each group.

Group	Subject number	Age (years and months)	Sex	Baseline wetting frequency	Initial 8 weeks of treatment: Number of wet nights	Initial 8 weeks of treatment: Number of days to last wet night	Initial 8 weeks of treatment: Percentage of group meetings attended	Subsequent 14 weeks of treatment: Number of wet nights	Subsequent 14 weeks of treatment: Number of days to last wet night	Subsequent 14 weeks of treatment: Percentage of group meetings attended	6-month follow-up
DBT with alarm following 4-week baseline	1	8-10	M	13	5	34	85	NOT APPLICABLE			
	2	10-11	M	14	9	36	100				*
	3	7-1	M	24	9	32	100				
	4	8-4	F	20	6	18	100				
	5	6-11	M	20	7	20	100				
	6	9-11	F	21	11	30	35				
	7	9-10	M	6	0	0	100				
	8	7-5	M	28	29	29	100				*
	9	7-0	F	28	14	42	70				*
	10	8-4	M	24	21	52	100				
	Mean	8-5		19.8	9.0	29.3	89.0				

* Relapse

APPENDIX 3.1 cont.

Group	Subject number	Age (years and months)	Sex	Baseline wetting frequency	Initial 8 weeks of treatment: Number of wet nights	Initial 8 weeks of treatment: Number of days to last wet night	Initial 8 weeks of treatment: Percentage of group meetings attended	Subsequent 14 weeks of treatment: Number of wet nights	Subsequent 14 weeks of treatment: Number of days to last wet night	Subsequent 14 weeks of treatment: Percentage of group meetings attended	6-month follow-up
DBT with alarm following 8 weeks of no-alarm treatment	1	7-10	F	24	24	56	88	2	5	30	*
	2	7-10	F	16	20	56	75	30	67	100	
	3	10-5	M	23	34	56	25	20	27	20	
	4#	10-7	F	13	8	0	88	4	12	100	*
	5	12-6	M	23	30	56	75	63	98	60	
	6#	8-0	F	22	7	24	100	2	5	100	
	7	9-5	F	6	10	56	63	5	25	25	
	8	10-10	M	20	23	56	25	9	15	33	*
	9	7-6	F	23	40	56	40	24	50	63	*
	10	8-4	F	20	22	56	25	26	45	20	
	Mean	9-4		19.0	21.8	47.2	60.4	18.5	34.9	55.1	

* Relapse

\# Subjects relapsed after achieving dryness criterion during no-alarm treatment phase.

APPENDIX 3.1 cont.

					Initial 8 weeks of treatment			Subsequent 14 weeks of treatment			
Group	Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights	Number of days to last wet night	Percentage of group meetings attended	Number of wet nights	Number of days to last wet night	Percentage of group meetings attended	6-month follow-up
DBT with alarm following 12 weeks without treatment (Control Group)	1	7-3	M	26	55	56	Not Applicable	7	9	100	
	2	9-7	M	28	56	56		19	73	70	
	3	7-6	M	28	55	56		29	93	20	
	4	10-1	F	27	55	56		14	31	30	
	5	11-3	M	25	53	56		12	32	40	*
	6	8-6	M	28	56	56		9	14	100	
	7	11-2	M	18	35	56		6	25	100	**
	8	8-1	F	6	12	56		5	16	65	
	9	11-5	M	10	19	56		10	44	15	
	10	9-8	M	5	9	56		5	19	100	
	Mean	9-5		20.1	40.5	56.0		11.6	35.6	64.0	

* relapse

APPENDIX 3.2. Experiment 3.1: Summary of covariate analysis of variance with planned comparisons of groups after eight weeks of treatment.

VARIABLE	SOURCE	SS	df	MS	F RATIO	p
Wet nights	Group	4836.87	2	2418.34	40.82	< .001
	Regression	3413.76	1	3413.76	57.62	< .001
	Error	1540.34	26	59.24		
	Total	9790.97	29			
	PLANNED COMPARISONS				t value (26 df)	p
	1. DBT without alarm versus Control group.				4.95	< .001
	2. DBT with alarm versus no-alarm groups combined.				7.55	< .001
Number of days to last wet night	SOURCE	SS	df	MS	F RATIO	p
	Group	3692.86	2	1846.42	9.95	< .001
	Regression	386.99	1	386.99	2.09	NS
	Error	4822.71	26	185.49		
	Total	8902.56	29			
	PLANNED COMPARISONS				t value (26 df)	p
	1. DBT without alarm versus Control group.				1.35	NS
	2. DBT with alarm versus no-alarm groups combined.				4.25	< .001

APPENDIX 3.3. Experiment 3.1: Summary tables of oneway analysis of variance for three groups treated by DBT with alarm.

VARIABLE	SOURCE	SS	df	MS	F RATIO	p
Wet nights	Group	482.07	2	241.03	1.62	NS
	Error	4024.90	27	149.07		
	Total	4506.97	29			
Number of days to last wet night	Group	238.47	2	119.23	< 1.0	NS
	Error	16779.40	27	621.46		
	Total	17017.87	29			

APPENDIX 3.4. Experiment 3.1: Summary tables of covariate analysis of variance with planned comparisons of groups treated by DBT with and without a urine-alarm device.

VARIABLE	SOURCE	SS	df	MS	F RATIO	p
Wet nights	Group	7269.83	3	2423.28	34.31	< .001
	Regression	2266.74	1	2266.74	32.10	< .001
	Error	8121.60	115	70.62		
	Total	17658.17	119			
	PLANNED COMPARISONS				t value (115 df)	p
	1. Group DBT with alarm versus individual DBT with alarm.				.84	NS
	2. Group DBT without alarm versus individual DBT without alarm.				2.93	< .01
	3. Combination of DBT with alarm groups versus combination of DBT without alarm groups.				8.12	< .001
Number of days to last wet night	SOURCE	S	df	MS	F RATIO	p
	Group	7949.71	3	2649.90	10.54	< .001
	Regression	1355.19	1	1355.19	5.39	< .05
	Error	28911.73	115			
	Total	38216.63	119			
	PLANNED COMPARISONS				t value (115 df)	p
	1. Group DBT with alarm versus individual DBT with alarm.				.24	NS
	2. Group DBT without alarm versus individual DBT without alarm.				.24	NS
	3. Combination of DBT with alarm groups versus combination of DBT without alarm groups.				5.14	< .001

APPENDIX 4.1. Experiment 4.1: Instructions for standard conditioning plus waking schedule.

This training is in 3 stages:-

Part 1 is the All night training. This is done on one night only.

Part 2 starts the following night and tells how to wake the child on a special schedule.

Part 3 begins when the child has reached 7 consecutive dry nights.

PART 1:- ALL NIGHT TRAINING

STEP A: At Bedtime

1. Set up bedwetting alarm according to the enclosed instruction sheet (see Appendix 2.1).
2. Explain to child what will be happening, that is, that tonight she will be woken every hour to practise going to the toilet and that if she wets, she will have to change her bedsheets and go to the toilet again.
3. Child now goes to sleep.

STEP B: Hourly Awakenings

1. Every hour thereafter on the first night wake the child and send her off to the toilet.
2. Wake child, using as little prompting as possible, that is if you need, the first time, to sit the child up in bed and gently shake her; next time try just shaking her gently on the shoulder without sitting her up. The idea is to reduce each time the things you do to wake her up so that she will learn to get up by herself. Do not turn on the bedroom light unless this is really necessary. If the child does not go straight to the toilet on wakening, point towards the toilet and ask "Where do you go when I wake you up?" If the child still does not walk towards the toilet, take her quickly into the toilet saying, "You have to hurry to the toilet if you don't want to wet your bed."
3. Child goes to the toilet and returns to bed.
4. At bedtime, ask child if her bedsheets are dry and get her to feel them and tell you that they are dry.
5. Parent praises child for having a dry bed and encourages her to keep it dry for the next hour.

APPENDIX 4.1 cont.

6. Get child to repeat training instructions for the next hourly toileting.
7. Child returns to sleep.

STEP C: When Child Wets the Bed

1. Wake child and give brief reprimand.
2. Turn off bedwetting alarm.
3. Send child to toilet to finish urinating.
4. Child is given cleanliness training -
   a) child has to change pyjamas,
   b) child takes off wet draw sheet, wipes rubber sheet and puts wet sheet into laundry,
   c) child puts on dry draw sheet,
   d) parent switches bedwetting alarm on again,
   e) child returns to sleep.

PART 2:- NIGHT AFTER INITIAL TRAINING

STEP A: Before Bedtime

1. Bedwetting alarm set.
2. Remind child of need to remain dry and tell her that if she wets she will have to go through cleanliness training.
3. Ask child to repeat your instructions so that you are sure she knows them.

STEP B: Night Toileting

1. Awaken child about 3 hours after she has gone to bed and send her to the toilet.
2. After each dry night, awaken the child 30 minutes earlier than on the previous night.
3. Stop waking the child when you are down to within one hour from her bedtime.

STEP C: Accidents

If the child wets the bed, give her the cleanliness training immediately.

APPENDIX 4.1 cont.

STEP D: After a Dry Night

1. Family praises the child for not wetting her bed.
2. Family praises her again at least 5 times during the day, e.g. during meals, just before bedtime, etc.
3. Parents encourage other relatives to praise the child for not wetting.

PART 3:- NORMAL ROUTINE

Begins when the child has had 7 dry nights in a row.

1. Take the alarm off the bed.
2. Inspect child's bed each morning and record whether it is wet or dry.
3. If a child wets on two nights in one week, go back to PART 2 (night after initial training) until the child again has 7 consecutive dry nights and then return to PART 3 (normal routine).
4. Treatment is regarded as completed when the child reaches 14 consecutive dry nights.

Please contact Mr. J. Bollard (Psychologist) each week at the pre-arranged time in order to report on progress (Telephone 2674999, ext 227).

APPENDIX 4.2. Experiment 4.1: Instructions for standard conditioning plus retention control training.

This training is in 3 stages:-

Part 1 is the All night training. This is done on one night only.

Part 2 starts the following night and describes the procedure to follow each time the child wets the bed.

Part 3 begins when the child has reached seven consecutive dry nights.

PART 1:- ALL NIGHT TRAINING

STEP A: At Bedtime

1. Set up bedwetting alarm according to the enclosed instruction sheet (see Appendix 2.1).
2. Child drinks as much as she can of her favourite drink.
3. Explain to child what will be happening, i.e. that she will be woken hourly to practise going to the toilet.
4. Child now goes to bed.

STEP B: Hourly Awakenings

1. Wake child, using as little prompting as possible, that is if you need, the first time, to sit the child up in bed and gently shake her; next time try just shaking her gently on the shoulder without sitting her up. The idea is to reduce each time the things you do to wake her up so that she will learn to get up by herself. Do not turn on the bedroom light unless this is really necessary. If the child does not go straight to the toilet on wakening, point towards the toilet and ask "Where do you go when I wake you up?" If the child still does not walk towards the toilet, take her quickly into the toilet saying. "You have to hurry to the toilet if you don't want to wet your bed".
2. Child walks to the toilet.
3. At the toilet door (before child goes in to urinate), ask child if she can go for one hour without urinating.

APPENDIX 4.2 cont.

(a) If child could not do this -

i) see if child can hold back for a few minutes,

ii) child urinates in toilet,

iii) parent praises child for correct toileting,

iv) child returns to bed.

(b) If child says she can hold in urine for one hour -

i) parent praises child for good control,

ii) child returns to bed.

4. At bedside, ask child if her bedsheets are dry and get her to feel them and tell you that they are dry.

5. Parent praises child for having a dry bed and encourages her to keep it dry for the next hour.

6. Get child to repeat training instructions for the next hourly toileting and give her another drink.

7. Child returns to sleep.

STEP C: When Child Wets the Bed

1. Wake the child and give brief reprimand.

2. Turn off bedwetting alarm.

3. Send child to toilet to finish urinating.

4. Child is given cleanliness training -

a) child has to change pyjamas,

b) child takes off wet draw sheet, wipes rubber sheet and puts wet sheet into laundry,

c) child puts on dry draw sheet,

d) parent switches bedwetting alarm on again,

e) child returns to sleep.

PART 2:- NIGHT AFTER INITIAL TRAINING

STEP A: Before Bedtime

1. Bedwetting alarm set.

2. Remind child of need to remain dry and tell her that if she wets she will have to go through cleanliness training.

APPENDIX 4.2 cont.

3. Ask child to repeat your instructions so that you are sure she knows them.

STEP B: Accidents

If the child wets the bed, give her the cleanliness training immediately.

STEP C: After a Dry Night

1. Family praises the child for not wetting the bed.
2. Family praises the child again at least five times during the day, e.g. during meals, just before bedtime, etc.
3. Parents encourage other relatives to praise the child for not wetting.

PART 3:- NORMAL ROUTINE

Begins when the child has had seven dry nights in a row.

1. Take the alarm off the bed.
2. Inspect the child's bed each morning and record when it is wet or dry.
3. If the child wets on two or more nights in one week, go back to PART 2 (night after initial training) until the child again has seven consecutive dry nights and then return to PART 3 (normal routine).
4. Treatment is regarded as completed when the child reaches 14 consecutive dry nights.

Please contact Mr. J. Bollard (Psychologist) each week at the pre-arranged time in order to report on progress (Telephone 2674999, Ext. 227).

APPENDIX 4.3. Experiment 4.1: Instructions for standard conditioning plus positive practice.

This training is done in three stages -

PART 1 describes the initial training night.

PART 2 describes the procedure on each subsequent night until the child achieves seven consecutive dry nights.

PART 3 begins when the child has reached seven consecutive dry nights.

PART 1:- INITIAL TRAINING NIGHT

STEP A: Half Hour Before Bedtime

1. Set up bedwetting alarm according to the enclosed instruction sheet (see Appendix 2.1).

2. Positive Practice Training

   a) child lies in bed with light off,

   b) child counts up to 50 slowly and silently,

   c) child gets up and goes to the toilet and tries to urinate,

   d) child returns to bed,

   e) child repeats steps a, b, c, and d, until she has done this 20 times.

During this, the parent stays out of the room, but keeps a check on the number of trips to the toilet.

3. Explain to the child that if he/she wets the bed, the positive practice procedure will follow immediately together with the requirement that he/she changes the wet sheets, deposits them in the laundry and re-makes the bed.

STEP B: At Bedtime

1. Child repeats training instructions.

2. Child now goes to sleep.

STEP C: When Child Wets the Bed

1. Wake child and give brief reprimand.

2. Turn off the bedwetting alarm.

APPENDIX 4.3 cont.

3. Send child to toilet to finish urinating.

4. Child is given cleanliness training -

   a) child has to change pyjamas,

   b) child takes off wet draw sheet, wipes rubber sheet and puts wet sheet into laundry,

   c) child puts on dry draw sheet,

   d) parent switches bedwetting alarm on again.

5. Tell the child she needs more practise to stay dry. Child then immediately given Positive Practise in correct toileting (20 trials of lying on bed then going to the toilet as in A2).

6. The following evening before bedtime, the child is given another 20 trials of Positive Practise.

PART 2:- NIGHTS AFTER INITIAL TRAINING

STEP A: Before Bedtime

1. Bedwetting alarm set.

2. Give child Positive Practise training if she wets the bed the previous night.

3. Remind child of need to remain dry and tell her that if she wets she will have to go through cleanliness training (remaking bed) and Positive Practise (20 trials).

4. Ask child to repeat your instructions so that you are sure she knows them.

STEP B: Accidents

If the child wets the bed, give her the cleanliness training and Positive Practise immediately after wetting and give her Positive Practise again at bedtime the next night.

STEP C: After a Dry Night

1. Family praises the child for not wetting her bed.

2. Family praises her again at least five times during the day, e.g. during meals, just before bedtime, etc.

3. Parents encourage other relatives to praise the child for not wetting.

APPENDIX 4.3 cont.

PART 3:- NORMAL ROUTINE

1. After seven consecutive dry nights, stop using the bedwetting alarm.

2. Inspect child's bed each morning. If bed is wet, have child remake it immediately and before bedtime the same day, give her another 20 trials of Positive Practise.

3. If the child wets on 2 nights in one week, go back to II (night after initial training) until the child again has 7 consecutive dry nights and then return to III (normal routine).

4. Treatment is regarded as completed when the child reaches 14 consecutive dry nights.

Please contact Mr. J. Bollard (Psychologist) each week at the pre-arranged time in order to report on progress (Telephone 2674999, Ext. 227).

APPENDIX 4.4. Experiment 4.1: Instructions for standard conditioning plus waking schedule and retention control training.

This training is in 3 stages:-

Part 1 is the All night training. This is done on one night only.

Part 2 starts the following night and tells how to wake the child on a special schedule.

Part 3 begins when the child has reached seven consecutive dry nights.

PART 1:- ALL NIGHT TRAINING

STEP A: At Bedtime

1. Set up bedwetting alarm according to the enclosed instruction sheet (see Appendix 2.1).
2. Child drinks as much as she can of her favourite drink.
3. Explain to child what will be happening, i.e. that she will be woken hourly to practise going to the toilet and that if she wets she will have to change her bedsheets and go to the toilet again.
4. Child now goes to sleep.

STEP B: Hourly Awakenings

1. Wake child, using as little prompting as possible, that is if you need, the first time, to sit the child up in bed and gently shake her; next time try just shaking her gently on the shoulder without sitting her up. The idea is to reduce each time the things you do to wake her up so that she will learn to get up by herself. Do not turn on the bedroom light unless this is really necessary. If the child does not go straight to the toilet on wakening, point towards the toilet and ask, "Where do you go when I wake you up?" If the child still does not walk towards the toilet, take her quickly into the toilet saying, "You have to hurry to the toilet if you don't want to wet your bed".
2. Child walks to the toilet.
3. At the toilet door (before child goes in to urinate), ask child if she can go for one hour without urinating.

APPENDIX 4.4 cont.

a) If child could not do this -

i) see if child can hold back for a few minutes,

ii) child urinates in toilet,

iii) parent praises child for correct toileting,

iv) child returns to bed.

b) If child says she can hold in urine for one hour -

i) parent praises child for good control,

ii) child returns to bed.

4. At bedside, ask child if her bedsheets are dry and get her to feel them and tell you that they are dry.

5. Parent praises child for having a dry bed and encourages her to keep it dry for the next hour.

6. Get child to repeat training instructions for the next hourly toileting and give her another drink.

7. Child returns to sleep.

STEP C: When Child Wets the Bed

1. Wake child and give brief reprimand.

2. Turn off bedwetting alarm.

3. Send child to toilet to finish urinating.

4. Child is given cleanliness training -

a) child has to change pyjamas,

b) child takes off wet draw sheet, wipes rubber sheet and puts wet sheet into laundry,

c) child puts on dry draw sheet,

d) parent switches bedwetting alarm on again,

e) child returns to sleep.

PART 2:- NIGHT AFTER INITIAL TRAINING

STEP A: Before Bedtime

1. Bedwetting alarm set.

APPENDIX 4.4 cont.

2. Remind child of need to remain dry and tell her that if she wets she will have to go through cleanliness training.

3. Ask child to repeat your instructions so that you are sure she knows them.

STEP B: Night Toileting

1. Awaken child about 3 hours after she has gone to bed and send her to the toilet.

2. After each dry night, awaken the child 30 minutes earlier than on the previous night.

3. Stop waking the child when you are down to within one hour from her bedtime.

STEP C: Accidents

If the child wets the bed, give her the cleanliness training immediately.

STEP D: After a Dry Night

1. Family praises the child for not wetting her bed.

2. Family praises her again at least 5 times during the day, e.g. during meals, just before bedtime, etc.

3. Parents encourage other relatives to praise the child for not wetting.

PART 3:- NORMAL ROUTINE

Begins when the child has had 7 dry nights in a row.

1. Take the alarm off the bed.

2. Inspect child's bed each morning and record whether it is wet or dry.

3. If a child wets on two nights in one week, go back to PART 2 (night after initail training) until the child again has 7 consecutive dry nights and then return to PART 3 (normal routine).

4. Treatment is regarded as completed when the child reaches 14 consecutive dry nights.

Please contact Mr. J. Bollard (Psychologist) each week at the pre-arranged time in order to report on progress. (Telephone 2674999, Ext. 227).

APPENDIX 4.5. Experiment 4.1: Instructions for standard conditioning plus retention control training and positive practice.

This training is in three stages:-

Part 1 is the all night training. This is done on the first night only.

Part 2 starts the following night, and describes the procedure to follow each time the child wets the bed.

Part 3 begins when the child has reached seven consecutive dry nights.

PART 1:- ALL NIGHT TRAINING

STEP A: Half Hour Before Bedtime

1. Set up bedwetting alarm according to the enclosed instruction sheet (see Appendix 2.1).
2. Explain to child what will be happening, that is, that tonight she will be woken every hour to practise going to the toilet and that if she wets, she will have to change her bedsheets and practise going to the toilet several times.
3. Give child her favourite drink.
4. Positive Practise Training

   a) child lies in bed with light off,

   b) child counts up to 50 slowly and silently,

   c) child gets up and goes to the toilet and tries to urinate,

   d) child returns to bed,

   e) child repeats steps a, b, c, and d, until she has done this 20 times.

   During this, the parents stay out of the room, but keeps a check of the number of trips to the toilet.

STEP B: At Bedtime

1. Child drinks as much as she can of her favourite drink
2. Child repeats training instructions, i.e. that she will be woken hourly to practise going to the toilet and if she wets, she will have to change her sheets and practise going to the toilet several times.

APPENDIX 4.5 cont.

3. Child now goes to sleep.

STEP C: Hourly Awakenings

1. Wake child, using as little prompting as possible, that is if you need, the first time, to sit the child up in bed and gently shake her; next time try just shaking her gently on the shoulder without sitting her up. The idea is to reduce each time the things you do to wake her up so that she will learn to get up by herself. Do not turn on the bedroom light unless this is really necessary. If the child does not go straight to the toilet on wakening, point towards the toilet and ask, "Where do you go when I wake you up?" If the child still does not walk towards the toilet, take her quickly into the toilet saying, "You have to hurry to the toilet if you don't want to wet your bed".
2. Child walks to the toilet.
3. At the toilet door (before child goes in to urinate) ask child if she can go for one hour without urinating.

   a) If child could not do this -

      i) see if child can hold back for a few minutes,

      ii) child urinates in toilet,

      iii) parent praises child for correct toileting,

      iv) child returns to bed.

   b) If child says she can hold urine for one hour -

      i) parent praises child for good control,

      ii) child returns to bed.

4. At bedside, ask child if her bedsheets are dry and get her to feel them and tell you that they are dry.
5. Parent praises child for having a dry bed and encourages her to keep it dry for the next hour.
6. Get child to repeat training instructions for the next hourly toileting and give her another drink.
7. Child returns to sleep.

STEP D: When Child Wets the Bed

1. Wake child and give brief reprimand.
2. Turn off the bedwetting alarm.

APPENDIX 4.5 cont.

3. Send child to toilet to finish urinating.
4. Child is given cleanliness training -
   a) child has to change pyjamas,
   b) child takes off wet draw sheet, wipes rubber sheet and puts wet sheet into laundry,
   c) child puts on dry draw sheet,
   d) parent switches bedwetting alarm on again.
5. Tell the child she needs more practise to stay dry. Child then immediately given Positive Practise in correct toileting (20 trials of lying on bed then going to the toilet as in A4).
6. The following evening before bedtime, the child is given another 20 trials of Positive Practise.

PART 2: - NIGHT AFTER INITIAL TRAINING

STEP A: Before Bedtime

1. Bedwetting alarm set.
2. Give child Positive Practise training if she wet the bed the previous night.
3. Remind child of need to remain dry and tell her that if she wets she will have to go through cleanliness training (remaking bed) and Positive Practise (20 trails).
4. Ask child to repeat your instructions so that you are sure he/she knows them.

STEP B: Accidents

If the child wets the bed, give her the cleanliness training and Positive Practise immediately after wetting and give her Positive Practise again at bedtime the next night.

STEP C: After a Dry Night

1. Family praises the child for not wetting the bed.
2. Family praises her again at least five times during the day, e.g. during meals, just before bedtime, etc.
3. Parents encourage other relatives to praise the child for not wetting.

APPENDIX 4.5 cont.

PART 3:- NORMAL ROUTINE

Begins when the child has had seven dry nights in a row.

1. Take the alarm off the bed.
2. Inspect child's bed each morning and record whether it is wet or dry.
3. If a child wets on two nights in one week, go back to PART 2 (night after training) until the child again has seven consecutive dry nights and then return to PART 3 (normal routine).
4. Treatment is regarded as completed when the child reaches 14 consecutive dry nights.

Please contact Mr. J. Bollard (Psychologist) each week at the pre-arranged time in order to report on progress. (Telephone 2674999, Ext. 227).

APPENDIX 4.6. Experiment 4.1: Instructions for standard conditioning plus waking schedule and positive practice.

This training is in three stages.

Part 1 is the All night training. This is done on one night only.

Part 2 starts the following night and tells how to wake the child on a special schedule.

Part 3 begins when the child has reached seven consecutive dry nights.

PART 1:- ALL NIGHT TRAINING

STEP A: Half Hour Before Bedtime

1. Set up bedwetting alarm according to the enclosed instruction sheet (see Appendix 2.1).
2. Explain to the child what will be happening, that is, that tonight she will be woken every hour to practise going to the toilet and that if she wets, she will have to change her bedsheets and practise going to the toilet several times.
3. Positive Practise Training

   a) child lies in bed with light off,

   b) child counts up to 50 slowly and silently,

   c) child gets up and goes to the toilet and tries to urinate,

   d) child returns to bed,

   e) child repeats steps a, b, c, and d, until she has done this 20 times.

   During this, the parent stays out of the room, but keeps a check of the number of trips to the toilet.

STEP B: At Bedtime

1. Child repeats training instructions, i.e. that she will be woken hourly to practise going to the toilet and if she wets, she will have to change her sheets and practise going to the toilet several times.
2. Child now goes to sleep.

APPENDIX 4.6 cont.

STEP C: Hourly Awakenings

1. Wake child, using as little prompting as possible, that is if you need, the first time, to sit the child up in bed and gently shake her; next time try just shaking her gently on the shoulder without sitting her up. The idea is to reduce each time the things you do to wake her up so that she will learn to get up by herself. Do not turn on the bedroom light unless this is really necessary. If the child does not go straight to the toilet on wakening, point towards the toilet and ask "Where do you go when I wake you up?" If the child still does not walk towards the toilet, take her quickly into the toilet saying, "You have to hurry to the toilet if you bon't want to wet your bed".
2. Child goes to the toilet and returns to bed.
3. At bedside, ask child if her bedsheets are dry and get her to feel them and tell you that they are dry.
4. Parent praises child for having a dry bed and encourages her to keep it dry for the next hour.
5. Get child to repeat training instructions for the next hourly toileting.
6. Child returns to sleep.

STEP D: When Child Wets the Bed

1. Wake child and give brief reprimand.
2. Turn off bedwetting alarm.
3. Send child to toilet to finish urinating.
4. Child is given cleanliness training -
   a) child has to change pyjamas,
   b) child takes off wet draw sheet, wipes rubber sheet and puts wet sheet into laundry,
   c) child puts on dry draw sheet,
   d) parent switches bedwetting alarm on again.
5. Tell the child she needs more practise to stay dry. Child then immediately given Positive Practise in correct toileting (20 trials of lying on bed then going to the toilet as in A3).
6. The following evening before bedtime, the child is given another 20 trials of Positive Practise.

APPENDIX 4.6 cont.

PART 2:- NIGHT AFTER INITIAL TRAINING

STEP A: Before Bedtime

1. Give child Positive Practise training if she wets the bed the previous night.
2. Remind child of need to remain dry and tell her that if she wets she will have to go through cleanliness training (remaking bed) and Positive Practise (20 trials).
3. Ask child to repeat yout instructions so that you are sure she knows them.

STEP B: Night Toileting

1. Awaken child about 3 hours after she has gone to bed and send her to the toilet.
2. After each dry night, awaken the child 30 minutes earlier than on the previous night.
3. Stop waking the child when you are down to within one hour from her bedtime.

STEP C: Accidents

If the child wets the bed, give her the cleanliness training and Positive Practise immediately after wetting and give her Positive Practise again at bedtime the next night.

STEP D: After a Dry Night

1. Family praises the child for not wetting her bed.
2. Family praises her again at least 5 times during the day, e.g. during meals, just before bedtime, etc.
3. Parents encourage other relatives to praise the child for not wetting.

PART 3:- NORMAL ROUTINE

Begins when the child has had seven dry nights in a row.

1. Take the alarm off the bed.
2. Inspect child's bed each morning. If bed is wet, have child remake it immediately and before bedtime the same day, give her another ten trials of Positive Practise.

APPENDIX 4.6 cont.

3. If the child wets on two nights in one week, go back to PART 2 (night after initial training) until the child again has 7 consecutive dry nights and then return to PART 3 (normal routine).

4. Treatment is regarded as completed when the child reaches 14 consecutive dry nights.

Please contact Mr. J. Bollard (Psychologist) each week at the pre-arranged time in order to report on progress (Telephone 2674999, Ext. 227).

APPENDIX 4.7. Experiment 4.1: Summary of data for children in each group.
Group 1 - Standard conditioning (see Appendix 2.7, group 1 and Appendix 2.7, group 5).

APPENDIX 4.7 cont.

Group 2 - Standard conditioning plus waking schedule.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night
1	7-7	M	28	4	24
2	17-0	M	12	4	8
3	12-3	M	16	12	50
4	6-4	F	27	19	40
5	9-8	M	24	24	102
6	6-10	F	10	5	19
7	5-6	F	28	47	95
8	12-4	M	18	7	54
9	11-1	M	20	10	19
10	13-4	M	6	2	23
11	9-2	M	28	8	24
12	7-0	M	28	15	27
Mean	10-0		20.4	13.1	40.4

APPENDIX 4.7 cont.

Group 3 - Standard conditioning plus retention control training.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night
1	8-4	F	23	23	31
2	6-1	F	20	19	46
3	7-10	M	27	45	140
4	9-3	F	17	13	30
5	10-3	M	24	17	36
6	9-8	M	14	26	65
7	10-8	M	28	13	27
8	7-11	M	28	29	48
9	7-0	M	28	26	83
10	12-6	M	28	62	136
11	10-2	F	8	3	7
12	9-11	M	27	10	31
Mean	7-1		22.7	23.8	56.7

APPENDIX 4.7 cont.

Group 4 - Standard conditioning plus positive practice.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night
1	13-8	M	11	3	19
2	6-8	F	27	15	22
3	7-0	F	28	10	37
4	8-2	M	27	13	29
5	7-1	M	18	13	32
6	10-3	F	24	6	18
7	5-8	F	28	79	140
8	11-4	M	28	88	140
9	10-6	F	28	14	44
10	8-0	M	24	22	51
11	9-10	M	24	10	19
12	13-10	M	6	4	20
Mean	9-4		22.8	23.1	47.6

APPENDIX 4.7 cont.

Group 5 - Standard conditioning plus waking and retention control training.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night
1	6-1	F	28	7	9
2	8-0	M	27	27	34
3	10-7	M	15	17	45
4	13-2	M	12	4	25
5	10-8	F	28	22	75
6	8-7	M	28	12	19
7	7-11	M	28	10	21
8	13-9	M	14	9	70
9	6-9	M	25	18	72
10	10-1	M	28	10	38
11	13-2	F	16	18	57
12	8-9	M	24	8	22
Mean	9-10		22.8	14.0	40.6

APPENDIX 4.7. cont.

Group 6 - Standard conditioning plus waking and positive practice.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night
1	9-3	F	9	0	0
2	11-2	F	12	7	42
3	9-9	M	16	10	30
4	11-7	F	28	17	33
5	7-6	M	10	7	49
6	11-5	M	24	23	85
7	10-2	F	24	15	33
8	13-5	M	28	5	25
9	8-9	M	28	8	22
10	14-10	F	16	8	43
11	6-2	M	28	8	20
12	11-1	M	28	6	8
Mean	10-5		20.9	9.5	32.5

APPENDIX 4.7 cont.

Group 7 - Standard conditioning plus retention control training and positive practice.

Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights after 20 weeks	Number of days to last wet night
1	10-1	F	28	12	27
2	9-6	M	24	8	11
3	9-5	M	28	82	140
4	7-6	M	27	15	28
5	9-10	M	24	16	43
6	12-0	F	24	14	26
7	7-6	M	25	22	49
8	10-3	F	25	7	18
9	6-9	M	25	18	72
10	9-2	M	28	47	126
11	8-11	F	20	5	13
12	13-3	F	8	7	54
Mean	10-6		23.8	21.1	50.6

APPENDIX 4.8. Experiment 4.1: Regression of baseline wetting frequency against number of wet nights during 20 weeks of treatment for eight groups.

Pearson r = 0.30, df = 125, $p < .05$

Regression slope = 0.1

The dependent variable (number of wet nights during treatment was then adjusted for subsequent analysis according to the formula -

new dependent variable = wets during treatment - (0.1 x baseline).

APPENDIX 4.9. Experiment 4.1: Analysis of variance of adjusted number of wet nights during treatment.

SOURCE	SS	df	MS	F RATIO	p
Between groups	5867.07	7	838.15	2.39	< .05
Within groups	41759.37	119	350.92		
Total	47626.44	126			

APPENDIX 4.9 cont.

Duncan post hoc comparisons of eight groups.

	GROUP							
	Standard conditioning plus waking schedule, positive practice	Standard conditioning plus waking schedule, positive control training (i.e. the full DBT programme)	Standard conditioning plus waking schedule	Standard conditioning plus waking schedule, retention control training	Standard conditioning plus positive practice, retention control training	Standard conditioning plus positive practice	Standard conditioning plus retention control training	Standard conditioning alone
Mean adjusted number of wet nights	7.41	9.12	11.04	11.23	18.70	20.81	21.57	25.04

Treatments underlined by a common line do not differ from each other (critical $p < .05$); treatments not underlined by a common line do differ from each other (critical $p < .05$).

APPENDIX 5.1. Experiment 5.1: Data for subjects who remained dry/relapsed following initial treatment.

Subjects who remained dry.							
Group	Subject number	Age	Sex	Baseline wetting frequency	Number of wet nights during treatment	Number of days to last wet night	Primary versus secondary enuresis
DBT	1	11-7	M	28	6	12	p
	2	9-3	M	14	9	37	p
	3	9-11	M	27	9	14	p
	4	10-2	F	20	6	31	s
	5	7-2	M	14	9	40	p
	6	10-0	M	24	7	16	p
	7	11-11	F	11	10	41	p
	8	5-8	F	27	16	25	p
	9	5-10	M	5	0	0	p
	10	8-8	M	23	12	39	p
	11	6-5	M	28	22	33	p
	12	15-0	M	23	4	6	p
	13	9-2	F	15	21	63	p
	14	11-5	F	4	16	46	s
	15	10-3	F	4	0	0	p
	16	6-8	F	15	5	24	p
	17	8-3	M	28	16	39	p
	18	8-1	M	23	0	0	p
	19	5-11	M	28	18	49	p
	20	8-10	F	27	13	48	s
	21	9-5	M	12	8	28	p
	22	7-11	M	25	4	11	p
	23	8-5	M	24	10	16	p
	24	11-5	M	20	32	105	p
	25	8-0	F	27	4	4	p
	26	9-10	M	17	4	7	p
	27	11-7	M	24	8	14	p
	28	4-2	M	28	24	33	p
	29	8-7	F	27	17	32	p
	30	11-9	M	11	8	37	p
	31	6-0	M	28	13	30	s
	32	9-7	M	23	63	125	p
	33	11-10	M	17	19	45	p
	34	8-3	M	21	4	14	p
	Mean	9-0		20.4	12.3	31.3	

APPENDIX 5.1 cont.

Group	Subject number	Age	Sex	Baseline wetting frequency	Number of wet nights during treatment	Number of days to last wet night	Primary versus secondary enuresis
Standard conditioning	1	6-9	M	27	3	14	p
	2	8-7	M	28	56	89	s
	3	9-10	F	23	12	36	p
	4	9-3	F	24	6	14	p
	5	8-0	M	28	55	191	p
	6	10-5	M	23	11	37	p
	7	11-11	M	15	4	31	s
	8	5-11	F	25	14	50	p
	9	12-2	F	17	6	13	p
	10	7-6	M	27	12	54	p
	11	12-8	M	18	11	45	p
	12	10-1	M	16	34	78	p
	13	11-4	M	27	34	55	p
	14	11-5	F	16	8	14	p
	15	11-9	M	11	13	35	p
	16	10-8	M	26	15	37	p
	17	10-8	F	19	63	180	p
	Mean	9-4		20.7	21.0	57.3	

APPENDIX 5.1 cont.

Subjects who relapsed

Group	Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights during initial treatment	Number of days to last wet night during initial treatment	Time of relapse (months)	Primary versus secondary enuresis	History of diurnal wetting (DW)	Renewed wetting frequency	Number of wet nights during second treatment	Number of days to last wet night during second treatment
DBT	1	9-4	M	28	10	16	6	p		20	3	8
	2	11-8	M	25	10	38	6	p	DW		not re-treated	
	3	10-5	M	28	14	65	24	s		12	10	37
	4	9-8	M	23	12	47	24	p		10	19	59
	5	12-7	M	24	16	34	6	p		11	8	18
	6	8-1	F	20	10	22	3	s			not re-treated	
	7	7-10	M	27	29	103	12,24	p			not re-treated	
	8	9-3	F	26	14	24	6,24	p		12	2	3
	9	6-3	M	27	15	40	6	p			not re-treated	
	10	8-5	M	22	15	47	24	p			not re-treated	
	11	7-4	M	15	10	25	6,24	p	DW	15	17	36
	12	8-7	F	27	7	26	12	p	DW	20	6	22
	13	9-9	M	24	16	47	3	p		20	4	12
	14	8-10	M	15	6	39	3	p		8	3	23
	15	9-10	F	26	9	16	3	p	DW	27	8	17
	16	7-9	M	28	41	84	3,24	p	DW	6	13	79
	17	10-1	M	21	13	28	24	p		16	8	23
	18	8-6	F	27	9	17	3	p	DW	17	dropped out	
	19	12-1	M	18	7	23	12	p		12	6	24
	20	6-10	F	27	17	38	24	s			not re-treated	
	21	11-4	M	26	7	13	24	p		28	15	23
	22	10-7	F	11	10	31	24	p	DW		not re-treated	
	Mean	9-4		23.4	13.5	37.4				15.6	8.7	25.3

APPENDIX 5.1 cont.

Group	Subject number	Age (years and months)	Sex	Baseline wetting frequency	Number of wet nights during initial treatment	Number of days to last wet night during initial treatment	Time of relapse (months)	Primary versus secondary enuresis	History of diurinal wetting (DW)	Renewed wetting frequency	Number of wet nights during second treatment	Number of days to last wet night during second treatment
Standard conditioning	1	5-7	M	23	10	32	3,24	p		24	22	61
	2	7-7	M	26	27	78	3	p	DW	8	12	22
	3	6-1	F	25	4	4	12	s		20	10	29
	4	12-5	M	23	9	9	3,24	p	DW	18	6	11
	5	5-10	M	23	15	52	3	p		8	3	10
	6	9-7	M	25	56	160	6,12,24	s		8	5	16
	7	10-0	M	27	23	81	24	p			not re-treated	
	8	5-6	M	28	11	45	12	p	DW	10	0	0
	9	7-6	F	9	16	51	24	p		19	7	16
	10	8-4	M	17	18	81	3	p			not re-treated	
	11	14-0	M	10	22	34	12	p		13	8	30
	12	9-7	F	28	18	42	3	p		13	7	28
	Mean	8-6		22.8	19.1	55.8				14.1	8.0	22.3

APPENDIX 5.2. Experiment 5.1: Summary table of analysis of variance: Treatment method x Wetting frequency prior to treatment.

SOURCE	SS	df	MS	F RATIO	p
Between subjects	726.27	24			
Treatment method	.40	1	.40	< 1.0	NS
Error	725.87	23	31.56		
Within subjects	1729.95	25			
Wetting frequency prior to treatment	985.68	1	985.68	30.48	< .01
Treatment method x wetting frequency prior to treatment	.40	1	.40	< 1.0	NS
Error	743.87	23	32.34		
Total	2456.22	49			

APPENDIX 5.3. Experiment 5.1: Summary table of analysis of variance: Treatment method x Number of wet nights during treatment.

SOURCE	SS	df	MS	F RATIO	p
Between subjects	2457.90	24			
Treatment method	34.23	1	34.23	< 1.0	NS
Error	2423.67	23	105.38		
Within subjects	3125.38	25			
Number of wet nights during treatment	327.68	1		2.75	NS
Treatment method x number of wet nights during treatment	55.23	1	55.23	< 1.0	NS
Error	2742.47	23			
Total	5583.28	49			

REFERENCES

ABELEW, P.H. (1972).Intermittent schedules of reinforcement applied to conditioning treatment of enuresis. *Dissertation Abstracts International,* 33, 2799B-2800B.

ALLGEIER, A.R.(1976). Minimizing therapist supervision in the treatment of enuresis. *Journal of Behavior Therapy and Experimental Psychiatry,* 7, 371-372.

ARGUNER, A., BAYBAS, S., GOZUKIRMIZI, E., and ZEMBILCI,N.(1978). Focal and generalized abnormalities during sleep in cases of enuresis nocturna.In *Sleep 1978. Fourth European Congress on Sleep Research.* Tirgu - Mures, 1978, 717-720 (Karger,Basel,1980).

AZRIN, N.H. and FOXX, R.M. (1971). A rapid method of toilet training the institutionalized retarded. *Journal of Applied Behavior Analysis,* 4, 89-99.

AZRIN, N.H., and FOXX, R.M. (1974). *Toilet Training in Less than a Day.* New York: Simon and Schuster.

AZRIN, N.H., SNEED, T.J., and FOXX, R.M. (1973). Dry bed: A rapid method of eliminating bedwetting (enuresis) of the retarded. *Behaviour Research and Therapy,* 11, 427-434.

AZRIN, N.H., SNEED, T.J., and FOXX, R.M. (1974). Dry-Bed Training: Rapid elimination of childhood enuresis. *Behaviour Research and Therapy,* 12, 147-156.

AZRIN, N.H., and THIENES, P.M. (1978). Rapid elimination of enuresis by intensive learning without a conditioning apparatus. *Behavior Therapy,* 9, 342-354.

AZRIN, N.H., THIENES-HONTOS, P., and BESALEL-AZRIN, V. (1979). Elinination of enuresis without a conditioning apparatus - an extension by office instruction of the child and parents. *Behavior Therapy,* 10, 14-19.

BAKER, B.L. (1969). Symptom treatment and symptom substitution in enuresis. *Journal of Abnormal Psychology,* 74, 42-49.

BAKWIN, H. (1961). Enuresis in Children. *Journal of Pediatrics,* 58, 806-819.

BAKWIN, H. (1973). The Genetics of enuresis. In I. KOLVIN, R.C. MacKEITH, and S.R. MEADOW (Eds.), *Bladder Control and Enuresis* Philadelphia, Pa., Lippincott.

BAKWIN, H., and BAKWIN, R.M. (1972). *Clinical Management of Behavioural Disorder in Children* (4th Edition) Philadelphia: W.B. Saunders.

BALLER, W.R. (1975). *Bed-Wetting: Origins and Treatment* New York: Pergamon.

BARBOUR, R.F., BORLAND, E.M., BOYD, M.M., OPPE, T.E., MILLER, A. (1963). Enuresis as a disorder of development. *British Medical Journal*, 2, 787.

BEHRLE, F.C., ELKIN, M.T., and LAYBOURNE, P.C. (1956). Evaluation of a conditioning device in the treatment of nocturnal enuresis. *Pediatrics*, 17, 849-855.

BELMONT, H.S. (1976). Hospitalisation and its effects upon the total child. *Clinical Paediatrics*, 9, 472-483.

BESALEL - AZRIN, V.A., AZRIN, N.H., THIENES-HONTOS, P., and McMORROW, M. (1980). Evaluation of a parent's manual for training enuretic children. *Behaviour Research and Therapy*, 18, 358-360.

BETTISON, S. (1978). Toilet training the retarded: Analysis of the stages of development and procedures for designing programmes. *Australian Journal of Mental Retardation*, 5, 95-100.

BETTISON, S., DAVISON, D., TAYLOR, P., and FOX,B. (1976). The long-term effects of a toilet training programme for the retarded: A pilot study. *Australian Journal of Mental Retardation*, 4, 28-35.

BIEGER, P.P. (1954). Enuresis nocturna in het lager. *Nederlandsch Tijdschriht voor Geneeskunde*, 98, 1839.

BIERING, A., and JESPERSEN, I., (1959). The treatment of enuresis nocturna with conditioning devices. *Acta Paediatrica*, 48, Supplement 118, 152-153.

BLACKWELL, B., and CURRAH, J., (1973). The pharmacology of enuresis. In I.KOLVIN, R.C. MacKEITH, and S.R.MEADOW (Eds). *Bladder control and enuresis*, Philadelphia, Pa., Lippincott.

BLOMFIELD, J.M., and DOUGLAS, J.W.B. (1956). Bedwetting: Prevalence among children aged 4 - 7 years. *Lancet*, 1, 850-852.

BOLLARD, J., (1982). A two-year follow-up of bedwetters treated by Dry-Bed Training and standard conditioning. *Behaviour Research and Therapy* - in press.

BOLLARD, J., and NETTELBECK, T., (1981). A comparison of Dry-Bed Training and standard urine-alarm conditioning treatment of childhood bedwetting. *Behaviour Research and Therapy*, 19, 215-226.

BOLLARD, J., and NETTELBECK, T. (1982). A component analysis of Dry-Bed Training for treatment of bedwetting. *Behaviour Research and Therapy* - in press.

BOLLARD, J., NETTELBECK, T., and ROXBEE, L. (1982). Dry-Bed Training for childhood bedwetting: A comparison of group with individually administered parent instruction. *Behaviour Research and Therapy* - in press.

BOLLARD, J., and WOODROFFE, P. (1977). The effect of parent-administered Dry-Bed Training on nocturnal enuresis in children. *Behaviour Research and Therapy*, 15, 159-165.

BORRIE, P., and FENTON, J.C.B. (1966). Buzzer ulcers. *British Medical Journal*, 2, 151-152.

BOSTOCK, J. (1958). Exterior gestation, primitive sleep, enuresis and asthma: a study in aetiology. *Medical Journal of Australia*, 149, 185.

BOSTOCK, J. (1962). The deep sleep-enuresis syndrome. *Medical Journal of Australia*, 49 (1), 240-243.

BOYD, M.M. (1960). The depth of sleep in enuretic school children and in non enuretic controls. *Journal of Psychosomatic Research*, 4, 274.

BRANSBY, E.R., BLOMFIELD, J.M., and DOUGLAS, J.W.B. (1955). The prevalence of bedwetting. *Medical Officer*, 94, 5-7.

BROUGHTON, R.F. (1968). Sleep disorders: Disorders of arousal? *Science*, 159, 1070-1078.

BROWNING, R.M. (1967). Operantly strengthening UCR (awakening) as a prerequisite to treatment of persistent enuresis. *Behaviour Research and Therapy*, 5, 371-372.

BUTLER, J.F. (1976). The toilet training success of parents after reading "Toilet Training in Less Than a Day". *Behavior Therapy*, 7, 185-191.

CAMPBELL, E.W. and YOUNG, J.D., (1966). Enuresis and its relation to electroencephalographic disturbances. *Journal of Urology*, 96, 947.

CAMPBELL, M.F. (1934). A clinical study of persistent enuresis. *New York State Journal of Medicine*, 34, 190.

CAMPBELL, M.F. (1970). Neuromuscular uropathy. In M.F.CAMPBELL and J.H. HARRISON (Eds.), *Urology* (Vol.2). Philadelphia,Pa.: Saunders.

CHURCH, R.M., and SOLOMON, R.L.(1956). Traumatic avoidance learning: The effects of delay and shock termination. *Psychological Reports*, 2, 317-326.

COHEN, E., and BURNS, P.(1977). *SPSS - MANOVA - Analysis of Variance and Covariance*. Instruction Manual prepared at Northwestern University, Illinois, U.S.A.

COLLINS, R.W. (1973). Importance of the bladder - cue buzzer contigency in the conditioning treatment for enuresis. *Journal of Abnormal Psychology*, 82, 299-308.

COLLINS, R.W.(1976). Mowrer's conditioning treatment for bedwetting; a case in point regarding psychological medical devices. Report prepared for the Committee on Psychological Devices of the Association for the Advancement of Behaviour Therapy.

COOTE, M.A. (1965). Apparatus for conditioning treatment of enuresis. *Behaviour Research and Therapy*, 2, 233-238.

CREER, T.L., and DAVIS, M.H.(1975). Using a staggered waking procedure with enuretic children in an institutional setting. *Journal of Behavior Therapy and Experimental Psychiatry*, 6, 23-25.

CROSBY, N.D. (1950). Essential enuresis: Successful treatment based on psychological concepts. *Medical Journal of Australia*, 2, 533-543.

DE CURTINS, F. (1957). Bettnässen in psychiatrischer Sicht. *Heilpädog. Werkbl.*, 26, 197-201. (*Psychological Abstracts* (1959) 33, No.4202).

DE JONGE, G.A. (1969). *Kinderen met Enuresis Een Epidemiologische Klinisch Onderzoek*. Assen: Van Gorcum.

DE JONGE, G.A. (1973). Epidemiology of enuresis: A survey of the literature. In I.KOLVIN, R.C. MacKEITH and S.R. MEADOW (Eds.), *Bladder Control and Enuresis.* Philadelphia, Pa.,: Lippincott.

DE LEON,G., and MANDELL, W. (1966). A comparison of conditioning and psychotherapy in the treatment of functional enuresis. *Journal of Clinical Psychology*, 22, 326-330.

DE LEON,G., and SACKS, S. (1972). Conditioning functional enuresis: a 4-year follow-up. *Journal of Consulting and Clinical Psychology*, 39, 299-300.

DEMENT, N. (1975). *Some must watch while some must sleep.* San Francisco: Freemont and Co.

DEMENT, W. and KLEITMAN, N. (1957). Cyclic variations in EEG during sleep and their relation to eye movements, body mobility and dreaming. *Electroencephalography and Clinical Neurophysiology*, 9, 673.

DE PERRI, R. and MEDURI, M.(1972). L'enuresi notturna Ulteriori elementi in tema di diagnostica strumentale *Acta Neurologica Napoli*, 27, 22-27.

DISCHE, S.(1971). Management of Enuresis. *British Medical Journal*, 2, 33-36.

DISCHE, S. (1973). Treatment of enuresis with an enuresis alarm. In I.KOLVIN, R.C. MacKEITH, and S.R. MEADOW (Eds.), *Bladder control and enuresis.* Philadelphia, Pa.: Lippincott.

DOLEYS, D.M. (1977). Behavioural treatments for nocturnal enuresis in children: a review of the recent literature. *Psychological Bulletin*, 84, 30-54.

DOLEYS, D.M., and CIMINERO, A.R. (1976). Childhood enuresis: considerations in treatment. *Journal of Pediatric Psychology*, 4, 21-23.

DOLEYS, D.M., CIMINERO, A.R., TOLLISON, J.W., WILLIAMS,C.L., and WELLS,K.C. (1977). Dry-Bed training and retention control training - a comparison. *Behavior Therapy*, 8, 541-548.

DOLEYS, D.M., and WELLS, K.C.(1975). Changes in functional bladder capacity and bedwetting during and after retention control training: A case study. *Behavior Therapy*, 6,685-688.

DOUGLAS, J.W.B. (1973). Early disturbing events and later enuresis. In I.KOLVIN, R.C.MacKEITH, and S.R.MEADOW (Eds.). *Bladder Control and Enuresis*. Philadelphia, Pa.: Lippincott.

DOUGLAS, J.W.B., and BLOMFIELD, J.M. (1958). *Children Under Five*. London: Allen and Unwin.

ESPERANCA, M.D., and GERRARD, J.W. (1969). Nocturnal enuresis: Studies in bladder function in normal children and enuretics. *Canadian Medical Association Journal*, 101, 324-327.

ESSEN, J. and PECKHAM, C. (1976). Nocturnal enuresis in childhood. *Developmental Medicine and Child Neurology*, 18, 577-589.

EVANS, J.I. (1971). Sleep of enuretics. *British Medical Journal*, 3, 110.

FAGIN, C.M. (1969). Mothers and children in hospital. *British Medical Journal*, May, 311.

FIELDING, D.(1980). The response of day and night wetting children and children who wet only at night to retention control training and the enuresis alarm. *Behaviour Research and Therapy*, 18, 305-317.

FINLEY, W.W. (1971). An EEG study of the sleep of enuretics at three age levels. *Clinical Electroencephalography*, 2, 35-39.

FINLEY,W.W., BESSERMAN,R.L., BENNETT,L.F., CLAPP,R.K., and FINLEY,P.M. (1973). The effect of continuous, intermittent and "placebo" reinforcement on the effectiveness of conditioning treatment for enuresis nocturna. *Behaviour Research and Therapy*, 11, 287-297.

FINLEY, W.W., and WANSLEY,R.A. (1977). Auditory intensity as a variable in the conditioning treatment of enuresis nocturna. *Behaviour Research and Therapy*, 15, 181-185.

FINLEY,W.W., WANSLEY, R.A. and BLENKARN,M.M. (1977). Conditioning treatment of enuresis using a 70% intermittent reinforcement schedule. *Behaviour Research and Therapy*, 15, 419-427.

FORSYTHE,W.I., and REDMAN, A. (1974). Enuresis and spontaneous cure rate. *Archives of Disease in Childhood*, 49, 259-263.

FOXX,R.M. and AZRIN,N.H. (1972). Restitution: a method of eliminating aggressive-disruptive behaviour of retarded and brain-damaged patients. *Behaviour Research and Therapy*, 10, 15-27.

FOXX, R.M., and AZRIN, N.H. (1973a). *Toilet Training the Retarded: A Rapid Program for Day and Nighttime Independent Toileting*. Champaign, Illinois: Research Press.

FOXX,R.M., and AZRIN,N.H. (1973b). Dry Pants: A rapid method of toilet training children. *Behaviour Research and Therapy*, 11, 435-442.

FRANCZAK,W. (1965). Daily rhythm of urinary excretion in children with urinary incontinence. *Pediatrica Polska*, 40, 405-408.

GASTAUT,H., BATINI,C., BROUGHTON,R., FRESSY,J., and TASSINARI,C.A. (1964). Etude electrographique des manifestations paroxystiques, non-épileptiques, au cours du sommeil nocturne. *Review Neurologique*, 110, 309-310.

GLICKLICK,L.B. (1951). An historical account of enuresis. *Pediatrics*, 8, 859.

GOEL,K.M., and SHANKS,R.A. (1974). Amitriptyline and imipramine poisoning in children. *British Medical Journal*, 1, 261-263.

GRAHAM,P. (1973). Depth of sleep and enuresis: A critical review. In I.KOLVIN,R.C., MacKEITH, and S.R.MEADOW (Eds.), *Bladder Control and Enuresis*. Philadelphia, Pa.: Lippincott.

GREAVES,M.W. (1969). Hazards of enuresis alarm. *Archives of Disease in Children*, 44, 285-286.

GUNNARSON,S., and MELIN,K.A. (1951). The electro-encephalogram in enuresis. *Acta Paediatrica (Uppsala)*, 40, 496.

GUYTON, A.C. (1966). *Textbook of Medical Physiology*. Philadelphia Pa.: Saunders.

HALLGREN, B.,(1956). Enuresis: 1. A Study with reference to the morbidity and sypmtomatology, *Acta Psychiatrica et Neurologica Scandinavica*, 31, 379-436.

HALLGREN, B.,(1957). Enuresis: A clinical and genetic study. *Acta Psychiatrica et Neurologica Scandanavica*, 32 Supplement 114.

HALLMAN,N. (1950). On the ability of enuretic children to hold urine. *Acta Paediatrica*, 39, 87-93.

HARRIS,L.S., and PUROHIT,A.P. (1977). Bladder training and enuresis: a controlled trial. *Behaviour Research and Therapy*, 15, 485-490.

HAWKINS,D.N. (1962). Enuresis: A survey. *The Medical Journal of Australia*, 1, 979-980.

HIGHNAM,A.R.C. (1953). An approach to the problem of simple enuresis. *Proceedings of the Royal Society of Medicine*, 46, 849-850.

ILLINGWORTH,R.S. (1968). *The Normal Child* (4th Edition) London: Churchill.

JONES,H.G. (1960). The behavioural treatment of enuresis nocturna. In H.J. EYSENCK (Ed.). *Behaviour Therapy and the Neuroses*. Oxford, England: Pergamon Press.

KAFFMAN,M., and ELIZUR,E. (1977). Infants who become enuretics. A longitudinal study of 161 Kibbutz children. *Monographs of Society for Research in Childhood Development*, 42, No.2, Serial No.170.

KALES,A., KALES,J.D., JACOBSON, A., HUMPHREY II,F.J., and SOLDATOS,C.R. (1977). Effects of imipramine on enuretic frequency and sleep stages, *Pediatrics*, 60, 431-436.

KIMMEL,H.D., and KIMMEL,E.C. (1970). An instrumental conditioning method for the treatment of enuresis. *Journal of Behavior Therapy and Experimental Psychiatry*, 1, 121-123.

KOLVIN,I., and TAUNCH,J. (1973). A dual theory of nocturnal enuresis. In I.KOLVIN, R.C.MacKEITH, and S.R. MEADOW (Eds.). *Bladder Control and Enuresis*. Philadelphia, PA.: Lippincott.

KOLVIN,I., TAUNCH,J., CURRAH,J., GARSIDE,R.F., NOLAN,J., SHAW,W.B. (1972). Enuresis: A descriptive analysis and a controlled trial. *Developmental Medicine and Child Neurology*, 14, 715.

LASSEN,M.K., and FLUET,N.R. (1979). Multifaceted behavioural intervention for nocturnal enuresis. *Journal of Behavior Therapy and Experimental Psychiatry*, 10, 155-156.

LEVINE, A.(1943). Enuresis in the navy, *American Journal of Psychiatry*, 100, 320.

LICKORISH, J.R. (1964). One hundred enuretics. *Journal of Psychosomatic Research*, 7, 263.

LOVIBOND, S.H. (1963a). The mechanism of conditioning treatment of enuresis. *Behaviour Research and Therapy*, 1, 17-24.

LOVIBOND, S.H. (1963b). Intermittent reinforcement in behaviour therapy. *Behaviour Research Therapy,* 1, 127-132.

LOVIBOND, S.H. (1964). *Conditioning and enuresis.* Oxford, England: Pergamon Press.

LOVIBOND,S.H. (1972). Critique of Turner, Young and Rachman's conditioning treatment of enuresis. *Behaviour Research and Therapy,* 10, 287-289.

LOVIBOND, S.H., and COOTE,M.A. (1970). Enuresis. In C.G. COSTELLO (Ed.), *Symptoms of psychopathology.* N.Y.: Wiley.

MacFARLANE,J.W., ALLEN,L., and HONZIK,M.P. (1954). *A Developmental Study of the Behavior Problems of Normal Children Between 21 Months and 14 Years.* Berkeley, California Press.

MARHOLIN 11, D., LUISELLI,J.K., and TOWNSEND, N.M.(1980). Overcorrection: An examination of its rationale and treatment effect. *Progress in Behavior Modification,* 9, 49-80.

MARTIN,C.R.A. (1966). *A New Approach to Nocturnal Enuresis.* London: Lewis.

MATSON,R.T.T. (1975). Some practical considerations for using the FOXX and AZRIN rapid method of toilet training. *Psychological Report,* 37, 350.

MEADOW,S.R. (1974). Drugs for bedwetting. *Archives of Disease in Childhood,* 49, 257-258.

MEADOW,S.R. (1981). *Help for Bed Wetting.* Edinburgh: Churchill Livingstone.

MIKKELSEN,E.J., RAPOPORT,J.L., NEE,L., GRUENAU,C., MENDELSON,W., and GILLIN,J.C. (1980). Childhood Enuresis 1. Sleep patterns and psychopathology, *Archives of General Psychiatry,* 37, 1139-1144.

MILLER, F.J.W. (1973). Children who wet the bed in I.KOLVIN,R.C., MacKEITH, and S.R. MEADOW (EDS.), *Bladder Control and Enuresis* Philadelphia, Pa.: Lippincott.

MILLER,F.J.W., COURT,S.D.M., WALTON,W.S., and KNOX,G.G. (1960). *Growing up in Newcastle-upon-Tyne.* Oxford University Press.

MILLER,P.M. (1973). An experimental analysis of retention control training in the treatment of nocturnal enuresis in two institutionalized adolescents. *Behavior Therapy,* 4, 288-294.

MORGAN,J.J.B., and WITMER,F.J. (1939). The treatment of enuresis by the conditioned reaction technique, *Journal of Genetic Psychology,* 55, 59-65.

MORGAN,R.T.T. (1978). Relapse and therapeutic response in the conditioning treatment of enuresis: A review of recent findings on intermittent reinforcement, overlearning and stimulus intensity. *Behaviour Research and Therapy*, 16, 273-279.

MOWRER,O.H. (1950). *Learning Theory and Personality Dynamics*. Ronald Press, N.Y.

MOWRER,O.H. (1960). *Learning Theory and Behaviour*. New York: Wiley.

MOWRER,O.H., and MOWRER,W.M. (1938). Enuresis: A method for its study and treatment. *American Journal of Orthopsychiatry*, 8, 436-459.

MUELLNER,S.R. (1960a). Development of urinary control in children. *Journal of the American Medical Association*, 172, 1256-1261.

MUELLNER,S.R. (1960b). Development of urinary control in children. A new concept in cause, prevention and treatment of primary enuresis. *Journal of Urology*, 84, 714-716.

MURPHY,G.H. (1978). Overcorrection: A critique. *Journal of Mental Deficiency Research*, 22, 161-173.

NEAL,B.W., and COOTE,M.A. (1969). Hazards of enuresis alarm. *Archives of Disease of Children*, 44, 651.

NELIGAN,G.A. KOLVIN,I., SCOTT,D.Mc., and GARSIDE,R.F. (1976). *Born too soon or born too small*. Clinics in Developmental Medicine No.61. London: Heinemann/S.I.M.P.

NETTLEBECK,T., and LANGELUDDECKE,P. (1979). Dry-Bed training without an enuresis machine. *Behaviour Research and Therapy*, 17, 403-404.

NIE,N.H., HADLAI HULL,C., JENKINS,J.G., STEINBRENNER,K., and BENT,D.H. (1975). *SPSS: statistical package for the social sciences*. N.Y. McGraw-Hill.

NORDQUIST,V.M. (1971). The modification of a child's enuresis: Some response - response relationships. *Journal of Applied Behavioural Analysis*, 4, 241-247.

NOTSCHAELE,L.A. (1964). Bedwateren bÿ kinderen van de kleuter - en lagere school. *Tijdschrift voor Sociale Geneeskunde*,422-226.

NOVICK,J. (1966). Symptomatic treatment of acquired and persistent enuresis. *Journal of Abnormal Psychology,* 77, 363-368.

OPPEL,W.C., HARPER,P.A., and RIDER,R.V. (1968). The age of attaining bladder control *Pediatrics,* 42, 614.

OSWALD,I., TAYLOR,A.M., and TREISMAN,M. (1960). Discriminative responses to stimulation during human sleep. *Brain,* 83, 440-453.

PASCHALIS,A.P., KIMMEL,H.D., and KIMMEL,E. (1972). Further study of diurnal instrumental conditioning in the treatment of enuresis nocturna. *Journal of Behavior Therapy and Experimental Psychiatry,* 3, 253-256.

PFAUNDLER,M. (1904). Demonstration eines Apparatus zur selstätigen stattgehabter Bettnäsung. *Verhandlungen der Gesellschaft für Kinderheilkunde,* 21, 219.

PFEIFFER,D.G., and LLYOD,D.T. (1978). Enuresis alarm innovations. *Monitor,* Sept./Oct., 148-150.

PIERCE,C.M., WHITMAN,R.M., and MASS,J.W., and GAY,M.L. (1961). Enuresis and dreaming. *Archives of General Psychiatry,* 4, 166.

RITVO,E.R., ORNITZ,E.M., GOTTLIEB,F., POUSSAINT,H.F., MARON,B.J., DITMON,K.S., and BLINN,K.A. (1969). Arousal and non-arousal enuretic events. *American Journal of Psychiatry,* 126, 77-84.

ROCKLIN,N., and TILKER,H. (1973). Instrumental conditioning of nocturnal enuresis: A reappraisal of some previous findings. *Proceedings of the 81st Annual Convention of the American Psychological Association,* 915-916.

RUTTER,M., YULE,W., and GRAHAM,P. (1973). Enuresis and behavioural deviance: Some epidemiological considerations. In I.KOLVIN, R.C.MacKEITH, and S.R.MEADOW (Eds.). *Bladder Control and Enuresis.* Philadelphia, Pa.: Lippincott.

SACKS,S., and DE LEON,G. (1973). Conditioning two types of enuretics. *Behaviour Research and Therapy,* 11, 653-654.

SALMON,M.A., TAYLOR,D.C., and DOUGLAS,L. (1973). On the EEG and enuresis. In I.KOLVIN, R.C.MacKEITH and S.R.MEADOW (Eds.), *Bladder control and enuresis.* Philadelphia, Pa.: Lippincott.

SAMAAN,M. (1972). The control of nocturnal enuresis by operant conditioning. *Journal of Behavior Therapy and Experimental Psychiatry,* 3, 103-105.

SHAFFER,D. (1973). The association between enuresis and emotional disorder: A review of the literature. In I.KOLVIN, R.C.MacKEITH. and S.R.MEADOW (Eds.). *Bladder Control and Enuresis,* Philadelphia, Pa.: Lippincott.

SHAFFER,D. (1980). The development of bladder control. In M.RUTTER (Ed.) *Scientific Foundations of Developmental Psychiatry*. London: William Heinemann.

SHAFFER,D. COSTELLO,A.J., and HILL,I.D. (1968). Control of enuresis with imipramine.*Archives of Disease in Childhood*, 43, 665-671.

SINGH,R., PHILLIPS,D., and FISCHER,S. (1976). The treatment of enuresis by progressively earlier waking. *Journal of Behavior Therapy and Experimental Psychiatry*, 7, 277-278.

SMITH, L.J. (1981). Training severely and profoundly mentally handicapped nocturnal enuretics, *Behaviour Research and Therapy*, 19, 67-74.

SMITH,S. (1948). *The Psychological Origin and Treatment of Enuresis*. Seattle: University of Washington Press.

STARFIELD,B. (1967). Functional bladder capacity in enuretic and non-enuretic children. *Journal of Pediatrics*, 70, 777-781.

STARFIELD,B., and MELLITS,E.D. (1968). Increase in functional bladder capacity and improvement in enuresis. *Journal of Pediatrics*, 74, 483-487.

STEDMAN, J.M. (1972). An extension of the Kimmel treatment method for enuresis to an adolescent: A case report. *Journal of Behavior Therapy and Experimental Psychiatry*, 3, 307-309.

STEIN, Z.A., and SUSSER, M.(1967). The social dimensions of a symptom: A socio-medical study of enuresis. *Social Science and Medicine*, 1, 183.

STEWART, M.A. (1975). Treatment of bedwetting. *Journal of the American Medical Association*, 232, 281.

SZABO,L., and POPOVICIU,L. (1969). Clinical EEG and polygraphic investigations of sleep in children with simple enuresis or associated with other non-convulsive nocturnal episodic manifestations. *Electroencephalography and Clinical Neurophysiology*, 27, 635-636.

TAYLOR,P.D., and TURNER,R.K. (1975). A clinical trial of continuous, intermittent and overlearning "bell-and-pad" treatments for nocturnal enuresis. *Behaviour Research and Therapy*, 2, 567-574.

THOMPSON, C.F. (1971). Correction of nocturnal enuresis in economically disadvantaged children. (Doctoral dissertation, United States International University, 1971).

THORNE,F.C. (1944). The incidence of nocturnal enuresis after the age of five years. *American Journal of Psychiatry,* 100, 686.

TOUGH,J.H., HAWKINS,R.P., MacARTHUR,M.M., and RAVENSWAY,S.V.(1971). Modification of enuretic behaviour by punishment. A new use for an old device. *Behavior Therapy,* 2, 567-574.

TROUP,C.W. and HODGSON,N.B. (1971). Nocturnal functional bladder capacity in enuretic children. *Pediatric Urology,* 105, 129-132.

TURNER,R.K. and YOUNG,G.C. (1966). CNS stimulant drugs and conditioning treatment of nocturnal enuresis: A long-term follow-up study. *Behaviour Research and Therapy,* 4, 225-228.

TURNER,R.K., YOUNG,G.C., and RACHMAN,S. (1970). Treatment of nocturnal enuresis by conditioning techniques. *Behaviour Research and Therapy,* 8, 367-381.

TURTON,E.C., and SPEAR,A.R. (1953). EEG findings in 100 cases of severe enuresis. *Archives of Disease in Children,*28, 316-320.

VERNON,D.T.A., FOLEY,J.M., SIPOWICZ,R.R. and SCHULMAN,J.L. (1965). *Psychological Responses of Children to Hospitalisation and Illness.* Springfield, Illinois: Thomas.

VINCENT,S.A. (1959). The mechanism of bladder control, *Ulster Medical Journal,* 28, 176.

VINCENT,S.A. (1960). Mechanical control of urinary incontinence. *Lancet,* 1, 292-294.

VINCENT,S.A. (1964). Treatment of enuresis with a perineal pressure apparatus: the irritable bladder syndrome. *Developmental Medicine and Child Neurology,* 6, 23-31.

VINCENT,S.A. (1966). Some aspects of bladder mechanics. *Bio-Medical Engineering,* 1, 438-445.

WENAR,C., and COULTER, J.B. (1962). A reliability study of developmental histories. *Child Development,* 33, 453.

WERNER,E., BIERMAN,J.M., and FRENCH,F. (1971). *The Children of Kanai. A longitudinal study from the prenatal period to age ten.* Honolulu: University of Hawaii Press.

WERRY,J.S., and COHRSSEN,J. (1965). Enuresis: An etiologic and therapeutic study. *Journal of Pediatrics*, 67, 423-431.

WHITE,M.A. (1968). A thousand consecutive cases of enuresis: Results of treatment. *Medical Officer*, 120, 151-155.

WILLIAMS,C.L., DOLEYS,D.M., and CIMINERO,A.R. (1978). A two-year follow-up of enuretic children treated with Dry-Bed Training. *Journal of Behavior Therapy and Experimental Psychiatry*, 9, 285-286.

YATES,A.J. (1970). *Behaviour Therapy*. N.Y.: Wiley.

YOUNG,G.C. (1964). A "staggered-awakening" procedure in the treatment of enuresis. *Medical Officer*, 111, 142-143.

YOUNG,G.C. (1965). The aetiology of enuresis in terms of learning theory. *Medical Officer*, 113, 19-22.

YOUNG G.C., and MORGAN,R.T.T. (1972a). Childhood enuresis: termination of treatment by parents. *Community Medicine*, 129, 247-250.

YOUNG,G.C., and MORGAN,R.T.T. (1972b). Overlearning in the conditioning of enuresis: A long-term follow-up. *Behaviour Research and Therapy*, 10, 419-420.

YOUNG, G.C., and MORGAN,R.T.T. (1972c). Overlearning in the conditioning treatment of enuresis. *Behaviour Research and Therapy*, 10, 147-151.

YOUNG,G.C., and MORGAN,R.T.T. (1973). Analysis of factors associated with the extinction of a conditioned response. *Behaviour Research and Therapy*, 11, 219-222.

YOUNG,G.C., and TURNER,R.K. (1965). CNS stimulant drugs and conditioning of nocturnal enuresis. *Behaviour Research and Therapy*, 3, 93-101.

ZALESKI,A., GERRARD,J.W., and SHOKIER,M.H.K. (1973). Nocturnal enuresis: The importance of a small bladder capacity. In I.KOLVIN, R.C.MacKEITH and S.R.MEADOW (Eds.), *Bladder Control and Enuresis*. Philadelphia, Pa. :Lippincott.

ZUNG, W.W.K., and WILSON, W.P. (1961). Response to auditory stimulation during sleep. *Archives of General Psychiatry*, 548-552.