ENURESIS,

A MAJOR PROBLEM
OR A SIMPLE DEVELOPMENTAL DELAY?

F.J.M. van Leerdam

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A MAJOR PROBLEM OR A SIMPLE DEVELOPMENTAL DELAY?

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STELLINGEN

bij het proefschrift van F.J.M. van Leerdam.

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1. Dat zo weinig ouders hulp zoeken voor het broek- en/of bedplassen van hun kind geeft aan dat veel volwassenen geen idee hebben van de impact van broek- en/of bedplassen op het (kinder)leven. *(o.a. dit proefschrift)*

2. Bedplassen gaat niet altijd vanzelf over wat bij veel getroffenen tot psychosociale problematiek leidt. *(o.a. dit proefschrift)*

3. Bij meisjes met aandachtsproblemen moeten hulpverleners bedacht zijn op teglijkertijd aanwezig zijn van de combinatie van broek- en bedplassen en dit zo nodig bespreekbaar maken en behandelen. *(dit proefschrift)*

4. Het gunstige effect van de plaswekker moet hulpverleners motiveren om meer en betere begeleiding aan kinderen met plasproblemen te geven. *(dit proefschrift)*

5. Het huidige beleid bij kinderen met de combinatie van broek- en bedplassen leidt tot onnodige medicalisering en kostenverhoging. *(dit proefschrift)*

6. Droge Bed Training leidt niet alleen tot het droog worden van het bed, maar ook tot het droog worden van de door het bedplassen veroorzaakte tranende ogen. *(dit proefschrift)*

7. Hulpverleners zonder specifieke ervaring op het gebied van diagnostiek en begeleiding van kinderen met bedplassen verlenen betere zorg door zich aan het richtsnoer enuresis nocturna te houden. *(o.a. dit proefschrift)*

8. Bedplassen is het meest voorkomende beïnvloedbare psychosociale probleem bij kinderen. Dit probleem dient daarom door de Jeugdgezondheidszorg krachtig aangepakt te worden. *(o.a. dit proefschrift)*

9. Als iedereen beseft dat personen met bedplassen "niet de enige" zijn, zullen deze personen zich "niet de enige" voelen.

10. Een overheid die echt de wachtlijsten voor de gezondheidszorg wil beperken doet er beter aan niet te investeren in meer aanbod van klinische zorg maar in meer aanbod van preventieve zorg.

11. Na 100 jaar moet de Jeugdgezondheidszorg zichzelf eindelijk als volwassen beschouwen en daar ook naar handelen.

12. Een jeugdarts is een betere specialist dan een arts maatschappij en gezondheid.

13. Als het kabinet Balkenende II serieus de universele rechten van het kind onderschrijft moet het in economisch moeilijke tijden het budget voor de Jeugdgezondheidszorg verviervoudigen (en in economisch gunstige tijden het budget verdubbelen).

14. Om herhaling bij volgende generaties te voorkomen moet de Nederlandse overheid alle kinderen ter wereld die op de vlucht zijn voor geweld het Nederlands staatsburgerschap toekennen en investeren in onderwijs en kennisoverdracht aan deze kwetsbare groep. Het geld dat hiervoor nodig is kan afgeroomd worden van de exorbitante salarisstijgingen van de hoogsten in hiërarchie

15. Meer promoties in de Jeugdgezondheidszorg leiden tot meer gezondheid en betere zorg bij de jeugd.

VRIJE UNIVERSITEIT

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Contents

page

Chapter 1

INTRODUCTION

Introduction

Night-time incontinence (nocturnal enuresis, bedwetting) is a socially embarrassing, invalidating disorder, and one of the most common negative events in childhood.[1-5] It is also the most prevalent psychosocial problem in childhood.[1-5] As a result, professionals in the Youth Health Care (YHC) system often see children with night-time incontinence. However, in the Dutch YHC system, almost every Municipal Health Authority has its own protocol for night-time incontinence. Despite the existing evidence, these protocols differ enormously in form and content.[6] To provide more uniform advice and clarity for parents and children, it is obvious that standardisation is necessary, and that guidelines should be issued and implemented for the professionals in the YHC system.
This is in itself a good reason to study the phenomenon of night-time incontinence in greater detail from the YHC perspective. The aim of this thesis is to provide more insight into the epidemiology of enuresis from a population-based perspective and to establish a better overview of the treatment that can be provided within, and start from, the YHC system.[7] This understanding is required for the development of YHC guidelines for the treatment of children with nocturnal enuresis.

Normal development

The drinking-bladder-micturition reflexes develop early in foetal life, and it is important for the healthy development of the foetus for this process to take place smoothly. It is assumed that control over this process starts with completely autonomous reflexes.
Voluntary control over sucking, and therefore over drinking, is already achieved quite early in foetal life. It is quite obvious that a certain amount of maturation is needed to achieve voluntary control over the bladder and the micturition cycle, because infants have no voluntary control over the bladder. Traditionally, voiding has been assumed to occur spontaneously in babies as a result of a simple spinal-cord reflex in response to a full bladder, with little or no mediation by the higher neural centres. However, the observation that micturition in intrauterine life, and even in infants, occurs almost exclusively while the foetus or infant is awake, means that this theory is probably an over-simplification.[8-10] The entire process, from drinking to micturition, is still not fully understood.

The two phases in the micturition process
The first phase in the micturition process, which is not voluntarily controlled, consists of the filling of the bladder and the storage of urine in the bladder. When the bladder is full, the detrusor relaxes, allowing the bladder to be filled further with no sharp rise in pressure.
The second phase is the voiding phase. When the bladder reaches its functional capacity, relaxation is no longer sufficient to keep the pressure low; the bladder wall reacts with regular contractions, and the brain transforms these contractions into the urge to release the urine that is stored in the bladder. Functional bladder capacity varies widely among individuals. Several formulas can be used to calculate normal bladder capacity in children. The one that is most often used for children below the age of 11 is: capacity in ml = 30 x (age in years + 2); another formula is: capacity in ml = 38 + (2.5 x age in months).[10] However, both formulas estimate the bladder

capacity in a clinical setting. A formula that is probably more appropriate for calculating the real functional capacity in daily practice in ml is 30 x (age in years + 1).
The control of micturition probably involves more complicated neural pathways and higher centres than has been appreciated in the past. There is evidence that a pronounced reorganisation of the pre-existing synaptic connections and neural pathways involved in bladder control occurs during the early postnatal period.[10] Both the filling phase and the voiding phase require the activity of sympathetic, parasympathetic, and somatic voluntary nerves co-ordinated by the spinal cord, brain stem, mid-brain and higher cortical centres.
The conscious awareness of bladder-filling first develops between the age of one and two. The next development is postponement of micturition, which is subject to voluntary control by the brain. A complexity of messages between brain and bladder controls this postponement, but the main message is contraction of the voluntary sphincter of the bladder. This voluntary sphincter is the pelvic floor muscle, the contraction of which helps the outer circular sphincter of the bladder to close the outlet. The result is the ability to postpone micturition until a better time and/or place. Central inhibition is crucial in achieving continence.[10] The duration of postponement also varies widely, and is dependent on the ability to control the voluntary sphincter, training and awareness. At a given moment, however, involuntary reflexes become stronger than voluntary postponement, and reflex micturition starts.
Normal micturition starts with the relaxation of the pelvic floor and outer circular sphincter, followed by a reflex contraction of the detrusor that empties the bladder completely.

Control of the micturition cycle: age
Awareness of bladder-filling develops between the age of one and two, and the ability to start or inhibit voluntary voiding at any stage of bladder-filling usually develops during the second and third year of life. This marks progression towards socially conscious continence, and a more voluntary type of control over micturition. Through an active learning process, children acquire the ability to inhibit and delay voiding voluntarily until they reach a socially convenient time and place, and then to actively initiate urination – even when the bladder is not completely full – and allow urination to proceed until completion.
From the age of three onwards, children are able to control their pelvic floor muscle, and therefore to postpone micturition for longer periods, and as this development proceeds, their bladder capacity increases. From the age of about four, they can not only initiate and inhibit voiding voluntarily, but also interrupt the micturition flow.[7,10] Whether awake or asleep, an individual's ability to control micturition depends on the ability of an individual to recognise the signals from the bladder and to respond adequately to those signals.
Psychologically, the achievement of night-time bladder control is an important stage in the development of a child. This event is welcomed and rewarded by the parents and, not least, by the children themselves. When they no longer have to wear diapers, children also feel more responsible and capable of performing other tasks. However, some children do not achieve control over their bladder and/or micturition during the day and/or night at the same age as their peers. When this control is not achieved before the age of 5, there is a possibility that the child may be suffering from enuresis or incontinence.

Definitions

The following definitions were used in the papers that form the basis for this thesis:

- *Monosymptomatic nocturnal enuresis (MNE) (Diagnostic and Statistical manual of* Mental disorders (DSM)-IV definition): an involuntary voiding of urine during sleep at least twice a week in the past four weeks for at least three consecutive months, in children over 5 years of age, not caused by another somatic disease and with no other symptoms.
- Monosymptomatic nocturnal enuresis (DSM-III-R definition): an involuntary voiding of urine during sleep, at least twice in the past four weeks in children of 5 and 6 years old and at least once in the past four weeks in children of 7 years and older, not caused by another somatic disease and with no other symptoms.
- Night-time wetting: parentally reported wet spots or complete micturitions in the clothing at night.
- Daytime wetting: parentally reported wet spots or complete micturitions in the clothing during the day.
- Leakage of urine in children during both the day and night (other than MNE) is nowadays referred to as incontinence in urological literature, just as it is in the adult population.[11]
- *Occasionally wet: occasionally a wet night (day), with a maximum of 1 wet night* (day) a week in the past 4 weeks.
- Continence criterion: 14 successive dry nights or days (after the start of treatment).
- Success: achievement of the continence criterion.
- Complete success: still dry after two years, with no relapse.
- Dry or continent: no wet nights in the past 4 weeks (28 nights).
- Relapse: after an initial success, at least two wet nights a week in the past 4 weeks.
- Failure: inability to meet the continence criterion.

Epidemiology

There is a considerable amount of literature on the subject of night-time incontinence. However, there is a lack of studies investigating night-time incontinence in sub-groups with concomitant problems and studies from a YHC perspective.

The prevalence of night-time incontinence varies in different sub-groups.[10-14] In general, boys wet their beds more often than girls, especially during childhood, and this gender difference is still noticeable in adolescence, although it is not as pronounced as in childhood.[15]

The prevalence of incontinence decreases with increasing age. Surveys carried out in Great Britain, the Netherlands, New Zealand and Ireland suggest that prevalence among boys is approximately 15-22% at the age of 5, decreasing to 13-19% at 7, 9-13% at 9 and 1-2% at 16 years of age. The reported prevalence rates for girls are 9-16% at the age of 5, decreasing to 7-15% at 7, 5-10% at 9 and 1-2% in the late teenage years.[10,14,16-19] However, it is not always clear whether the data represent nocturnal enuresis only or also a combination of night-time and daytime incontinence. In the Netherlands, the prevalence of night-time incontinence in children with parents from Turkey or Morocco is higher than in Dutch children. Prevalence in children in

special schools for the mentally and/or physically handicapped is also higher than in children in normal schools.[14]
Night-time incontinence also occurs in 50-60% of children with daytime incontinence. For children with night-time incontinence, daytime incontinence is sometimes (8-10%) an additional problem. However, the prevalence rates reported in the literature are difficult to interpret because of substantial variations in the definitions and the study populations.[20, 21]
We had always assumed, as many people still do, that enuresis is self-limiting, and nearly always ceases in time. However, we discovered that some of the parents of children wiht night-time incontinence had still night-time incontinence themselves.

Aetiology
There are several possible reasons why some children do not become continent. The latest research has identified several factors that play, separately or jointly, an important role in the continuation of night-time incontinence.[22-24] The contributing role of each of these factors can vary from child to child. The five most important factors are described below.

1. Waking up in response to the signal of a full bladder. Many parents explain their child's night-time incontinence by stating that the child simply sleeps too deeply. We know from research that enuresis can occur in every phase of sleep,[25,26] but research has also confirmed that at least one (and probably the most important) explanation of nocturnal enuresis in children is an arousal problem at night.[27-33] These children have difficulty in waking up in response to any signal, including the signal of a full bladder.
2. A relative shortage of vasopressin. This is the antidiuretic hormone that enables us to produce less urine during the night,[34-36] and if there is a shortage or relative shortage of this hormone at night compared to the normal situation, the result is the production of more urine at night than the bladder can store. It is, however, still not known why some children fail to wake up, with incontinence during the night as a result. It is therefore possible that there is another factor that influences both vasopressin excretion and arousal reactions.[37-40]
3. Detrusor overactivity. In children with this problem, the detrusor is mainly overactive during the night or the contractions of the detrusor may not be co-ordinated. Children with this problem are not able to empty their bladder completely during micturition. As a result, there is possibly a residue of urine in the bladder (resulting in an increased susceptibility to urinary tract infections). In these children, the amount of urine that the bladder can store before the detrusor starts to contract is often smaller, and this can lead to incontinence.[28,41-43]
4. Diminished bladder capacity. This is often in combination with factors 2 and 3.[44-46]
5. The familial or genetic factor. In most (70%) of the children with incontinence at night, the problem also runs in the family. If both parents have a childhood history of night-time incontinence, the risk for their children is 77%. If only one parent has a childhood history of night-time incontinence, the risk is approximately 44%.[55]
   Several foci on chromosomes have been linked to night-time incontinence, and chromosomes 4, 8, 12, 13 and 22 have been found to play a role in hereditary night-time incontinence.[23,56-60] There is no clear relationship between a genotype and one or more subtypes of MNE.[61,62]

Possible future focus of research on aetiology
An interesting observation is that the first four factors mentioned above are influenced by a group of noradrenergic neurones in, or in the area of, the locus coeruleus in the brain stem.[47] This region plays a crucial role in arousal and awareness in response to either external or internal stimuli, such as bladder distension or detrusor contractions.[48] It is the main binding site for desipramine, the active metabolite of imipramine (see the section on therapy).[49,50] There are connections between the noradrenergic, locus coeruleus, neurones and the vasopressin-producing cells of the hypothalamus, and stimulation of these neurones has been shown to cause vasopressin release.[51,52] Interestingly, vasopressin also stimulates the activity of the locus coeruleus neurones.[53] Destruction of the locus coeruleus, on the other hand, may cause all kinds of micturition disturbances.[54] A developmental disturbance or trauma in this region could therefore mean that one of the factors described above – or a combination of them – can result in incontinence.[23,47] Another possibility is that this region is just as susceptible to developmental delay as some regions in the motorcortex or language-centres in the brain. The affected children are not yet "ready" to master this skill. Some children achieve this early in life, and others later in life, with or without great difficulty.

Examples of other factors that are either related to incontinence at night, or that prevent children from becoming continent are: constipation, urinary tract infections, sleep disorders or other medical/psychological/psychosexual problems.[7]

Psychological problems associated with persistent night-time incontinence
In the 20th century it was thought that night-time incontinence was primarily a psychological or even psychiatric disorder, and that children with incontinence had more emotional and/or behavioural problems than "dry" children [16,63-66] The assumption was therefore that it was unwise to treat the incontinence without treating the underlying problem, because symptom substitution would most probably be the result.[67-70] For children with a combination of incontinence and a condition such as Attention-Deficit Hyperactivity Disorder (ADHD), treatment of the incontinence without treatment of the ADHD was thought to be pointless, although the literature on the relationship between incontinence and ADHD is inconclusive.[71-73] In the literature, we also find similar hypotheses and discussions relating to the link between nocturnal enuresis and other associated problems frequently found in children with night-time incontinence, such as daytime incontinence. [10,74,-76]
Only a few studies have evaluated changes in associated problems when children are successfully cured of night-time incontinence. However, these studies do not make it clear whether or not the improvements are related to the alleviation of the incontinence.[69,70,77] In addition, few of these studies make it clear whether these problems are causes or effects of each other, or whether they coincide more or less by chance.
The delay in bladder control often results in embarrassment and a lack of self-confidence and self-esteem, and also gives rise to feelings of failure, both in the children with incontinence and in their parents. The children are seemingly most concerned about the social implications.[2,3,5,70,77,78] These children avoid sleeping anywhere but in their own home, and are afraid that their friends will find out about the night-time incontinence; most of them are not aware that there are many more children with the same problem.[79] According to children, night-time incontinence is

the third worst thing that can happen to them, after parental fighting and divorce or the death of a parent.[3] Moreover, incontinence often leads to problems in the relationships, not only between the children and their parents, but also between the children and their siblings.[2,4,80-82] Sometimes, these problems are so serious that they result in child abuse.[80,82,83,84]

Treatment

In the Netherlands, there are two standardised recommended questionnaires for distinguishing between MNE and other forms of incontinence (see Appendices I and II). If the answers to all questions in questionnaire I are "no", the probability of MNE is very high. If the answer to one or more of the questions is "yes", there are probably associated problems. Questionnaire II can be used to assess the seriousness of the nocturnal enuresis. It can also be used to make a choice between the various types of treatment that are available and to assess the effect of the treatment.[85]
There are various approaches to the treatment of children with nocturnal enuresis.[85] Many children can achieve bladder control with positive attention and help from their parents and professionals in the YHC system or general practice. There is quite a good step-by-step approach to the MNE treatment options.[24] Nevertheless some 20-30% of children with MNE still continue having night-time incontinence, and an elaboration of the existing step-by-step approach is necessary for these children. Because of the major implications of night-time incontinence for a child, it is now thought that the best time to start treatment is from the age of five onwards, when both the child and the parents are motivated.[4,23] This maximises the chance of achieving permanent bladder control. The goal is to keep psychosocial problems to a minimum and to give the child the opportunity to develop without further problems now or in the future.
The treatment strategy should be individualised on the basis of thorough history-taking and an appraisal of the motivation and abilities of the individual children and their parents.
Treatment for nocturnal enuresis focuses on alarm treatment or pharmacological therapy, or a combination of both, and the main treatment modalities are discussed below. Most of the other treatment modalities are described in some reviews of the literature.[4,7]

Alarm treatment

In a few European countries, such as the Netherlands, England and Belgium, the keystone of treatment is the use of an enuresis alarm.[4,23] In other European countries, such as France, Germany and Denmark, and in the USA, the enuresis alarm is strangely under-utilised and under-appreciated, despite the existing evidence of its effect.[86-89] Recently, some impressive overviews of the literature on alarm treatment have been published.[76,89-91] Alarm treatment has been found to be effective in the short term,[33,89,90] but the type and quality of the alarm and the quality of the support provided in combination with the alarm is at least partially responsible for the high success rate. Another reason for the rather high success rate seems to be the motivation of the parents and children who use the alarms. [7] Glazener and colleagues conclude, in two recent Cochrane reviews, that alarm interventions are an effective method of treatment for MNE in children.[88,89] Alarms also appear to be more effective than desmopressin or tricyclics by the end of the intervention period and thereafter. Overlearning (giving the child extra fluids at bedtime once bladder control has been achieved with an alarm) and the avoidance of penalties may further

reduce the relapse rate. Further research comparing alarms with other interventions is needed, including a follow-up period to determine relapse rates.[88] Glazener and colleagues also conclude that an alarm only is better than Dry Bed Training (DBT) only, but there is some evidence that combining an alarm with DBT is better than an alarm only. There is also some evidence that direct contact with a therapist might enhance the effects of an intervention.[89] Only a few studies have evaluated the long-term effects of alarm treatment, and the results are conflicting.[91-94]

In general, it is claimed that alarm treatment should be reserved for the treatment of children with MNE only.[7,89] The usual treatment options for MNE are thought to be ineffective for night-time incontinence combined with other symptoms such as daytime incontinence and voiding problems. The assumption is that the combination of night-time incontinence with other symptoms is a different entity, and should therefore be treated differently. In addition, one of the other symptoms is often perceived as the marker problem that needs be addressed before treating the night-time incontinence.[10,21,86]

Pharmacological therapy
Since the latter half of the 20th century, pharmacological therapy has been available for the treatment of night-time incontinence symptoms.
Imipramine was the drug of choice in the 1970s and 1980s. This is a tricyclic antidepressive drug, and it is still not known how it influences the factors that play a role in bedwetting.
During the past fifteen years there have been few publications about imipramine in the treatment of night-time incontinence,[87] but more about desmopressin, which is a vasopressin analogue that reduces the level of urine production. The most important side-effect is water intoxication resulting from continued fluid intake after the administration of desmopressin.
Both drugs result in rapid success. Unfortunately, however, most children revert to night-time incontinence again when they stop taking the drug.[86,87] The major problem with imipramine in the treatment of night-time incontinence is its narrow therapeutic bandwidth and the possibility of side-effects that can be fatal, so it must be used with great caution.[86] As a result, imipramine is now outdated as a standard treatment for nocturnal enuresis.
Oxybutinin is sometimes used to treat night-time incontinence. It is an anticholinergic drug, and its use should be restricted to those cases in which the night-time incontinence is at least partially caused by detrusor instability with limited bladder capacity and/or micturition problems during the day. It is a drug that should not be given to children with MNE.
The first choice of drug in the pharmaceutical treatment of night-time incontinence is therefore desmopressin. For an optimal result, the timing of desmopressin treatment and the dosage should be individualised. However, the results after withdrawal are poor.[95] Most children revert to night-time incontinence again when they stop taking the medication. Some recent studies have established a positive effect after long-term use of desmopressin,[96] But there is still an ongoing debate about the magnitude of the positive effect of long-term use of this drug.
The prevailing opinion in the Netherlands is that desmopressin treatment should be restricted to the following situations[24,94]:

- Holidays, camps, excursions, etc.
- When rapid success is needed.

- In addition to alarm treatment if the alarm treatment has no effect within 2-3 weeks.
- As individually tailored treatment supervised by someone with experience in the treatment of difficult cases. This can result in the long-term use of desmopressin with a treatment pause every 3-6 months to check whether the child has become continent.

Reasons for diagnosing and treating nocturnal enuresis

If the night-time incontinence is not self-limiting at an early age, and if children with night-time incontinence and adults have additional problems because of the incontinence, there is good reason to treat children with incontinence at the most suitable age.

The screening principles developed by Wilson and Jungner are appropriate for checking the usefulness of diagnostics and treatment procedures for diseases in a YHC setting. [97] These principles are discussed below in relation to nocturnal enuresis.

1. *The condition sought should be an important health problem (for the individual and for the community).*
   The incidence of night-time incontinence is high and, according to the affected children, it is one of the worst things that can happen to them.[3] With increasing age, there can also be an increase in comorbid psychosocial, and sometimes even psychiatric, disturbances. Children with incontinence feel different from their peers, and are often teased or bullied by other children, or are afraid that this might happen. The parents often feel perplexed and concerned about the child's well-being, particularly if they believe the origin of the incontinence is psychological. The perpetual changing and washing of bed linen and night clothes impose an extra workload and a financial burden on the parents,[79] and their concern and frustration may lead to punitive attempts to cure the problem. There are no recent Dutch population-based data on the prevalence of night-time incontinence, daytime incontinence or the combination of the two.

2. *There should be an accepted treatment for patients with recognised disease (or some other form of useful intervention should be available).*
   Empirical data from several YHC professionals have shown that MNE can be cured in nearly all cases. Several treatment modalities are available, and most of the major treatment modalities have already been discussed. However, information about the long-term effect of treatment, and the treatment of children with night-time incontinence in combination with daytime incontinence, is scarce.

3. *Facilities for diagnosis and treatment should be available (for the patients identified by this programme).*
   MNE can be successfully diagnosed and treated by the Preventive Health Services (YHC) or primary health care (GPs), and also in outpatient care by paediatricians or urologists.[7,42] However, there is no professional standard for all disciplines indicating how to diagnose and treat bedwetting.

4. *There should be a recognisable latent or early symptomatic stage.*
   Night-time incontinence is normal before the age of 5, and even after the age of 5 it is not considered to be a problem for many children and their parents.

However, if it is not treated (or does not cease spontaneously) incontinence becomes a problem and causes more problems (particularly psychosocial) as a child grows older. With regard to psychosocial problems due to incontinence, the diagnosis of incontinence indicates the latent stage of the disorder.

5. *There should be a suitable test or examination (for detecting the disease at an early or latent stage).*
   MNE can be identified quite straightforwardly at all ages by means of a standardised questionnaire and a simple physical examination combined with simple urine analysis.

6. *The test should be acceptable to the population.*
   It is commonly accepted for YHC professionals and GPs to ask questions about micturition and defecation in children and, when necessary, to perform a simple urine analysis.

7. *The natural history of the condition, including development from latent to declared disease, should be adequately understood.*
   The natural history of incontinence in childhood is well known. The prevalence of night-time incontinence decreases with increasing age, and the rate of decline is somewhere between 14% and 18% each year. If not treated, some 1-2% of teenagers will suffer from night-time incontinence.[14,17,19] There are no population-based data available on night-time incontinence in adults.

8. *There should be an agreed policy about whom to treat as patients (and the treatment at the pre-symptomatic stage of the disease should benefit course and prognosis).*
   With the use of the standardised questionnaires, the children who need special attention or referral to a GP, a paediatrician or a urologist are easy to distinguish from those who can be treated within the YHC system.[7] The implementation of this knowledge should be included in the guidelines to be developed.
   If we can successfully cure incontinence without symptom substitution, we can spare children one of the most common negative childhood events. This may also prevent incontinence from causing psychological problems for the child and in the child-parent relationship. Whether these psychosocial problems will really be prevented or reduced after the incontinence is cured remains to be determined.

9. *The cost of case finding (including diagnosis and treatment of patients diagnosed) should be proportional to possible expenditure on medical care as a whole (and the cost of treatment if the patient does not present until the disease reaches the symptomatic stage).*
   Effective screening and treatment for MNE is generally feasible within the YHC system, and is therefore relatively cheap compared to many other treatment modalities for other diseases and problems in childhood.[98]
   As long as children continue to present with prolonged incontinence and submerged psychological problems, incontinence will result in major expenditure on aids and health care utilisation.

10. *Case-finding should be a continuing process and not a "once and for all" project.* Every child in the Netherlands has the right to be seen by YHC professionals three times between the age of 4 and 19.[99] The periodical evaluation of the development of all children is the cornerstone of the YHC policy. One of the developmental milestones in childhood is bladder control during the day and at night. Questions about incontinence during the night and day should be basic, and are compulsory in the Basic Tasks for the YHC system.[99]

The preliminary conclusion, based on the Wilson and Jungner criteria, is that the diagnosis and treatment of MNE within the YHC system seems to be possible, necessary and useful.

Aims of the thesis

Although many studies have focused on night-time incontinence, there are still a number of questions that remain unanswered. The main aim of this thesis is to determine the epidemiology of incontinence and to detect subgroups in population-based studies. The effects of some new treatment modalities and some existing treatment modalities are discussed, and the advice that can be given by the YHC professionals in the Netherlands is formulated.

The aims of this thesis result in the following research questions:

Part I.

1. What is the prevalence of daytime incontinence, night-time incontinence and the combination of daytime and night-time incontinence in children in the Netherlands? (Chapter 2)
2. What is the prevalence of bedwetting in adults in the Netherlands? (Chapter 3)
3. What is the relationship between Attention Problems and incontinence? (Chapter 4)

Part II.

4. What is the long-term effect of alarm treatment on children with MNE? (Chapter 5).
5. What is the effect of alarm treatment on children with daytime and night-time wetting? (Chapter 6)
6. What is the effect of Dry Bed Training on behavioural problems in children with MNE? (Chapter 7)
7. What is the appropriate treatment for children with persistent night-time incontinence? (Chapter 8)

The results of the studies will be discussed in Chapter 9, which will conclude with the implications for future research and for routine practice in the YHC system.

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Chapter 2

VOIDING PATTERNS AND COUNSELLING FOR INCONTINENCE-PROBLEMS IN A POPULATION-BASED SAMPLE OF DUTCH SCHOOLCHILDREN BETWEEN 4 AND 12 YEARS OLD

Submitted as: Leerdam FJM van, Renders CM, Witt JM, Nijman RJM, Heijden AJ van der, Hirasing RA. Voiding patterns and counselling for incontinence-problems in a population-based sample of Dutch schoolchildren between 4 and 12 years old.

Abstract

Purpose
To assess the prevalence of day- and/or night-time incontinence in Dutch schoolchildren and to determine possible associations with age, gender, frequency of incontinence, frequency of defecation and counselling.

Material and methods
The parents of 2836 children (4-12 year, 1531 boys, 1289 girls, 16 gender unknown) completed a questionnaire on daytime and night-time incontinence (response rate 77.9%).

Results
Night-time incontinence was found in 240 children (8.5%), 70 of whom (29.2%) had a combination of day- and night-time incontinence. Isolated daytime incontinence occurred in 121 (4.3%) children. The percentages of day- and/or night-time incontinence were higher in boys and younger children respectively. Frequent voiding (8 times or more) was most prevalent in children with day- and night-time incontinence, whereas children with isolated daytime incontinence had the highest prevalence of infrequent voiding (3 times or less). Parents sought counselling for 6.6% of children with isolated night-time incontinence, 29.7% of the children with isolated daytime incontinence and 33.3% of the children with the combination of both. Parents of non-Dutch children sought help less frequently.

Conclusions
In this population-based study, the prevalence of children with day- and/or night-time incontinence was high. Almost 30% of the children with night-time incontinence also have daytime incontinence and almost 40% of the children with daytime incontinence also have night-time incontinence. Most parents did not seek counselling. Because treatment is possible for the majority of the affected children, physicians should actively provide information about day- or night-time incontinence, and especially the combination of both, and offer parents and children structured treatment plans.

Introduction

Nocturnal enuresis and daytime incontinence are both common but disturbing problems in childhood.[1,2] Obtaining voluntary bladder control is a complex developmental process. Several factors may interfere with this process: heredity, drinking patterns, voiding and defecation habits, potty-training and psychosocial factors.[3,4]

At present, the prevalence of nocturnal enuresis at the age of 5 is 18% in boys and 10% in girls, decreasing to about 2% in adolescence and about 0.5% in adulthood.[5-9] However, the prevalence in the different age categories in international literature varies enormously: from 6.8% [10] to16.4% at the age of 7, for example.[11] These differences are most likely caused by differences in definitions and inclusion criteria, and partly by socio-cultural differences, rather than by differences in genetic predisposition. Despite the different definitions of monosymptomatic nocturnal enuresis (MNE) and nocturnal enuresis combined with daytime incontinence, epidemiological studies rarely differentiate between the two.[3,12-14] At the age of 7, the prevalence of isolated daytime incontinence is between 1.8% and 3.9% and the combination of day- and night-time incontinence between 3.2% and 6.7%. At the age of 15-17 years, the prevalence of isolated daytime incontinence is reported to be 1.8%, with the prevalence of the combination of day- and night-time incontinence varying between 1.2% and 3.0%.[11,15]

International literature on the treatment of enuresis deals almost exclusively with MNE or with isolated daytime incontinence. Paediatric textbooks contain almost no information about the prevalence and background of the combination of day- and night-time incontinence. If they do cover the subject, the textbooks often suggest psychological factors as a cause, and behavioural treatment as a solution.[16] Urological textbooks dealing with the combination of both daytime and night-time incontinence also contain almost no information about prevalence; they often state that thorough medical investigation is needed first to diagnose the underlying problem, and that the daytime incontinence should be treated before the night-time incontinence.[4,17]

It is therefore important to determine the prevalence in the normal population of isolated daytime incontinence, isolated night-time incontinence, and the combination of day- and night-time incontinence without other pathology.

An epidemiological study was designed to determine the prevalence, and relations between, daytime incontinence and night-time incontinence in a population-based sample of Dutch schoolchildren.

Purpose

The aim of the study was to assess the prevalence of day- and/or night-time incontinence in a population-based sample of healthy Dutch schoolchildren and to determine possible correlations with age, gender, frequencies of incontinence, constipation and counselling for the incontinence.

Material and methods

Sample

Power calculation revealed that at least 200 children were needed for each year group between 4 and 12. In order to obtain the required number of children (with an expected response of 70%), data were necessary for children from 15 primary schools (at least 2571 children). A random sample of schools in "Midden-Kennemerland", a region in the north-west of the Netherlands, was established until

the minimum desired population was reached. The questionnaire was then distributed to the parents of all the children at these 15, randomly selected, primary schools. The schools had pupils from all social classes. There were no exclusion criteria.

Data collection

A non-validated questionnaire with 23 questions was developed. The questionnaire consisted of general questions about gender, date of birth, etc., questions about incontinence, about the age at which the child became dry, the method used to attain this goal, seeking help for the problems, and questions about ideas relating to the cause of, and experience with, the incontinence. The study questionnaire also included some of the standard questionnaire on bedwetting [5] as well as questions about treatment, nationality and social economic status.

The questionnaire was tested in a pilot study of 30 randomly chosen parents visiting the School Health Centre of one of the authors (JW). The questionnaires were subsequently taken to the schools with extensive instructions and completed by the same author (JW).

Night-time incontinence was defined as parentally reported night-time wetting in the past 3 months regardless of frequency.

Daytime incontinence was defined as parentally reported wetting of the pants or diapers during the day in the past 3 months, regardless of frequency.

Non-Dutch ethnicity was defined as a child and one or both of its parents being born outside the Netherlands or a child born in the Netherlands but with both parents born outside the Netherlands.

Analysis

The prevalence of isolated night-time incontinence, isolated daytime incontinence and the combination of the two were examined first. The analysis then turned to the question whether the parents of children with day- and/or night-time incontinence turned to professionals for advice.

The results were analysed using Statistical Package for the Social Sciences/PC Version 11.5. The chi-square test was the statistical test used.

Results

Of the 3642 eligible children, a total of 2836 (1531 boys, 1289 girls and 16 gender unknown) participated (response rate 77.9%). Analyses were conducted on the 2820 children with known gender. The characteristics of the children (age, gender) are shown in table 1. The mean age was 8.0 years.

Table 1. Population characteristics.

	Gender		*Total*
Age	*Boys*	*Girls*	
4	130	120	250
5	145	137	282
6	172	141	313
7	196	176	372
8	194	162	356
9	216	180	396
10	216	172	388
11	157	132	289
12	105	69	174
Total	1531	1289	2820

The response rate was lower in the higher age groups compared to the lower age groups (74% in the age group of 10-12 year-olds compared to 83% in the group of 4-9 year-olds).
The prevalence of the different forms of incontinence according to age and gender is shown in figure 1, figure 2 and table 2.

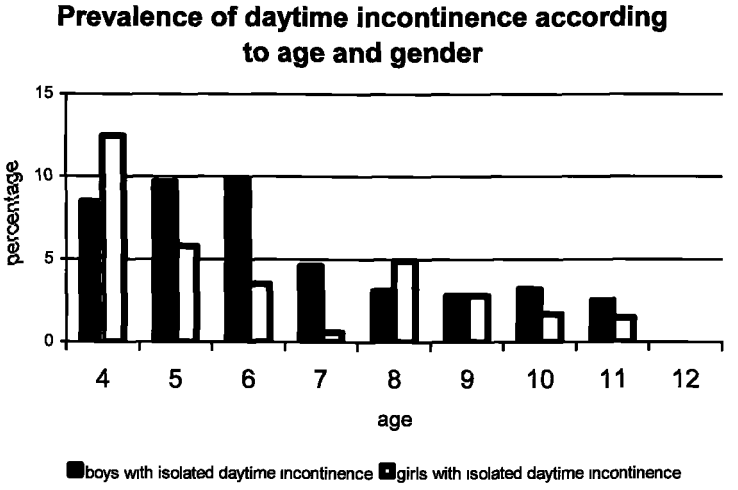

Figure 1. Prevalence of daytime incontinence according to age and gender.

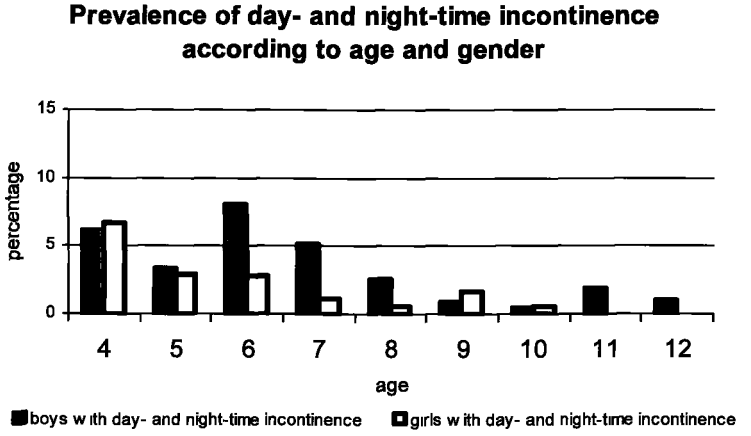

Figure 2. Prevalence of day- and night-time incontinence according to age and gender.

Table 2. Incontinence according to gender

	Boys 4-7 n (%)	*Boys 8-12 n (%)*	*Boys total n (%)*	*Girls 4-7 n (%)*	*Girls 8-12 n (%)*	*Girls total n (%)*	*Total 4-7 n (%)*	*Total 8-12 n (%)*	*Total n (%)*
Isolated night-time incontinence	61 (9.5)	43 (4.8)	104 (6.8)	54 (9.4)	12 (1.7)	66 (5.1)	115 (9.4)	55 (3.4)	170 (6.0)
Isolated daytime incontinence	51 (7.9)	23 (2.6)	74 (4.8)	29 (5.1)	18 (2.5)	47 (3.6)	80 (6.6)	41 (2.6)	121 (4.3)
Day- and night-time incontinence	36 (5.6)	12 (1.4)	48 (3.1)	18 (3.1)	4 (0.6)	22 (1.7)	54 (4.4)	16 (1.0)	70 (2.5)
Dry	495 (77.0)	810 (91.2)	1305 (85.2)	473 (82.4)	681 (95.2)	1154 (89.5)	968 (79.5)	1491 (93.0)	2459 (87.2)
dni % of ni	37.1	21.8	31.6	25	25	25	32.0	22.5	29.2
dni % of di	41.4	34.3	39.3	38.3	18.2	31.9	40.3	28.1	36.6
Total	643	888	1531 (54.3)	574	715	1289 (45.7)	1217 (43.2)	1603 (56.8)	2820

dni % of ni = percentage of children with night-time incontinence who also have daytime incontinence.
dni % of di = percentage of children with daytime incontinence who also have night-time incontinence.

Night-time incontinence was found in 240 children (8.5%). Of these children, 70 (29.2%) suffered from a combination of day- and night-time incontinence. Daytime incontinence was observed in 191 children (6.8%). Of these children, 36.6% suffered from a combination of day- and night-time incontinence. The figures for all forms of incontinence were significantly higher in statistical terms in boys and in the younger age groups.

Frequent voiding (8 times or more daily) was significantly less common in continent children (4.8%) compared to incontinent children. This was especially true for children with the combination of day- and night-time incontinence (15.7%).

Infrequent voiding (3 times or less each day) was significantly less common in children with isolated night-time incontinence (8.8%) compared to children with isolated daytime incontinence (16.5%). There was no significant difference between dry children and children with isolated night-time incontinence or children with isolated daytime incontinence.

Voiding problems (straining during voiding, a weak or interrupted flow, post-void dribbling, dysuria, haematuria or urinary tract infections) were twice as prevalent ($p = 0.001$) in children with the combination of day- and night-time incontinence (32.9%) or isolated daytime incontinence (27.3%) compared to continent children (16.1%) or children with isolated night-time incontinence (15.9%). The difference in voiding problems between dry children and children with isolated night-time incontinence was not statistically significant. Urinary tract infections were not related to day- and/or night-time incontinence (7.5% in all incontinent children; 5.9% in children with isolated night-time incontinence; 6.6% in children with isolated daytime incontinence as opposed to 8.2% in dry children (not significant)). (Table 3).

Table 3. Incontinence characteristics according to different forms of incontinence

	isolated night-time incontinence n (%)	*isolated daytime incontinence n (%)*	*day- and night-time incontinence n (%)*	*dry n (%)*
Characteristic	*n=170*	*N=121*	*n=70*	*n=2459*
>/= 8x voiding a day	15 (8.8)$	15 (12.4)#	11 (15.7)#	119 (4.8)#
</= 3x voiding a day	15 (8.8)	20 (16.5)	6 (8.6)	322 (13.1)
Voiding problems	27 (15.9)	33 (27.3)*	23 (32.9)#	395 (16.1)*
Leaves bed to drink	8 (4.7)	10 (8.3)	2 (2.9)	106 (4.3)
Defecation frequency ≥ 1 x 2 days	159 (93.5)	114 (94.2)	63 (90.0)	2298 (93.5)
Defecation frequency ≤ 3 x week	6 (3.5)	4 (3.3)	5 (7.1)	85 (3.5)
Parentally reported constipation	9 (5.3)	7 (5.8)	4 (5.7)	84 (3.4)
Sought counselling	35 (20.6)*	40 (33.1)#	26 (37.1)#	289 (11.8)#

Voiding problems: straining during voiding, a weak or interrupted flow, post-void dribbling, dysuria, haematuria or urinary tract infections.
Sought counselling = sought counselling for day- and or night-time incontinence from general practitioner, Youth Health Care, paediatrician, urologist or others.
Statistics: children with isolated daytime incontinence, isolated night-time incontinence or the combination of day- and night-time incontinence compared to dry children and dry children compared to all children with day- and/or night-time incontinence.
#: p = <0.001
**: p = 0.001*
$: p = <0.05

Constipation or encopresis may be related to incontinence. Parentally reported constipation and frequency of defecation reported by parents were both part of the questionnaire. There was no statistically significant difference between parentally reported constipation in children with isolated night-time incontinence (5.3%), children with isolated daytime incontinence (5.8%), children with day- and night-time incontinence (5.7%) or dry children (3.4%). Nor was there a difference between a defecation frequency of 3 times a week or less in any form of incontinence or in dry children (3.5% in isolated daytime, 3.3% in isolated night-time, 7.1% in day- and night-time incontinence and 3.5% in dry children). Of the children with parentally reported constipation, 71.2% defecated every day or every other day. According to parents, 75% of the children who defecated three times a week or less did not suffer from constipation. (Table 4).

Table 4. Constipation in relation to defecation frequency.

parentally reported constipation	*defecation frequency n (%)*					
	once or more each day	*every other day*	*1-3 times a week*	*less than once a week*	*other*	*total*
yes	36 (1.6)	38 (10.1)	22 (23.4)	3 (50.0)	5 (16.7)	104 (3.8)
no	2220 (98.4)	340 (89.9)	72 (76.6)	3 (50.0)	25 (83.3)	2660 (96.2)
Total	2256 (81.6)	378 (13.7)	94 (3.4)	6 (0.2)	30 (1.1)	2764

Parents sought professional counselling for 20.6% of the children with isolated night-time incontinence, 33.1% of the children with isolated daytime incontinence, and 37.1% of the children with daytime and night-time incontinence. Parents of non-Dutch children sought help significantly less often than parents of Dutch children.

Discussion

The response rate in this population-based study was high (77.9%). The response was higher in girls (79.8%) than in boys (77.2%), higher in normal education (81.0%) than in special education (70.0%) and higher in younger age groups. This high response rate was possible because the study was performed in the setting of the Youth Health Care system in the Netherlands.

Our results show that almost 30% (70/240) of the children with parentally reported night-time incontinence also have parentally reported daytime incontinence. This is well below the 71% found in the study of Bakker and colleagues.[14] Probable explanations are that Bakker and colleagues looked at different age groups (10-14 years) than our study did (4-12 years) or that there was some form of selection bias. In older age groups, the group that remains incontinent has a combination of problems more often. The rate of 36.6% in our study for the children with parentally reported daytime incontinence as well as night-time incontinence (70/191 of the children) concurs more with the 44.0% in Bakker's study.[14] Nevertheless, it is obvious that a large proportion of the children with one of the forms of incontinence also have the other form. As far as we know, there are no recent population-based data available for the prevalence of the combination of day- and night-time incontinence in boys and girls in the age groups we studied.

It is supposed that the normal treatment options for Monosymptomatic Nocturnal Enuresis do not apply to children with the combination of day- and night-time incontinence.

Recently however, we described how, for the majority of children with the combination of day- and night-time incontinence without signs of pathology, alarm treatment can be used to achieve the same success percentages for continence at night as in children with MNE. A large proportion of the children with combined symptoms even became dry during the day. Referral to a clinical specialist with experience in the treatment of enuresis is appropriate only for children with a combination of day- and night-time incontinence that remain incontinent after alarm treatment and for children with a combination of day- and night-time incontinence with signs of pathology.[18] All children suffering from day- and/or night-time incontinence more than once a month after the age of 7 should receive special attention because social pressure will increase considerably and their self-esteem may deteriorate. Incontinence problems often lead to bullying and absence from school.[12,18] The early detection and treatment of day- and/or night-time incontinence is equivalent to the primary prevention of behavioural and/or emotional problems as a result of incontinence.[2,18,19]

Frequent voiding (8 times or more daily) was significantly more common in all forms of incontinence in our study. Bladder training before alarm treatment could make the treatment more successful in these children. Voiding problems (straining during voiding, a weak or interrupted flow, dysuria, hematuria or urinary tract infections) were, as suspected, more common in children with daytime incontinence (with or without night-time incontinence) than in children who were dry or in children with isolated night-time incontinence. A more surprising result was that there was no

difference in voiding problems between dry children and children with isolated night-time incontinence. Surprisingly, contrary to widespread belief, parentally reported urinary tract infections as an isolated factor were not found to be related to any form of day- and/or night-time incontinence. If confirmed in other studies, this raises the question of whether it really is necessary to refer all children from the normal population with day- and/or night-time incontinence and a history of urinary tract infection for urodynamical evaluation.

Almost every paper on the subject suggests that there is a relation between incontinence of urine and constipation or encopresis. However, the definitions of constipation, soiling, incontinence of stool and encopresis vary enormously. A common definition of constipation meets at least two of the following criteria: (1) defecation frequency less than three times per week; (2) soiling and/or encopresis more than two times per week; (3) production of large amounts of stool once per 7-30 days; and (4) the presence of a palpable abdominal or rectal mass. Soiling is often defined as the loss of a small amount of loose stool in the underwear. Encopresis is often defined as the loss of a normal amount of stool in the underwear after the age of 4 years, without an underlying organic disorder.[20] In our study, both parentally reported constipation and frequency of defecation were covered by the questionnaire. However, our results in this population-based study prove that there is little concurrence between the two approaches (table 4). Most children with parentally reported constipation had a normal defecation frequency and most children with a defecation frequency of three times a week or less had no parentally reported constipation. To diagnose constipation it is therefore not useful to ask parents if the child has constipation. This makes it difficult to prove a relation between incontinence of urine and constipation and the pathophysiological, diagnostic and prognostic relevance of a relation is unclear. Even so, in our population-based study, there is no significant difference between either parentally reported constipation or frequency of defecation and children with or without any form of incontinence. The links mentioned in the literature might have occurred because both constipation and incontinence are more common in boys than in girls.[20]

In general, we find that, if a child has constipation and incontinence, the two problems need to be addressed at the same time. The success rate for achieving continence and/or control over defecation is probably lower when there is a relation between the two problems in a child. However, if the child can be cured of one of the problems, there may be more energy to deal with the other problem.

Daytime incontinence is more socially noticeable than night-time incontinence, which can be hidden. That is probably why parents seek professional counselling for their children with daytime incontinence more often than for their children with night-time incontinence. Children who combine both forms of incontinence have double problems, so parents are probably much more willing to seek help for their bedwetting children if they also have daytime incontinence. However, it is disturbing that, despite all the efforts made and the "open" character of the Dutch Health system, the majority of parents did not seek professional counselling, even though this is one of the main problems to afflict children. Furthermore, parents of non-Dutch children are even less inclined to seek counselling. This supports the view that day- and/or night-time incontinence is a hidden condition for children, just as it is for adults.[6,14] In their study in Belgium, Bakker and colleagues also found a low percentage of parents seeking medical help for their children's incontinence. A difference between our study and theirs is that they found that isolated night-time incontinence was the main reason for seeking help, and that isolated daytime

incontinence seemed to be the least worrisome.[14] The Dutch families concerned may not know qualified help is available, or perhaps think there is no cure for the problem, or that time will heal. However, as stated above, a cure is available for these problems for most children. In the Dutch Public Youth Health Care system, all children are seen, together with their parents, on a regular basis. It is also possible that the parents involved may feel they have been given enough information during these regular consultations but that they do not consider this to be professional medical advice.

Conclusion

In this population-based study, the prevalence of children with day- and/or night-time incontinence was high. Almost 30% of the children with night-time incontinence also have daytime incontinence and almost 40% of the children with daytime incontinence also have night-time incontinence. Most parents did not seek counselling. Treatment is possible for the majority of the affected children, so physicians should take an active approach to providing information about day- or night-time incontinence, and especially the combination of the two, and to providing parents and children with structured treatment plans.

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Chapter 3

ENURESIS NOCTURNA IN ADULTS

Reprinted from: Scand J Urol Nephrol 1997; 533-6. Hirasing RA, Leerdam FJM van, Bolk-Bennink L, Janknegt RA. Enuresis Nocturna in adults.

Abstract
To assess the prevalence and characteristics of enuresis nocturna in adults, the treatment they received and the perceived impact, a random sample of 13081 non-institutionalized adults (18- 64 years old) were asked to participate in the study in January-March 1996. The response rate was 87%. A personal computer questionnaire included 23 questions on frequency of bedwetting, daytime wetting, treatment and perceived impact. Any respondent reporting bedwetting at least once during the previous 4 weeks was considered to have enuresis nocturna.
The overall prevalence of enuresis nocturna was 0.5%. Differences between age groups and sexes were not significant. Fifty percent of men and 19% of women reporting enuresis nocturna had primary enuresis nocturna, of those with enuresis noturna 12% of men and 29% of women had always daytime incontinence. Fifty percent of the men and 35% of the women had never consulted a care provider for their bedwetting and 38% of the men and 26% of the women had done nothing to become dry. Only 30% believed that bedwetting was treatable. Bedwetting was associated with several psychosocial problems. Enuresis nocturna in adults is common and may lead to embarrassment and discomfort. It may affect careers, social life and personal relationships. Adults should be more aware of that bedwetting is a treatable problem. More information should be given on this issue.

Introduction

Enuresis is a socially embarrassing symptom with emotional and behaviourial difficulties. It is a common disorder affecting 15-20% of 5-year-old children and 1-2% of adolescents.[10,11] Prevalence declines with age and is generally higher among boys. The annual spontaneous cure rate for 5-9 year-old children is 14% and for 10-18 years-old it is 16%.[2] For adults, prevalence by age groups and spontaneous cure rate is unknown.

Common treatments for children with enuresis nocturna are: bladder training, lifting or waking the child at night, rewards and "star charts", drug treatment and the use of an enuresis alarm. Despite the availability of these treatments, a number of children and adults continue to wet their bed. There are few reports on bedwetting in adolescents. During the Second World War, Levine found that 1.2% of recruits had enuresis nocturna, but no definition was given.[7] Bieger reported that 0.19% of conscripts were rejected for military service in peace time because of nocturnal enuresis.[1] Since De Graaff bravely brought to the world's attention his efforts and consultations during 40 years to find a solution to his disabling nocturnal wetting, this complaint is getting more attention.[4] However, the prevalence of bedwetting in adults in The Netherlands is unknown. Therefore a group of adults was studied to assess prevalence and characteristics of enuresis nocturna, the treatments they received and the perceived impact. Such information may help physicians to appreciate the need to deal more actively with enuresis nocturna in adults.

Material and method

In January-March 1996, a total of 13081 non-institutionalized adults aged 18-64 years were visited at home by a trained cadre of interviewers and were asked to participate in the study. Of each visited adult, sex and age were registered. The adults were randomly selected from a database of the 6 million dwellings in the 700 municipalities in The Netherlands. A total of 11406 (87%) decided to participate in the study. The response rate did not differ between age groups (Table 1).

Table 1 *Response according to age group and gender*

	Men			*Women*			*Total*		
Age group	*Selected*	*Response No.*	*%*	*Selected*	*Response No.*	*%*	*Selected*	*Response No*	*%*
18-24 year	728	626	86	774	709	92	1502	1335	89
25-34 year	1413	1253	89	2231	1986	89	3644	3239	89
35-44 year	1215	1054	87	2364	2110	89	3579	3164	88
45-54 year	968	804	83	1525	1326	87	2493	2130	85
55-64 year	983	790	80	880	748	85	1863	1538	83
Total	5307	4527	85	7774	6879	88	13081	11406	87

To provide more privacy, the respondents self-operated a personal computer and completed the self-administered questionnaire, which included 23 questions about the enuresis. For each question, a choice of possible responses were presented. The first question in the series was: "Did you wet your bed at least once during the past

4 weeks". This was a trigger question. If the respondent answered no, the interview was ended. If the respondent answered 'yes', questions on frequency of enuresis, daytime wetting, treatment and perceived impact were posed. Any respondent reporting wetting his/her bed at least once within the last 4 weeks, was considered to have enuresis nocturna. Chi-squared tests were used for statistical analyses, p values are reported for all significant comparisons.

Results

The overall prevalence of bedwetting was 5‰ The differences between the age groups and sexes were not statistically significant (Table 2).

Table 2 Prevalence of enuresis nocturna according to age group and gender

	Men			*Women*			*Total*		
Age group (years)	*Number of respondents*	*Enuresis nocturna No.*	*‰*	*Number of responden ts*	*Enuresis nocturna No.*	*‰*	*Number of responden ts*	*Enuresis nocturna No.*	*‰*
18-24 year	626	3	5	709	1	1	1335	4	3
25-34 year	1253	9	7	1986	10	5	3239	19	6
35-44 year	1054	4	4	2110	8	4	3164	12	4
45-54 year	804	5	6	1326	7	5	2130	12	6
55-64 year	790	5	6	748	5	7	1538	10	7
Total	4527	26	6	6879	31	5	11406	57	5

Of those reporting enuresis nocturna 28% of the men and 36% of the women wet their bed at least twice a week (Table 3); 20% of the men and 26% of the women wet their bed almost every night.

Table 3 Frequency of enuresis nocturna according to gender

Frequency	*Men*		*Women*		*Total*	
	No.	*%*	*No.*	*%*	*No.*	*%*
1-3 per month	9	35	8	26	17	30
1 per week	2	8	2	6	4	7
2-3 per week	1	4	3	10	4	7
4-5 per week	1	4	-	-	1	2
6 perweek	2	8	1	3	3	5
Daily	3	12	7	23	10	18
Otherwise	8	31	10	32	18	31

In men who wet their bed 50% had never experienced a period of dryness of at least 6 months (primary enuresis nocturna); in women, this percentage was 19. The difference between men and women was statistically significant ($p \leq 0.01$). In men with

enuresis nocturna 50% had never day time incontinence, 38% sometimes and 12% (almost) always; in women these percentages were 25, 46 and 29, respectively. Fifty percent of the men and 35% of the women never consulted a care provider for their bedwetting (Table 4). Those who did ask for help, usually consulted a general physician.

Table 4 *Type of care provider according to gender*

Care provider	*Men (n=26)*		*Women (n=31)*		*Total (n=57)*	
	No.	*%*	*No.*	*%*	*No.*	*%*
None	13	50	11	35	24	42
General practitioner	5	19	9	29	14	25
Specialist	3	12	5	16	8	14
Psychologist	3	12	1	3	4	7
Other	4	16	6	19	10	18

Table 5 shows that respondents used a variety of methods for dealing with enuresis nocturna. Surprisingly, 38% of men and 26% of women had done nothing to become dry. Of the respondents who wetted their bed, 16% had used medication and 25% had done bladder training. Only 7% had ever used the enuresis alarm. Of those with enuresis nocturna, 39% of men and 55% of women wore incontinence pads at night.

Table 5 *Action taken to become dry*

Activity	*Men (n=26)*		*Women (n=31)*		*Total (n=57)*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Never tried anything	10	38	8	26	18	32
Bladder training	4	15	10	32	14	25
Fluid restriction after dinner	2	8	4	13	6	11
Wake up to urinate	1	4	-	-	1	2
Enuresis alarm	3	12	1	3	4	7
Drugs	5	19	4	13	9	16
Dry bed training	2	8	-	-	2	4
Other	5	20	13	42	18	32

Of the respondents: 30% believed that bedwetting was treatable, 30% of the bedwetters were concerned about bedwetting; 40% said it was terrible that they wet their bed and 37% feel sad because they wet their bed, 32% said that bedwetting had a great influence on their life, because of bedwetting 33% were reluctant to go on holidays or stay overnight and 23% said that bedwetting complicated their relationships.

Discussion

This is the first national population-based study in The Netherlands on prevalence and characteristics of enuresis nocturna in non-selected adults aged 18-64 years. In this population, 0.5% of the adults had wet their bed at least once during the previous 4 weeks. Almost one-quarter of the adults who wet their bed did this (almost) daily. No similar study could be traced in the literature, therefore we are unable to compare the prevalence we found in The Netherlands with that in other countries. Unlike in children, the difference between age groups and gender was statistically not significant.

Bedwetters are commonly divided in two groups: those who have never experienced a period of dryness of at least 6 months (primary enuresis nocturna) and those who experienced a dry period of 6 months or more (secondary enuresis nocturna). In our study population 50% of the men and 81% of the women had secondary enuresis nocturna. These percentages are much higher than in children.[3,5,6]

Fifty percent of the men and 25% of the women had monosymptomatic bedwetting. Most of the others had daytime incontinence occasionally. The meaning of occasional daytime incontinence is not clear.

The figures on prevalence of enuresis nocturna and the type indicate that the annual spontaneous cure rate in adults is very low and that it is not justified to tell children that they will grow out of enuresis. Indeed, most of the children will, but some will never become dry if no action is undertaken.

Our results show that bedwetting in adults is associated with a great psychosocial impact.

One-third was concerned about bedwetting, one third was sad and 40% said it was terrible. Because of bedwetting, 33% were reluctant to go on holidays or stay overnight and 23% said it complicated their relationships. Although the impact of the disorder seems high, 40% never consulted a care provider. This could signify a lack of confidence in the care providers ability or desire to deal with enuresis.

It is striking that 32% had done nothing to become dry and that only 7% had ever used the enuresis alarm, although this has proved to be the most effective method to treat enuresis nocturna in children.[8] Also striking was that only 30% of the bedwetting adults believed that bedwetting was treatable. In the future, the prevalence of bedwetting in adults could decrease through an improved treatment for children and the consultation of care providers by adults. To reach this goal we must strive to provide more information on bedwetting in adults and teach care providers to deal with this complaint.

One shortcoming in our study is that we did not asked for other drugs used, as it is known that some medication can precipitate nocturnal enuresis.[9] This, however, plays a greater role in adults of 65 years and older.

Another limitation of our study is that although the total sample was large and representative for the adults in The Netherlands, the number of subjects who reported nocturnal enuresis was relatively small. Nevertheless, we can conclude that nocturnal enuresis in adults is a common but little publicized problem that leads to embarrassment and discomfort and can affect the careers, social life and personal relationships. Physicians have to take a more active role in detecting and diagnosing enuresis nocturna in adults and need to be more aware that enuresis is an important problem.

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Chapter 4

PREVALENCE OF DAY- AND/OR NIGHT-TIME INCONTINENCE IN CHILDREN WITH ATTENTION PROBLEMS

Submitted in Dutch as: Leerdam FJM van, Reijneveld SA, Hoog N de, Heijden AJ van der, Hirasing RA. Prevalentie van broek- en/of bedplassen bij kinderen met aandachtsproblemen.

Abstract
Aim of the study was to assess the prevalence of daytime and/or night-time incontinence in children with a clinical score on Attention Problems.
Of the population sample of 4970 children, 4480 participated (response 90.1%). Parents of 4171 children (2069 boys and 2102 girls) aged between 4 and 15 years filled out the Dutch version of the Child Behaviour Check List (CBCL). Mean age was 9.3 years. For daytime and night-time incontinence, we used the items "daytime wetting" and "bedwetting" respectively of the CBCL. For Attention Problems we used the Attention Problems syndrome scale of the CBCL.
The prevalence of daytime incontinence in this population-based study was 2.3%, of night-time incontinence 9.3% and of the combination of day- and night-time incontinence 1.2% (statistically significant higher in boys and in younger children). For children with a clinical score on the Attention Problems scale, parents reported daytime incontinence in 4.5% (2.4% of the boys and 8.0% of the girls), night-time incontinence in 12.1% (12.2% in boys and 12.0% in girls) and the combination of day- and night-time incontinence in 3.0% (0% of the boys and 8.0% of the girls). For children with a normal score, parents reported daytime incontinence in 2.2%, night-time incontinence in 9.2% and the combination of day- and night-time incontinence in 1.2%. The differences between children with a clinical score are not significant with the exception of girls with the combination of day- and night-time incontinence.
There is no relation between day- or night-time incontinence separately and Attention Problems. These findings need to be confirmed in large studies with a clinical assessment of Attention-Deficit Hyperactivity Disorder.

Introduction

Both incontinence for urine and ADHD (Attention-Deficit Hyperactivity Disorder) are common and invalidating disorders in childhood in industrialized countries. Night-time incontinence prevalence at the age of 5 is 18% in boys and 10% in girls, decreasing to about 2% in adolescence. Even 0.5% of adults have night-time incontinence.[1-7] The prevalence of ADHD in the Netherlands is about 3-5% in primary school children, 1.5% in adolescents and about 1% in adults. Boys are affected twice as often as girls.[8]

Children with a combination of incontinence and a chronic condition like ADHD have double problems. There is some evidence that ADHD and incontinence for urine are associated.[9-11] A possible explanation is that enuresis is a problem of not paying "attention" to the signals of a full bladder, causing children with attention problems to have more difficulty in waking in response to, or in recognising, the signals of a full bladder. The available results on the possible relation between ADHD and incontinence are, however, mostly casuistic and limited to small clinical samples.[12-15] Data from community samples are lacking.

The aim of this study was to assess the prevalence of day- and/or night-time incontinence in children with Attention Problems (as indication of ADHD) in a non-selected population.

Methods

Sample

We obtained our sample using a two-stage selection procedure. In the first stage, a random sample of 19 was taken from the 63 Child Health Care Services in the Netherlands, after stratification by region and degree of urbanisation in the district. In the second stage, each service provided a sample of 75 children for each of 4 grades (second, fourth, and seventh grades of primary school, and the second grade of secondary school) for which they provided preventive health care. Of the 4970 eligible children, 4480 (90.1%) participated.

Differences between responding and non-responding children by sex, age, ethnicity, and degree of urbanisation were small according to the Cohen effect size index w (range of w, 0.01-0.08).[16] Details of the data collection procedure have been presented elsewhere.[17,18]

Data collection

The data were collected in a standardised way during the routine preventive health assessments from October 1997 to June 1998. The design of the study had been approved by the local Medical Ethical Committee. The Child Behaviour Check List (CBCL) [19,20] was mailed to parents, along with the standard invitation for the preventive health assessment. The CBCL was completed by the parents and returned to the researchers in a sealed envelope.

We used the Dutch version of the CBCL.[20] The CBCL consists of 20 competence items and 120 problem items.[19] For the present study, we only used problem items relating to attention problems and micturition (items 107: "daytime wetting" and 108: "bedwetting", dichotomised in scores zero and the combining of scores one and two). The Attention Problems syndrome scale consists of 11 items and is dichotomised in a normal range and a clinical range with scores above the 98th percentile of the age and gender group of the Dutch normative sample. [20]

Analysis

We first examined the prevalence rates for day- and/or night-time wetting in children with and without clinical scores on the Attention Problems scale of the CBCL. We conducted all analyses for girls and boys separately and after adjustment for age because prevalence rates for both Attention Problems and incontinence are known to differ according to gender and age.

The results were analysed using the Statistical Package for the Social Sciences/PC Version 11.0. The statistical tests used were the chi-square test and Fisher's exact test when subgroup numbers were too small. The level of statistical significance is indicated in the figures.

Results

We received completed CBCL forms from 4171 parents of children (2069 boys and 2102 girls) between 4 and 15 years old. Mean age was 9.3 years.

Parents reported daytime incontinence (with or without night-time incontinence) in 94 (2.3%) of the children (2.9% of the boys and 1.6% of the girls). Night-time incontinence (with or without daytime incontinence) was reported in 386 (9.3%) of the children (12.0% of the boys and 6.5% of the girls). The combination of day- and night-time incontinence was reported in 50 (1.2%) of the children (1.6% of the boys and 0.8% of the girls) (Table 1). The prevalence of both day- and/or night-time incontinence reported by parents was significantly higher in boys than in girls and significantly higher in younger children than in older children.

Parents reported daytime incontinence in 4.5% of children with a clinical score on the Attention Problems scale (2.4% of the boys and 8.0% of the girls), night-time incontinence in 12.1% (12.2% in boys and 12.0% in girls) and the combination of day- and night-time incontinence in 3.0% (0% of the boys and 8.0% of the girls) (Table 2). The differences between children with a normal score and children with a clinical score on the Attention Problems scale are not significant for day- or night-time incontinence. On the Attention Problems scale, this difference is only statistically significant for girls ($p=0.017$) for the combination of day- and night-time incontinence.

Table 1. Daytime and/or night-time incontinence (CBCL-wetting items) by age and gender (percentages)

	4-6 years			7-9 years			10-12 years			13-15 years			Total			p-value	
	Boys n = 686	Girls n = 646	Total n = 1332	Boys n = 355	Girls n = 362	Total n = 717	Boys n = 426	Girls n = 459	Total n = 885	Boys n = 602	Girls n = 635	Total n = 1237	Boys n = 2069	Girls n = 2102	Total n = 4171	Boys	Girls
Daytime incontinence	42 (6,1)	20 (3,1)	62 (4,7)	13 (3,7)	4 (1,1)	17 (2,4)	5 (1,2)	6 (1,3)	11 (1,2)	0 (0)	4 (0,6)	4 (0,3)	60 (2,9)	34 (1,6)	94 (2,3)	<0,0001	0,003
Night-time incontinence	142 (20,7)	77 (11,9)	219 (16,4)	56 (15,8)	34 (9,4)	90 (12,6)	32 (7,5)	18 (3,9)	50 (5,6)	19 (3,2)	8 (1,3)	27 (2,2)	249 (12,0)	137 (6,5)	386 (9,3)	<0,0001	<0,0001
Day- and night-time incontinence	23 (3,4)	10 (1,5)	33 (2,5)	7 (2,0)	2 (0,6)	9 (1,3)	3 (0,7)	4 (0,9)	7 (0,8)	0 (0)	1 (0,2)	1 (0,1)	33 (1,6)	17 (0,8)	50 (1,2)	<0,0001	0,044

Table 2. Daytime and/or night-time incontinence in children classified according to Attention Problems scale (normal vs. clinical) (percentages).

	Normal Score Attention Problems scale			Clinical Score Attention Problems scale			p-value	
	Boys n = 2028	Girls n = 2077	Total n = 4105	Boys n = 41	Girls n = 25	Total n = 66	Boys	Girls
Daytime incontinence	59 (2,9)	32 (1,5)	91 (2,2)	1 (2,4)	2 (8,0)	3 (4,5)	1,0	0,06
Night-time incontinence	244 (12,0)	134 (6,5)	378 (9,2)	5 (12,2)	3 (12,0)	8 (12,1)	1,0	0,22
Day- and night-time incontinence	33 (1,6)	15 (0,7)	48 (1,2)	0 (0)	2 (8,0)	2 (3,0)	1,0	0,017

Discussion:

Day- and/or night-time incontinence and signs of ADHD are all disturbing and embarrassing symptoms for children and their parents.[2,4-12] As far we know, our study is the first population-based study with a high response about the prevalence of day- and/or night-time incontinence in children with a clinical score on the Attention Problems scale of the CBCL (an indication of ADHD). In our study, only girls with a clinical score on the Attention Problems scale of the CBCL had significantly more daytime incontinence combined with night-time incontinence compared to girls with a normal score. There were no significant differences for boys. The prevalence of day- or night-time incontinence among both boys and girls with a clinical score on the Attention Problem scale was, in our study, the same as among children with a normal score. The lack of a link between night-time incontinence and a clinical score on the Attention Problem scale contrasts with the findings of Robson and colleagues. In their study (with a selected population), children with ADHD at the age of 6 were 2.7 times more likely than other children of the same age to have nocturnal enuresis and 4.5 times more likely to have diurnal enuresis. In the older age groups, there was no difference.[12] Kodman-Jones and colleagues found in a small and highly selected population a prevalence of ADHD of 21% in children with daytime incontinence (without urinary-tract infection) and of 22% in children with isolated night-time incontinence.[14] Bailey and colleagues however, concluded that the pattern of inheritance of Primary Nocturnal Enuresis and of ADHD demonstrated that transmission was independent.[13] The most likely explanation for the difference between our study and most previous studies is that ours is a population-based study, whereas the previous studies looked at selected groups of children with concentrations of morbidity of various kinds/types. [12-15] Our population-based study did not confirm a relation between Attention Problems and incontinence. This indicates that there seems to be no reason to spend more resources than normal on identifying night-time incontinence in the group of children with Attention Problems (as indication of ADHD). However, extra attention should be paid to daytime incontinence combined with night-time incontinence in girls with a clinical score on the Attention Problems scale. On the other hand, there are reports in the literature that treatment of urinary incontinence in children with ADHD is less effective than treatment for those without ADHD and that children with nocturnal enuresis have a higher relapse rate after treatment with an enuresis alarm.[21] So when a child suffers from both ADHD and day- and/or night-time incontinence, it is therefore important for this child to receive extra attention for relieving the incontinence problem. The wetting problem will be curable in most cases, so the child will have more energy left to cope with the ADHD.[22]

The prevalence of night-time wetting in this study is high compared to the prevalence of bedwetting in other studies, especially in the younger age groups.[1,23] In addition to the different criteria used in the different studies, another possible explanation is the delay observed in recent decades in the attainment of bladder control by young children.[24]

Our study was a community-based study with a large study population and a high response. There were, nevertheless, some limitations. First, the criteria used for an indication of ADHD and for incontinence were not the best possible criteria. However, other authors have found a fair correlation between the results of the CBCL and DSM syndromes.[1,11,20,25] Achenbach and Rescorla themselves found a correlation of 0.85 between the DSM-oriented ADHD problems of the 2001 ASEBA scales and the 1991 CBCL Attention Problem scale.[25] Confirmation of our results

are needed from studies using clinical assessments to diagnose ADHD and incontinence according to DSM criteria. Another limitation is a common problem in community-based studies: although the total group was rather large, its power to detect small associations between ADHD and incontinence was relatively low because the first condition in particular is rare in the population as a whole. Because no association was found in our rather large population an existing association will probably have no clinical relevance.

Conclusion

The differences between children with a clinical score are not significant with the exception of girls with the combination of day- and night-time incontinence.
There is no relation between day- or night-time incontinence separately and Attention Problems. These findings need to be confirmed in large studies with a clinical assessment of Attention-Deficit Hyperactivity Disorder.

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Chapter 5

ALARM TREATMENT IN NOCTURNAL ENURESIS GIVES HIGH LONG-TERM CURE RATES

Submitted as: Leerdam FJM van, Zwetsloot ACM, Heijden AJ van der, Hirasing RA. Alarm treatment in nocturnal enuresis gives high long-term cure rates.

Abstract
241 children were treated with an enuresis alarm in 1997. Non-response was not related to age, sex or the results of initial alarm treatment.
Immediately after alarm treatment, 85.5% of the children were dry. Including those with an initial failure, 76.7% of the children were dry after two years, ranging from 76.5% to 77.3% in the different age categories (n.s.) and from 76.1% for boys and 77.9% for girls. Of the children with initial success, 70.0% were dry after two years. Of the dry children, 15.2% woke up every night (wet children 3.9%) and 51.5% sometimes to urinate (wet children 27.5%).
Conclusion
Alarm treatment is a good treatment option for children of 5 years and older with nocturnal enuresis. More medical investigation and tailor-made treatment by professionals may be required for the group not being dry after initial alarm treatment and the group with a relapse after being dry.

Introduction

Nocturnal enuresis is a common disorder, affecting 10-20% of 5-year-olds and 1-2% of adolescents.[1-7] Even 0.5% of adults wet their beds.[3] The acquisition of night-time bladder control is an important stage in the development of children.
Enuresis is a socially embarrassing symptom, leading to emotional and behavioural problems.[8-10]
Various treatments are available for children with nocturnal enuresis. One of these treatments is the use of an enuresis alarm. Recently, some impressive overviews of the literature have been published.[11,12,13] The enuresis alarm treatment is widely recommended in many European countries, although it is not often used in the United States.[14] In the enuresis guideline in the Netherlands, alarm treatment plays an important role in the treatment of bedwetting.[15] It has proven effective in the short term. However, there are only a few long-term studies and they present conflicting results about long-term effectiveness.[16-20] Until now, there were no Dutch long-term effect studies of alarm treatment for bedwetting. We therefore investigated the long-term effect of the enuresis alarm in a Dutch population.
The aim of the study was to assess the long-term outcome of alarm treatment in enuretic children.

Patients and methods

241 consecutive children who met the inclusion criteria were included in the study. They were recruited in 1997 by a company that rented enuresis alarms to parents of bedwetting children. The alarm used in this study consists of specially wired underpants, which are connected to an alarm on the bedpost of the child's bed. All children used the same type of alarm. Before the parents start with the enuresis alarm, the parents were asked a series of questions from a standard questionnaire.[2]

The inclusion criteria were nocturnal enuresis (according to DSM IV: at least two wet nights a week in the past 3 months) and no incontinence or other urological problems. The parents were asked to complete a bedwetting diary for as long as they used the alarm. A questionnaire was sent to the parents after six months, and again after two years following the original start of the alarm treatment.
Two years after starting with an enuresis alarm, it was possible to incorporate the data of 223 children (92.5%) in the study. The remaining 18 children moved and could not be reached, or did not want to participate in the study anymore. Of these 223 children, 155 were boys (69.5%) and 68 girls (30.5%). They came from all over the Netherlands. Their age at the start of the study ranged from 5 to 16 years old. Non-response was not related to age, sex or the results of the initial alarm treatment.
A child was considered 'dry' when it remained completely dry while sleeping for at least 28 consecutive nights. It was considered 'occasionally wet' when the child had at most one wet night a week in a four-week period. The term 'relapse' is used for children who started wetting the bed again for two or more times a week after they had achieved dryness.
The results were analysed with SPSS/PC Version 8.0. The statistical test used was the chi-square test. Results with a p-value < 0.05 were considered to be statistically significant.

Results

After the alarm treatment, 206 of the original 241 children were dry (85.5%, 95% CI = 80.2% - 90.0%). After six months, 101 (49.0%, 95% CI = 42.1% - 56.1%) of the dry

children were still completely dry and 67 (32.5%, 95% CI = 26.3% - 39.4%) were only occasionally wet. Thirty-four children (16.5%, 95% CI = 11.9% - 22.4%) were wet again. After 6 months, 4 children (1.9%) were missing for follow-up (figure 1). Including the occasionally wet children in the dry group six months after alarm treatment, the success percentage was 69.7% (95% CI = 63.4% - 75.4%) for the whole group studied.
Of the 168 children who were dry after the alarm treatment and still dry after six months (including the occasionally wet children), 9 were missing for follow-up after 2 years. Of the remaining 159 children, 106 were still completely dry after two years: 44.0% (95% CI = 37.7% - 50.5%) of the original group. Including the 36 children with only occasionally wet nights, 58.9% (95% CI = 52.4% - 65.1%) of the original group were still dry two years after the alarm treatment.
Of the 34 children being dry after the treatment who had suffered a relapse after six months, 14 (41.2%, 95% CI = 25.1% - 59.2%) were dry again after two years. Four (11.8%, 95% CI = 3.8% - 28.4%) of them were completely dry and 10 (29.4%, 95% CI = 15.7% - 47.7%) were only occasionally wet.
In summary, 156 of the 241 children treated with alarm treatment (64.7%, 95% CI = 58.3% - 70.7%) were still successful or successful again (completely dry or only occasionally wet) after two years. Excluding the missing children, this success percentage is 70.0% (95% CI = 63.4% -75.8%).
We failed to register the success after six months of the group that was not successful after the treatment, but we did register their success after two years. We were able to retrieve 32 of the 35 children. After two years, 9 (28.1%, 95% CI = 14.4% – 47.0%) of them were dry and 6 (18.8%, 95% CI = 7.9% - 37.0%) of them occasionally had a wet night.
Including all dry children and the children with an occasional wet night, the success percentage of the alarm treatment after two years is 71.0% (95% CI = 64.7% - 76.5%). If one excludes the missing children at follow-up, the long-term success percentage rises to 76.7% (95% CI = 70.5% - 82.0%).
The results of the 3 measuring moments (imidiately after alarm treatment, after 6 months and after two years) are summarised in figure 1.
The results of the different age and sex categories are summarised in table 1.

Table 1. Absolute number and percentage dry children according to age and gender.

		success after two years		
age	*n*	*Boys n (%)*	*Girls n (%)*	*Total n (%)*
5-7	102	54 (74.0)	24 (82.8)	78 (76.5)
8-10	99	53 (79.1)	23 (71.9)	76 (76.8)
11-16	22	11 (73.3)	6 (85.7)	17 (77.3)
Total	223	118 (76.1)	53 (77.9)	171 (76.7)

After two years, 25.7% (95% CI = 19.5% - 33.1%) of the dry children (including the occasionally wet children) slept through the night and 15.2% (95% CI = 10.4% - 21.7%) woke up every night to urinate. About half of the dry group (51.5%, 95% CI = 43.7% - 59.1%) sometimes woke up and sometimes slept through the night. In 7.6% this is unknown or different. Of the wet group, 56.9% (95% CI = 42.3% - 70.4%) slept through the night and only 3.9% (95% CI = 0.7% - 14.6%) woke up every night. Of the wet children, 27.5% (95% CI = 16.3% - 42.0%) sometimes woke up and sometimes slept through the night and, in 11.8%, the sleeping habits are unknown.

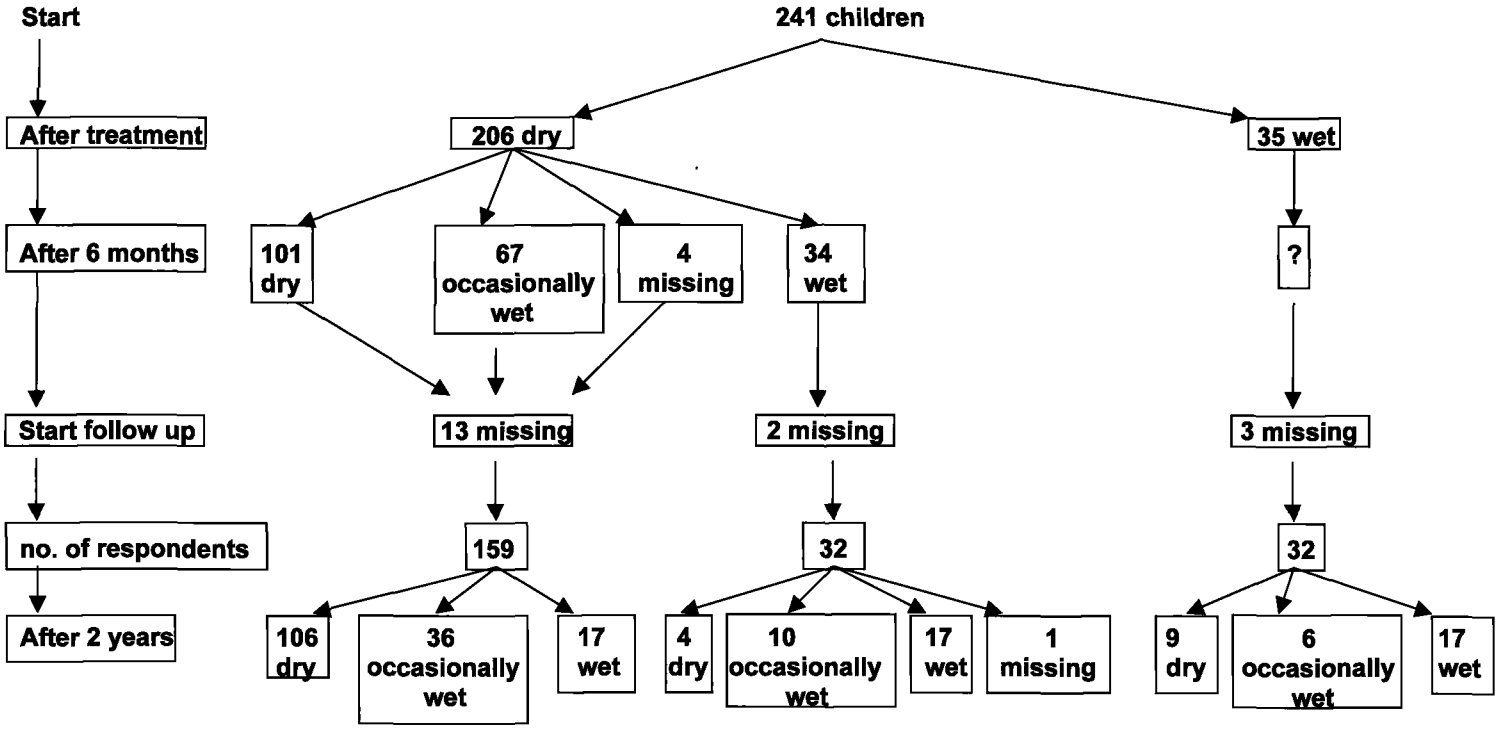

fig. 1 Long term results after alarm treatment.

Discussion

Immediately after the alarm treatment, 85.5% of the wet children were dry. Two years after the alarm treatment, 76.7% of the children were successful (with or without an occasional wet night). However, only 44.0% of the children who were dry initially remained completely dry throughout the study period. The other children were again wet for longer or shorter periods after the alarm treatment. If the children with occasionally wet nights are included in the success group, the success percentage increases to 58.9%. A shortcoming of the study is that a control group is lacking. However, the obtained results are much higher than the known spontaneous cure rate for bedwetting of about 15-18% each year.[3,21] Our results immediately after alarmtreatment and 6 months thereafter are in concordance with a recent Cochrane Review by Glazener and colleagues. They concluded that research including follow-up to determine relapse rates is needed.[13] Follow-up data are provided by this study.

The high failure rate after alarm treatment found in some studies[12] might be originate from the poor design and quality of the alarms used and the quality of the support given with the alarm.[13,22] A reason for the rather high success rate in our study is the high motivation of the parents and children.[12,23] They rented the enuresis alarms directly from the alarm device company, so this group consists of people who are willing to take an active approach to become dry.

Several interesting observations can be made based on this study. Firstly, a rather large group of children being dry after alarm treatment becomes wet again or have occasional wet nights. However, the majority of the second group does not get worse and continues to have occasional wet nights or is even dry again two years after treatment. Those children can be reassured that their relapse is probably temporary. On the other hand, it is surprising that the majority of the children who were dry immediately after the alarm treatment, but wet again after 6 months, were still wet after two years. Apparently this is a group that requires extra attention and perhaps renewed medical investigation and tailor-made treatment by professionals with a special interest in the field of enuresis. The renewed use of the enuresis alarm with or without desmopressin is one of the possibilities because the children were dry immediately after the initial alarm treatment. However, if unsuccessful, other possibilities should also be tried.

About half of the group that did not respond to the initial alarm treatment stayed wet. The majority of this group slept through the night. Apparently, they are still not ready to be woken up either by their full bladder or by an enuresis alarm. On the other hand, the other half of the group that did not respond to the initial alarm treatment eventually became dry (including those with occasionally wet nights), but after a longer period of time.

Of the dry children, 15.2% woke up every night and 51.5% woke up sometimes to urinate. By contrast, only 3.9% of the wet children woke up every night and 27.5% woke up sometimes. This suggests that at least part of the mechanism of the alarm treatment is learning children to wake up in response to a signal from a full bladder. Whereas the majority of the dry children wake up to urinate, the majority of the wet children sleep through the night. This is another confirmation of the belief held by many parents that bedwetting is caused by an arousal problem.[23]

There are several possible explanations why some children do not respond to the alarm treatment. Maybe they are not "ready" for it. They have an arousal problem in response to any signal, including the signal of a full bladder or the signal from an alarm or they have a shortage (relative or absolute) of anti-diuretic hormone at

night.[24] Another possibility is that they have simultaneous problems that are either a cause of the wetting at night or that prevents them to become dry, such as a small or overactive bladder, sleep disturbances or other medical pathology.[15]
We found virtually the same success percentage in the different age categories, so it is obvious that the alarm treatment can also be used successfully for the young bedwetting children between 5 and 7 years old. We already reported this after the initial study,[25] and can now state that the relapse rate in this group was not higher. Our observation that the alarm treatment can be used successfully in the older age group concurs with observations of Butler and Robinson. [26]

Conclusion

Alarm treatment is a good treatment option for children aged 5 years and older with nocturnal enuresis, regardless of sex or age. The results in the long term are much better than expected compared to the spontaneous cure rate. Alarm treatment is the most effective means of eliminating bedwetting. The group that does not become dry after the initial alarm treatment and the group that had a relapse after initially becoming dry require extra attention and perhaps renewed medical investigation and tailor-made treatment by professionals with a special interest in the field of enuresis. Reintroducing the bedwetting alarm, with or without desmopressin, is an option for the latter group.

Acknowledgements

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Chapter 6

ALARM TREATMENT IS SUCCESSFUL IN CHILDREN WITH DAY- AND NIGHT-TIME WETTING

Reprinted from: Scand J Urol Nephrol 2004; 38(3):211-5. Leerdam FJM van, Blankespoor MN, Heijden AJ van der, Hirasing RA. Alarm treatment is successful in children with day- and night-time wetting.

Abstract

Objective:

To assess the effect of alarm treatment in children with day- and night-time wetting compared to those with night-time wetting only.

Material and Methods

A total of 37 consecutive children (25 boys and 12 girls), all of whom suffered from both day- and night-time wetting, were compared to a group of 21 boys and 16 girls with nocturnal enuresis only. In both groups the age range was 5 -13 years. Inclusion criteria were at least two wet nights a week in the previous 4 weeks combined with day-time wetting. The parents were asked to complete a diary during the study period.

Results

Sixty-five percent of the children with day-time and night-time wetting became dry at night, the average time needed being 49 days (range 22-134 days). Seventy-six percent of the children with only night-time wetting became dry at night, the average time needed being 52 days (range 22-121 days). No significant differences were found between the success rates for the two groups or between the different age groups in the two groups.

Of the children with day- and night-time wetting who became dry at night after alarm treatment, 42% also became dry during daytime.

Two years after alarm treatment, 15/16 traced children were still dry at night and all 10 traced children are still dry during day-time.

Conclusion

As with children with only night-time wetting, the majority of children with day- and night-time wetting become dry at night with the use of an enuresis alarm. The results are good compared to the spontaneous cure rate. By using alarm teatment at night , children often also become dry during the day.

Introduction

Both bedwetting and day-time wetting are common, disturbing and embarrasing occurences in childhood.[1-3]

At the age of 5 years, the prevalence of bedwetting in The Netherlands is 18% in boys and 10% in girls, decreasing to ≈ 2% in adolescence and ≈ 0.5% in adulthood.[4-10]

The prevalence of day-time wetting at the age of 4 years in The Netherlands is 19% in girls and 15% in boys, decreasing to ≈ 1% at 13-15 years of age in both sexes.[11]

The prevalence of the combination of day- and night-time wetting is 2% at the age of 4-6 years, decreasing to 0.1% at 13-15 years of age.[11]

The most successful treatment for bedwetting until now has been alarm treatment, with initial and long-term success rates of 70-90% and 50-70%, respectively.[12-15]

Many professionals and textbooks state that this treatment should be reserved for cases of monosymptomatic nocturnal enuresis (MNE) and particularly for severe cases.[16-18]

Concerning the combination of day- and night-time enuresis, paediatric textbooks contain almost no information about its precalence, background or therapy. If they do cover the subject, textbooks often suggest psychological factors as a cause and behavioural treatment as a solution.[17-19]

Urological textbooks that deal with the combination of day- and night-time wetting often state that, in order to diagnose the underlying problem, a thorough medical investigation is needed first, and that the day-time wetting should then be treated before the night-time wetting.[20,21]

It is supposed that the normal treatment options for MNE will not work for children with day- and night-time wetting. This is partly because it is thought that the combination of the two problems constitutes a different entity[14,21] and partly because day-time wetting is seen as the marker problem that should be addressed prior to treatment of the bedwetting.[17-19] Treatment of night-time wetting cannot be expected to be successful until the child is dry during the day.[20,22]

Some authors .[12,23,24] divide children with enuresis in three groups: (i) those with arousal problems, (ii) those with nocturnal urine production that exceeds the capacity of the bladder due to lack of vasopressin release; and (iii) those with detrusor-instability or hyperactivity. Alarm treatment is supposed to work particularly for children in the first group, whereas children with day- and night-time wetting are thought to be found mostly in the other two groups.

However, anecdotal reports from parents with children with day- and night-time wetting who had tried alarm treatment gave us the idea that children could become dry at night, and sometimes even during the day, with the alarm treatment. As far as we know, this observation has not been the subject of scientific studies.[12,25]

We therefore designed a study to check this observation.

The aim of the study was to assess the effect of alarm treatment in children with day- and night-time wetting in comparison with those with night-time wetting only.

The research questions were:

1) What is the success rate of the alarm treatment in children with combined day- and night-time wetting compared with those with night-time wetting only?
2) How much time do the children need to become dry?
3) What is the long-term success rate of the alarm treatment in children with combined day- and night-time wetting?

Material and Methods

Between August and December 2000, we asked the parents of children with day- and night-time wetting who met the inclusion criteria and rented an alarm from a bedwetting alarm company (Elther B.V.) if they wanted to participate in this study. The study population consisted of 25 boys (68%) and 12 girls (32%). These children were compared with a group of 21 boys (57%) and 16 girls (43%) with MNE only. In both groups, the age range was 5-13 years. The average age of the group with day- and night-time wetting was 7.7 years and that of the group with MNE only 7.8 years. All participants received standard instructions regarding how to use the alarm, what to do when the alarm went off (hold the urine flow, go to the toilet and finish emptying the bladder) and what to do if the child did not woken up from the alarm. No specific instructions were given concerning day-time wetting.

Before starting to use the enuresis alarm, the parents were asked a series of questions from a standard questionnaire designed to diagnose MNE and/or day-time wetting.[8] The answeres to these questions determined whether a child would be included in the study. The inclusion criteria were nocturnal enuresis (at least two wet nights per week during the previous 4 weeks) combined with day-time wetting in children aged 5-19 years [B1]. Day-time wetting was defined as wet spots or complete voiding in the underpants during the day-time.

"Dry" at night was defined as sleeping completely dry for at least 14 consecutive nights.

In both groups of children, the parents were asked to complete a diary during the study period in which they could note the dry and wet nights and/or days. After completion or failure of the alarm treatment, the diaries were sent back to the researchers.

In 2003 we conducted a short follow-up study by telephone among the parents of children who became dry (during the day and/or night) after alarm treatment. Our aim was to assess its long-term effect.

The results were analysed using SPSS/PC Version 10.0. The statistical tests used were the chi-square test, Fisher's exact test and the student-*t* test. Differences with a *p*-value of < 0.05 were considered significant.

Results

Before the alarm treatment, 70% of the group with day- and night-time wetting wetted their bed every night, 14% six times a week; 14% four to five times a week and 3% two to three times a week. Of the group with only night-time wetting, 70% wetted their bed every night; 8% six times a week; 14% four to five times a week and 8% two to three times a week. The difference between the two groups was not significant.

Of the group with day- and night-time wetting, 32% had wet underpants during the day fewer than 3 times a week, 32% three to four times a week and 35% more than four times a week. In 57% of the children, the day-time wetting was limited to wet spots in the underpants; in 3% the underpants were always completely wet and in 41% the underpants were sometimes completely wet and sometimes had wet spots. There was no significant difference between the two groups in terms of bedwetting in close relatives (parents and siblings).

Sixty-five percent (95% CI = 47-79%) of the children with day- and night-time wetting became dry at night, the average time needed to become dry being 49 days (range 22-134 days). Seventy-six percent (95% CI = 58-88%) of the children in the group with night-time wetting only became dry, the average time needed to become dry being 52 days (range 22-121 days). The success rates and the average time needed

to become dry did not differ significantly between the groups nor was there any significant difference in the success rates for the different age groups in either group. Thirty-eight percent (95% CI = 23-55%) of the children with day- and night-time wetting became dry during the day after alarm treatment at night. Of the children with day- and night-time wetting who became dry at night, 42% (95% CI = 23-63%) also became dry during the day. Thirty-one percent (95% CI = 10-61%) of the children who stayed wet at night nevertheless became dry during the day after alarm treatment at night.

Of the parents of the children who became dry during day- and/or night-time after alarm treatment, 21/28 (75%) gave permission for us to contact them for follow-up. After 2 years, we conducted a telephone survey of those parents and traced 20 of them, i.e. the response of the follow-up was 95%. In total, 15/16 of the children who were dry at night after alarm treatment and were traced by telephone were still dry at night after two years (Fig. 1).

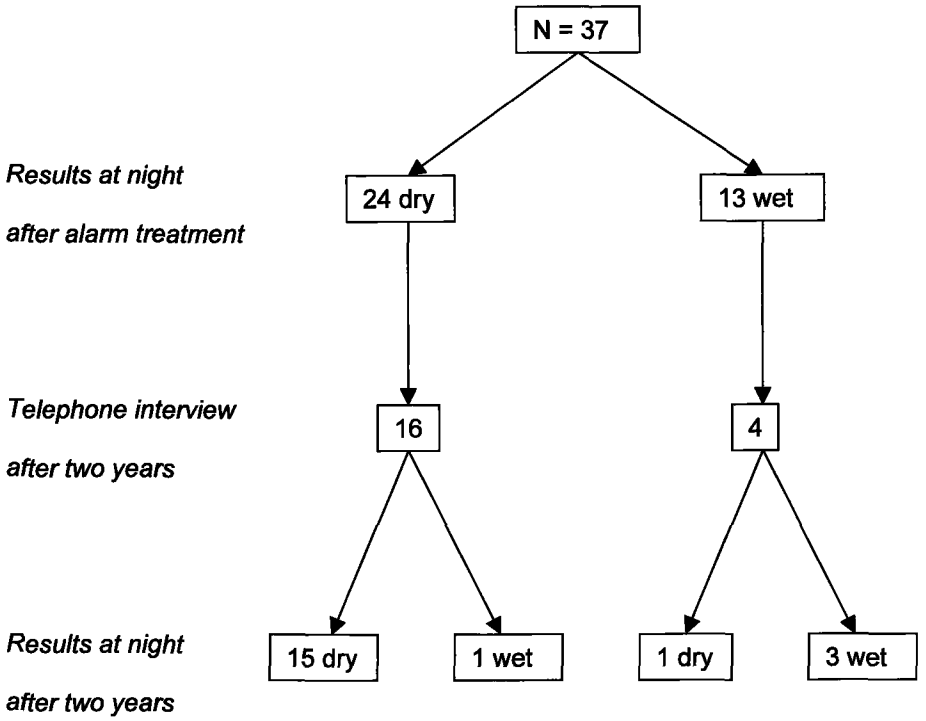

Figure 1. Results at night-time after two years in children with daytime and night-time wetting.

All 10 children who were dry during day-time after alarm treatment and were traced with the telephone were still dry during day-time after 2 years (Fig. 2).

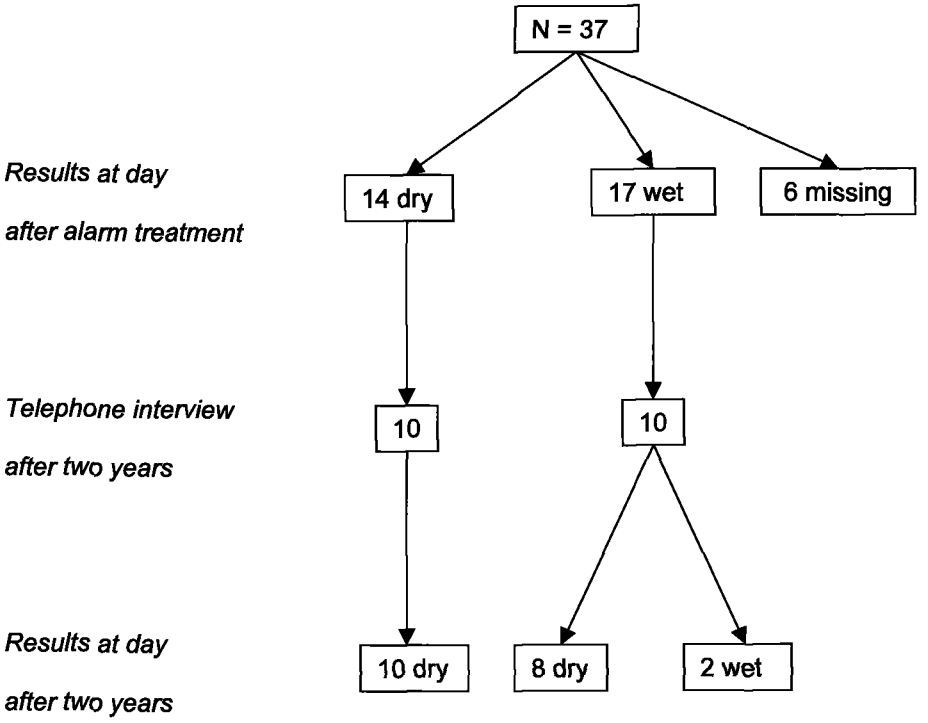

Figure 2. Results at daytime after two years in children with daytime and night-time wetting.

Discussion

Bedwetting and day-time wetting are embarrassing problems for both children and their parents.[6,26,27] Children who wet both their bed and their pants are often thought to be ill-behaved or badly raised. Often, it is thought that wetting your pants is a sign of more serious psychosocial problems or the symptom of an organic problem that causes the day-time wetting.[14,17,21] This psychosocial or organic problem is thought to interfere with the successful treatment of the enuresis.[20-22]

There is now a fairly good range of treatment options for MNE; however, this is not the case for children with both bedwetting and day-time wetting.[8]

Contrary to general practice, in our study we found that 65% of children with day- and night-time wetting became dry at night with the use of an enuresis alarm. 76% of children with night-time wetting only became dry. Both of these percentages are much higher than the reported spontaneous cure rate for MNE of ≈ 15-18% per year.[9,28] In our study there was no significant difference between the group of children with day- and night-time wetting and the group of children with MNE only. Consequently, children with day- and night-time wetting can be treated with an enuresis alarm for bedwetting.

Even more surprisingly, we found that 38% of children with day- and night-time wetting also became dry during the day after treatment with an enuresis alarm at night. Becoming dry during the day is not an expected effect of the treatment but is welcomed by both children and parents. Using this relatively simple treatment at

night, they managed to eliminate both day- and night-time wetting. The mode of action is unknown but it is possible that by learning to react on a signal of a full bladder at night (by closing the sphinctor of the detrusor or waking up to go to the toilet), children also learn to react in the proper way on the signal of a full bladder during day-time. Another possible explanation is that treatment with an alarm at night increases bladder capacity.[29,30]
From remarks made by the parents in the diaries, it is clear that the children who were dry at night but remained wet during the day were nevertheless very pleased with the result obtained.
Follow-up revealed that 15/16 of the traced children were still dry at night and all 10 traced children were still dry during day-time 2 years after treatment. Therefore, for the most children the results obtained did not represent only a temporary relief of their symptoms. The results are much better than would be expected from the spontaneous cure rate after 2 years. This concurs with the long-term results for children with MNE only.[12]
We consider that primary treatment of children with day- and night-time wetting can be done using an enuresis alarm. Of course, children with day- and night-time wetting who remain wet during and after alarm treatment need special, more intensive medical examination. It is probable that underlying pathology is more likely to be found in this group. It is obvious that children with pre-existing organic problems or other urological pathology should be referred to a hospital for a thorough anamnesis and physical examination before starting alarm treatment. An indication for the absence of urological pathology in most children in our study group is the existing active system of Child and Youth Health Care in The Netherlands. Under this system, almost all children are seen by a doctor during infancy and childhood on a number of occasions. Most children with urological pathology should therefore already have been referred to a hospital.
One limitation in this study was the small sample size (37 children in both groups). However, because of the idea mentioned in the Introduction that treatment for MNE was not expected to work in children with both day- and night-time wetting, we expected there to be a major difference between the children with day- and night-time wetting and those with night-time wetting only in terms of becoming dry at night. The fact that we did not find a statistically significant difference may be an indication that there is not a large difference, if any at all.
Another limitations is that at the 2-year follow-up we only retrieved data from children that became dry during day- and/or night-time after alarm treatment. Although we found 20/21 of the parents who gave permission for follow-up (of the 28 children who became dry), the results would have been enhanced had we included a larger proportion of the studypopulation.

Conclusion

We found that the majority of children with day- and night-time wetting became dry at night using an enuresis alarm, just like children with night-time wetting only. The results were good compared to the spontaneous cure rate.
A large proportion of the children with day- and night-time wetting even became dry during day-time after using an enuresis alarm at night.
We therefore urge caregivers not to delay the treatment of children with bedwetting combined with day-time wetting with enuresis alarms. This will allow these children to eliminate one of their major problems.

Acknowledgements
We thank the parents and children who provided us with the data we needed to perform this study freely and without any incentive other than the hope that the results would benefit other children with nocturnal enuresis in the future.
We also thank Elther B.V. and its employees, who interviewed the parents.
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Chapter 7

EFFECT OF DRY BED TRAINING ON BEHAVIOURAL PROBLEMS IN ENURETIC CHILDREN

Reprinted from: Acta Pædiatr 2002; 91:960-4. HiraSing RA, Leerdam FJM van, Bolk-Bennink LF, Koot HM. The effect of the dry bed training on behavioural problems in enuretic children.

Abstract
Children with nocturnal enuresis (n = 91) selected by school doctors in the Netherlands from 1991 to 1994 were included in a study to assess the course of behavioural problems especially when the children became dry after the Dry Bed Training (DBT) programme.
The Child Behaviour Checklist (CBCL) questionnaire was completed by 88 parents (96%) prior tot DBT(T1) and by 83 parents (91%) 6 mo after DBT (T2).
The mean CBCL total problem score at T1: 24.0 (range 2-91, SD 16) was significantly higher than that of a Dutch norm group: 20.45, (p=0.025).
Compared to T1 the mean CBCL total problem score at T2 was 16.8 (range 0-73; SD 14.7; $p<0.0001$). Of the children with CBCL total problem scores at T1 in the borderline or clinical range, 92% became dry and 58% improved to the normal range. At T2, the children seemed to have less internal distress, fewer problems with other people, and were less anxious and/or depressed.
Conclusion
Children with behavioural/emotional problems who wet their beds need not first be treated for their behavioural/emotional problems. Bedwetting can be treated successfully with DBT when other treatments such as normal alarm treatment have failed, and alarm treatment/DBT can have a positive influence on behavioural/emotional problems.

Introduction

Enuresis nocturna is a common disorder, affecting 15-20% of the 5-y-old children and 1-2% of adolescents.[1,2] The acquisition of night-time bladder control is an important stage in the development of children.

Enuresis is a socially embarrassing symptom, with concomitant emotional and behavioural difficulties.[3] However, from the studies showing an association between bedwetting and behavioural/emotional problems it is not clear whether these problems are cause or consequence of the enuresis.[3,4]

Many claims have been made supporting the view that enuresis is a result of social adversity or psychological trauma. These claims have sometimes taken on mythical proportions, such that families have been negatively affected by the attitude that they are themselves to blame, or are at least indirectly responsible for the problem.[5]

Enuretic children with behavioural problems are sometimes first referred to psychosocial workers or a psychiatrist in order to treat their behavioural problems in the belief that these are the cause of the bedwetting.

Although a great deal of literature addresses the possible psychological correlates of enuresis[6-8] only a few studies have evaluated changes in behavioural problems when the child is successfully cured of bedwetting.[8-12] From these studies it is not completely clear if the improvements are related to the alleviation of the enuresis.

For children with enuresis nocturna, various treatment approaches are available. One of these is the Dry Bed Training (DBT) programme, which involves behaviour modificaton therapy and incorporates the use of an enuresis alarm along with a variety of other procedures, which are divided into three stages:

- Intensive training during one night: waking the child every hour, conditioning him/her to wake up to mild prompts.
- Practising going to the toilet and reinforcement for urinating on the toilet at night.
- Extensive follow-up training, which starts on the second night and continues until the child has managed to stay dry for 14 consecutive nights.

A few examples of the many aspects covered are: alarmtherapy, positive practice (to get the child into the habit of waking up and automatically going to the toilet) and cleanliness training (which teaches the child to take full responsibility for changing his/her own bedsheets, pyjamas etc.);

When the child has achieved the goal and is dry: instructions are given on how to cope should a bedwetting accident occur.

DBT is an intensive training programme and should be reserved for cases resistant to the normal alarm-treatment or for special cases.[13]

In 1996 we published the results of the intensive DBT programme for groups of parents with enuretic children.[13] This paper describes the effect of the DBT on behavioural/emotional problems in enuretic children.

Aim

The aim of this part of the study was to assess the course of the behavioural problems, especially when the children were successfully cured of their bedwetting.

Population and method

Children with nocturnal enuresis (n=91) were selected from various primary schools by school doctors from the Youth Healthcare sections of two Community Health Services in the Netherlands from April 1991 to May 1994 during the regular school health examinations. The selection criteria and details regarding recruitment have been described elsewhere.[13] In short: prior to taking part in the programme, the child

was examined by the school doctor in order to exclude any underlying pathological causes of enuresis or other disorders. After an interview with the parent(s), the schooldoctor decided whether the child could join the DBT programme. The criteria for inclusion were: monosymptormatic nocturnal enuresis; the child had to be at least 6 y old; previous treatments had failed; both parent and child were motivated.
The criteria for exclusion in the DBT were: any underlying pathological cause of the enuresis; relational problems between the child's parents or between parent and child; parents unable to read, speak or write the Dutch language; evidence of imminent life events in the family (birth of a sibling, divorce, moving house).
The entry criteria for the DBT instruction programme were fullfilled by 74 boys and 17 girls aged from 6 to 15 y, with a mean of 9.3 y. Before starting DBT, the children were wetting the bed an average of 5.4 times a week, 12 (13%) of them had secondary nocturnal enuresis (again wet after being dry for more than 6 mo). Prior to DBT only 14% had tried one type of therapy, 68% had tried 2 or 3 types and 18% had tried 4 to 8 types of thearpy. Waking or lifting the child at night and restricting fluid intake had the highest rates (87% and 68%), drug treatment and alarm treatment were both used in 24% before DBT, bladder training in 20% and other therapies in 32%.
The parents included in the DBT instruction programme were asked to complete two questionnaires.

- Questionnaire I, completed prior to the start of the DBT (T1), aimed at obtaining general data as well as background information relevant to the enuresis.
- Questionnaire II had to be completed 6 mo after completion of the first questionnaire (T2). The objective of this questionnaire was to record the results achieved with the DBT programme and to record the viability of DBT based upon the experiences of the parents.

The results of these questionnaires have been published earlier.[13]
To assess behavioural/emotional problems the Child Behaviour Checklist (CBCL)[14] was completed by the parents on two occasions, i.e. before (T1) and 6 mo after the DBT (T2).
The Dutch version of the CBCL[15] was used to obtain standardized reports from parents of problem behaviours in their children. The checklist includes 20 competence items and 118 problem items. Only the findings of the problem section will be reported here. Parents are requested to circle a zero if the problem is not true for their child, 1 if the item is somewhat or sometimes true, and a 2 if it is very true or often true. A total problem score is computed by summing all zeros, ones and twos. The possible range of scores is 0-236. The CBCL total problem score is broken down into a normal range, a borderline range for scores between the 85th and the 90th percentile of the distribution of scores in the general population and a clinical range for scores above the 90th percentile. Scores in the clinical range are comparable with those of children receiving mental health care for behavioural/emotional problems. Eight syndrome scale scores (Withdrawn, Somatic complaints, Anxious/Depressed, Social problems, Thought problems, Attention problems, Delinquent behavior and Aggressive behavior) with different cut-off values are computed by summing the scores of the items belonging to the scales. Two broadband groups of syndromes, designated as "externalizing" and "internalizing" were also used in the analyses. Externalizing problems reflect conflicts with other people and their expectations of the child, whereas internalizing problems reflect internal distress. The internalizing group includes the anxious/depressed, somatic complaints, and withdrawn syndromes. The externalizing group includes the aggressive and delinquent behaviour syndromes.

The CBCL is suitable for use in clinical practice as well as in research. Parents can complete the questionnaire in 15-20 minutes and for the researcher or diagnostician it is easy to use. The good reliability and discriminative validity established by Achenbach and Edelbrock were confirmed in other studies using the Dutch translation of the CBCL.[16-18] Comparisons between American and Dutch large population samples showed a non-significant difference, which means the CBCL is applicable in the Netherlands, too.
However, the CBCL is an instrument which gives a standardized description of the problem behaviour of the child as reported by the parents. It is not meant to be an instrument to assess clinical diagnosis or treatment.
This study is a retrospective, case-control design in which we compare the CBCL scores at T1 and T2 with those children who did and those who did not profit from the DBT. The Dutch norms for the CBCL were used as a reference.[15]

Results

Results of the bedwetting

Six months after treatment, the enuresis decreased from an average of 5.4 episodes a week to an average of 1 episode a week. The bedwetting of children who continued to wet the bed after 6 mo decreased from 5.8 times a week to 3.3. times a week after treatment. Bedwetting frequency before training had no influence on achieving dryness. No statistical differences were found between the successful and unsuccessful groups regarding the variables age, sex, bed-wetting frequency, secondary enuresis, family history and therapies followed.

Results at T1

The CBCL questionnaire was completed by 88 parents (96%) prior to the DBT programma (T1) and by 83 parents (91%) 6 mo after the DBT (T2). We used the results of those respondents who completed the CBCL questionnaires at both T1 and T2 (n=78).
The distribution of children in the different CBCL ranges at T1 and T2 is presented in Table 1. At T1, 54 children (69%) had a normal CBCL score on the total problem scale; 16 children (21%) were in the clinical range and 8 children (10%) in the borderline range. Boys (n=62) had a CBCL total problem score of 24.03 and the girls (n=16) 24.06. Evidently, the bedwetting boys did not differ significantly in the level of behavioural/emotional problems from the girls ($p = 0.89$). The mean CBCL score at T1 was 24.0 (range 2-91; SD 16) (Table 2), which was significantly different from the mean CBCL score in the Dutch norm group, where the mean was 20.45 ($t(80)=1.98$, $p=0.025$, one-sided).

Results at T2

Six months after the training the number of children in the clinical range on the total problem scale dropped from 16 to 8 and in the borderline range from 8 to 4, which is a statistically significant difference ($p=0.0047$ Wilcoxon Test) (Table 1).

Table 1. Numbers of children scoring in the clinical, borderline and normal range of Total Problem-scale of the CBCL before DBT (T1) and 6 months after DBT (T2).

	Number (%) of children in Success group (n=66)		*Number (%) of children in No-success group (n=12)*		*Number (%) of children in Totalgroup (n=78)*	
CBCL range	T1	T 2	T1	T2	T1	T2
Clinical	15 (23)	7 (11)	1 (8)	1 (8)	16 (21)	8 (10)
Borderline	7 (11)	3 (5)	1 (8)	1 (8)	8 (10)	4 (5)
Normal	44 (67)	56 (85)	10 (83)	10 (83)	54 (69)	66 (85)

Fifteen out of 16 children with CBCL total problem scores in the clinical range reached the continence criterion (14 consecutive dry nights), but one child did not. Nine of these 16 children were in the normal range at T2, 1 child was in the borderline range and 6 remained in the clinical range. The one child who did not reach the continence criterion stayed in the clinical range. Of the 8 children in the borderline range, 7 became dry, but one child did not. Five of these children had normal scores at T2, 2 in the borderline range and 1 in the clinical range. The one child who did not reach the continence criterion remained in the borderline range. In other words: of the children with high CBCL total problem scores at T1 (in the borderline or clinical range), 92% became dry (>succes group=) and 58% improved to the normal range. Of the 54 children with a normal CBCL total problem score at T1, 81% reached the continence criterion and 10 children (19%) did not. The CBCL total problem score of one dry child increased to the clinical range and one to the borderline range.
For the group as a whole, the CBCL total problem score declined from 24.0 at T1 to 16.8 at T2 ($t=(80)=6.56;p<0.000$) (Table 2).

Table 2. Mean CBCL Total Problem scores at T1 and T2.

	N	*T1*	*T2*
Success group	66	25.7	17.5^{***}
No success group	12	15.1	13.3^{0}
Total group	78	24.0	16.8

*** *p < 0.0001*
^{0} *p = 0.32 ns*

There were no evident differences in decline of scores between boys and girls. The mean CBCL total problem score at T1 of the Success group was 25.7 (range 2-91; SD 16) and of the No-success group 15.1 (range 2-43; SD 12.9). However, this

difference was not significant. The mean CBCL total problem score of the Success group declined significantly from T1 to T2 (t(65)=6.44;p<0.000, paired sampled t-test). This difference was not seen in the results of the No-success group; however, the number of subjects in the No-success group was very small.
Prior to the DBT, children who became dry, had significantly higher scores on social problems (1.7; p=.005) and attention problems (3.7; p=0.04) than the children who remained wet (respectively: 0.25, 0.92).
When we take a look at the syndrome scales across time, we found the same results as those with the total problem scores: it was only in the Success group we obtained significant changes from T1 to T2. The following syndromes show a very significant difference between T1 and T2: Internalizing, Anxious/ depressed, Externalizing (Table 3).

Table 3. Mean syndrome scores for the Success and the No-success group before (T1) and after the Dry Bed Training (T2).

	Success group (n=66)		*No-success group (n=12)*		*Total group (n=78)*	
Syndrome scales	*T1*	*T2*	*T1*	*T2*	*T1*	*T2*
Internalizing	6.5	4.6 ***	4.2	4.1	6.2	4.5 ***
Externalizing	8.3	6.4 **	4.3	3.7	7.7	5.9 ***
Withdrawn	2.5	2.2	1.8	1.6	2.4	2.1
Somatic complaints	0.9	0.4 *	0.5	0.3	0.8	0.4 **
Anxious/depressed	3.2	2.1 ***	1.8	2.2	3.0	2.1 ***
Social problems	1.7	1.3	0.3	0.3	1.4	1.1
Thought problems	0.6	0.4	0.7	0.8	0.6	0.4
Attention problems	3.7	2.8 *	0.9	0.6	3.2	2.5 **
Delinquent behaviour	1.2	0.8 *	1.3	1.3	1.2	0.9
Aggressive behaviour	7.1	5.5 *	4.4	2.3	6.6	5.0 **

*** *p<.0001 (paired sampled t-tests)*
** *p<.001*
* *p<.01*

Discussion

In our study, the mean CBCL total problem score at T1 (24.0) differed statistically significantly from the Dutch normgroup (20.45). In other words, on average, this group bedwetting children had more behavioural/ emotional problems than the Dutch norm group. However, this was a selected group of children with persistent bedwetting. In a population-based study, the CBCL total problem score of 66 children with enuresis nocturna was similar to that of the norm-group.[19]
What is remarkable is that the mean CBCL total problem score dropped significantly from T1 to T2, especially for the children who became dry. At T2, after the training, children seem to have less internal distress, fewer problems with other people, and were less anxious and/or depressed than at T1, before the training. Of the children

who had a CBCL total problem score in the borderline or clinical range, 92% became dry and 58% improved their score to the normal range at T2. This corresponds with the hypothesis that behavioural/emotional problems are often a *consequence* of the bedwetting rather than the cause.[20,21] Behavioural/emotional problems are sometimes described as a factor inducing secondary nocturnal enuresis, atlhough other authors find no differences in behavioural/emotional problems between primary and secondary enuretics.[1,19] Even if problems precede the secondary enuretic events, this does not mean that behavioural/emotional problems are a cause for the bedwetting. Perhaps the problems activate or trigger a (temporary) inbalance in a child whose voidingsystem is just over the edge of becoming dry but is prone to bedwetting.

From our study we can also conclude that children with behavioural/emotional problems who wet their beds do not need to be treated first for their behavioural/emotional problems.

Children who have a score in the clinical or borderline range become dry just as often as children with a score in the normal range. So it seames that bedwetting can be treated successfully with DBT when other treatments such as normal alarm treatment have failed and alarm treatment/DBT can have a positive influence on the behavioural/emotional problems. This is in concordance with the literature where Moffatt[11] also described how the self-perception of children appears to improve with succesful treatment; the improvements in self-perception will not result in a cure for a genuine psychiatric disturbance; there is no evidence that the behaviour in children who fail treatment will deteriorate. Hägglöf et al.[12] showed that children with nocturnal enuresis have low self-esteem and that their self-esteem may be normalized with proper treatment (alarm treatment or desmopressin).

Although the results of our study are very encouraging, it should be noted that this study did not have a case-control experimental design. Therefore it might be suggested that the decline in behavioural/emotional problems is attributable to regression towards the mean or to natural fluctuations. However, deviant scores are very unlikely to drop into the normal range, as was the case in this group. Of children in the Dutch general population who are scored in the deviant range for CBCL total problems, even after 2 y, only 44% were scored normal and 56% after 4 y[17,18], whereas in this sample, 60% of the deviant scores dropped into the normal range after 6 mo. Furthermore, two observations argue for the conclusion that the decrease in problem behaviour was consequential to the DBT programme. First, the effect of the training was not any better in the children having CBCL scores below the borderline or clinical cut-point, indicating that high initial levels of problem behaviour are no obstacle to treatment effect. If the behavioural/emotional problems had been independent of the enuresis problem, these problems would have hindered the parental management required for successful DBT. Second, 83% of the children in the success group showed a decline in problem behaviour.

Furthermore, our study shows that the mean CBCL score of the children in the no-success group did not change between T1 and T2. They seem to have a lower score at T1 than the success group but this difference is not significant. At T2 the scores between the success and the No-success groups were comparable. The behaviour of children in the no-success group remained unchanged after training. It could be that parents do not want to make a fuss about the bedwetting and do not see any advantage in the behavioural therapeutic approach. Congruently, they may put less effort into the training themselves, which could lead to the child becoming less motivated to become dry.

A shortcoming of this study is that only parent reports were used, as information by teachers and scholastic results were not available.

Conclusion

The behavioural/emotional problems of children who wet thei beds need not be treated first.

Children who have relatively many behavioural/emotional problems, according to parental reports, become dry just as often as children with problem scores in the normal range. After successful treatment of enuresis, children seem to have less internal distress, fewer problems with other people and are less anxious/depressed. Bedwetting can be treated successfully with DBT when other treatments such as normal alarm treatment have failed, and alarmt reatment/DBT can have a positive influence on the behavioural/emotional problems.

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GUIDELINE ON NOCTURNAL ENURESIS FOR PERSISTENT BEDWETTING

Submitted as: Leerdam FJM van, Hirasing RA, Sukhai RN, Capelle JW, Froeling FMJA, Vijverberg MAW. Guideline on nocturnal enuresis for persistent bedwetting.

Abstract
To achieve dryness in children who suffer from persistent bedwetting, it is important to find out which factors play a role in their bedwetting and why previous treatment has failed. The use of a micturition diary is essential. The child's problems and needs have to be identified and treated individually. The enuresis alarm, with proper guidance, is the preferred form of initial treatment. Desmopressin is particularly suitable in cases of nocturnal polyuria or if the use of the alarm is not feasible. Both the dose and the time when the medicine is taken determine the result. If the alarm does not have any effect within two weeks or if a rapid result is important, a combination of desmopressin and the alarm is advisable. Bedwetting combined with daytime micturition problems is often indicative of a small bladder capacity and/or detrusor hyperactivity. In these children, bladder training and/or treatment with an anticholinergic drug (possibly combined with desmopressin) may be effective.

Introduction

The "Dutch Guideline Nocturnal Enuresis" was published in 1996.[1] It set out a protocol for the diagnosis and step-by-step treatment of nocturnal enuresis with the enuresis alarm as first-line treatment and desmopressin for special situations. In recent years, many studies have looked at the background and treatment of nocturnal enuresis. The latest studies have been brought together in recently published overviews.[2-4] However the step-by-step procedure did not have the desired result in a minority of cases (± 20-30%). The aim of this addition to the existing guideline is to achieve dryness in these "non-responders" on the basis of the latest evidence and experience. It also discusses a few new developments.

Patient history in persistent bedwetting

If treatment for bedwetting using the phased procedure does not lead to the patient becoming dry, the two patient history forms developed for that purpose can be used again to determine the extent to which the patient is suffering from "monosymptomatic nocturnal enuresis ".[1] In addition, the professional should determine which treatment has been tried, what experience has been acquired with these treatment, and why previous treatment has failed. Table 1 contains a list of items requiring attention and figure 1 shows a micturition diary that gives additional information. This micturition diary should be used for two or three whole days. These diaries will make it possible to establish a picture of the factors affecting bedwetting. The latest reviews indicates that the main factors are one or more of the following three: (a) failure to wake up in response to a signal that the bladder is full (arousal problem); (b) a relative vasopressin deficit resulting in nocturnal polyuria and (c) reduced bladder capacity and/or nocturnal detrusor instability.
Naturaly the last two factors only result in bedwetting if the patient fails to wake up in response to a full bladder.

Date	*Liquid intake**			*Micturition#*		*Urine loss*		*Defecation*	
	time	*amount+ (ml)*	*type*	*time*	*amount (ml)*	*time*	*amount (score 1, 2, or 3)***	*time*	*amount; consistency*

* *Normal value: 1-1.5 litres/day.*

\+ *1 cup = 125 ml; 1 mug/glass= 200 ml; 1 desert = 150 ml; 1 piece of fruit = 75 ml.*

\# *Bladdercapacity below the age of 11: (age + 2) x 30 ml; as normal value 2/3-3/4 of this amount can be taken.*

** *If diaper worn: weight of wet diaper minus weight of dry diaper;*
If underwear worn: score 1 = a few drops; score 2 = minor loss (damp underwear); score 3 = considerable (change of clothes necessary).

Fig. 1. Example of a micturition diary that can be used to establish a picture for a child of the factors that play a role in bedwetting. The diary is used for two or three whole days. There are several rows per day.

Table 1. Items requiring attention during the anamnesis for children with persistent bedwetting and the parent(s).

Subjects	*focus on*
Previous treatment (duration and order)	♦ enuresis alarm ♦ desmopressin, imipramine, oxybutynin ♦ other i.e. .....
*causes for failure of previous treatment**	♦ no effect, or hardly any ♦ treatment too much of a burden on child and/or family and therefore terminated ♦ inadequate motivation or compliance ♦ imprecise dosage ♦ child does not wake in response to enuresis alarm ♦ treatment resulted in side-effect(s), i.e. ..... ♦ definite improvement, but relapse immediately/ ... weeks/ ... months after end of treatment ♦ dry/virtually dry, but relapse immediately/ ... weeks/ ... months after end of treatment ♦ other i.e. .....
Home situation	♦ single-parent family, divorced parents, shared parenthood, sleeps at several places ♦ conflicts within the family ♦ language barrier ♦ position of child in the family (oldest, youngest or one of the middle children) ♦ own bedroom ♦ low bed, raised bed or bunk bed ♦ lavatory accessible, same floor, light, privacy.
Perception of bedwetting by child	♦ motivation to become dry ♦ problems with social contacts ♦ bullied at home or school ♦ reserved attitude ♦ general well-being
Attitude of parents towards the bedwetting	♦ understanding and/or positive encouragement ♦ punishment ♦ motivation to assist the child
*Pattern of defecation, micturition and liquid intake***	♦ pattern of defecation and consistency of faeces ♦ daytime wetting (damp spots in underwear) ♦ frequency and volume of micturition and urine loss at day and at night** ♦ frequency and volume of drinking/liquid intake** ♦ quality of the urine jet

* *check for all types of treatment given*

** *using a modified "micturition diary" (see figure) to monitor the pattern of liquid intake, urination, urine loss and defecation for 2-3 days.*

Individualised treatment

Before starting treatment, it is advisable to provide both the child and the parents with information about the background to bedwetting and about treatment. Explanation about general techniques to be used by parents is also advisable.

On the basis of the information from the patient history forms and micturition diaries referred to above, and after consultation with parents and child, it will be possible to establish individualised treatment. Here, we describe possible and appropriate treatment options for particular problems and types of bedwetting. Table II contains a general guideline for these treatment options.

Comorbidity: urinary tract infections and constipation
Urinary tract infections, a weak flow and incontinence may be symptoms of an underlying problem and merit further examination by the paediatrician or urologist. Constipation should be treated at the start of the treatment of bedwetting.

Unusual drinking habits
Children with unusual drinking habits can be advised to spread their drinking more evenly through the day. They should be warned against excessive drinking in the evening of drinks that stimulate diuresis, such as coke, coffee or tea.

Normal micturition and drinking pattern, failure to wake up in response to a full bladder
The children with normal micturition and drinking patterns but who fail to wake up in response to a full bladder, and their parents, can best receive initially and adequate encouragement for using the enuresis alarm.[4-6] With this treatment, the chance of permanent success is 40-70%.[3,4,7] Even where treatment with the enuresis alarm has been tried unsuccessfully in the past, another attempt is often successful. Adequate explanations and instructions for the child and the parents are indispensable.
If the enuresis alarm does not result in an improvement within two weeks, especially in therapy-resistant cases, a combination with desmopressin may help. The rapid effect of desmopressin can encourage the child and parents to continue with the enuresis alarm.[4-6] If a rapid effect is important (when there are problems with self-image, for example) it is advisable to use the combination of desmopressin and the enuresis alarm from the start of the treatment. Equally, when the enuresis alarm does not wake up the child when it is bedwetting at the beginning of the night, support treatment with desmopressin may be useful. Since desmopressin reduces urine production, most children will urinate later on in the night. They will then often wake up in response to the alarm.

Nocturnal polyuria, no problems during the day
The success rate for treatment of nocturnal polyuria with desmopressin is high. If previous treatment with desmopressin has not produced adequate results, it is advisable to determine the reason of this failure (see table 1).

Individualised desmopressin treatment
To achieve the best result, it is important to determine the right dose and time to take desmopressin for each individual (see table 2). Desmopressin is usually taken before going to sleep. If there is no effect, children who usually wet their beds during the early part of the night may benefit if they take desmopressin earlier in the evening and do not drink anything after that, or, in case of an overactive detrusor, treat them with an anticholinergic drug.[9-10] In the case of children who only wet their beds in the latter part of the night, it may help to lift them later in the evening and only then to give them desmopressin.

Long-term treatment with desmopressin
Long-term treatment with desmopressin is a new development. In recent years, various studies (lasting a maximum of two years) have shown that desmopressin is also safe and effective during long-term treatment.[11] A new way of achieving permanent or long-term dryness with desmopressin is to resume treatment with

desmopressin (possibly using a lower dose) when there is a relapse during a therapy-free period (stop week once every 3-6 months) until the patient remains dry during the stop week.[5]

*Table 2. Guideline for treatment of nocturnal enuresis with an enuresis alarm and/or desmopressin** for children with persistent symptoms.*

enuresis alarm	*Desmopressin*
Instruction	
- in accordance with the usual instructions - if there is no improvement after two weeks, add desmopressin (see right-hand column)	- initial dose: 0.2 mg by mouth (1 tablet) or 10 µg spray per nostril, before bedtime - if effect inadequate, double the dose and/or change time taken in accordance with the pattern of bedwetting
evaluation (after 6-8 weeks)	
if effect inadequate: prescribe desmopressin (see right-hand column)	*evaluation* (after one month) if effect inadequate: enuresis alarm or Dry Bed Training with intensive supervision or refer to specialist
if partly dry: continue for another 6-8 weeks	if partly dry: continue with treatment* and raise dose where appropriate or change time taken
if dry: stop treatment	if dry: gradually reduce dose to minimum effective dose

* *after every 3-6 months of treatment, 1-2 weeks break to determine whether continuation is necessary.*

** *with a combination of enuresis alarm + desmopressin: follow instructions in right-hand column; if dry/partly dry: first run down desmopressin and continue where appropriate with enuresis alarm for up to a maximum of three months.*

Desmopressin versus imipramine

The effect of desmopressin on bedwetting is comparable to that of imipramine.[12] A major drawback of imipramine is that it often has side-effects and that it can be extremely toxic, even at slight overdoses.[13] The risk of side-effects with desmopressin is small,[14,15] although the antidiuretic action of desmopressin makes it still necessary to keep an eye on the possibility of severe side-effects. Severe side-effects however, have hardly been found at all in children who stick to the prescribed dose and follow advice not to drink excessively.[15] Because of the nature of the side-effects of imipramine, the relatively safe desmopressin is now preferred in the Netherlands.[16]

Inadequate motivation and effort

Effort and motivation for treatment with the enuresis alarm will be particularly impaired after treatment failure(s). It must be clear that the treatment can be seen as a type of athletic performance in which optimal motivation and effort are required to achieve results. Treatment can best start when the circumstances are right for making an effort of this kind. Discussing the possibility of disappointments beforehand allows people to deal better with them.

Exceptional home situation

If the home situation is not suitable for treatment with an alarm, pharmaceutical treatment may be an option: examples may be cramped housing, sleeping at different places (parents divorced) or the rejection of the enuresis alarm by the child or parents.

Reduced bladder capacity, with or without micturition problems during the day
In bedwetting combined with micturition problems during the day, other factors such as reduced bladder capacity and/or detrusor hyperactivity could play a role alongside problems with arousal and possible nocturnal polyuria. Obstruction of the lower urinary tracts can also result in reduced bladder capacity. Approximately 30% of monosymptomatic bedwetting is accompanied by reduced bladder capacity and detrusor hyperactivity.[17-19] These children often wet the bed several times and also often soon after falling asleep. Treatment using the enuresis alarm is worth trying here only if there are no indications of a physical cause for nocturnal enuresis or daytimewetting. Recent research has shown that more than half of patients (65%) suffering from nocturnal enuresis and daytime wettingare dry at night after treatment with the enuresis alarm.[20] Some of them also achieve dryness during the day. Other treatments are advisable when enuresis alarm therapy fails, examples being bladder training (possibly supported with an anticholinergic drug such as oxybutynin) or the combination of an anticholinergic drug and desmopressin.[21-24]

Children with training difficulties, desmopressin non-responders
When there are difficulties with training, there is also the possibility of ambulatory dry bed training (DBT). This is an intensive, supervised training programme that also involves the use of an enuresis alarm.[25] If this therapy does not work or is not feasible at home, Dry Bed Training may be possible in exceptional circumstances at a hospital or incontinence centre.

Special groups
Minority ethnic groups
It is often more difficult to treat bedwetting in children from minority ethnic groups. Embarrassment about the bedwetting means that people often wait for a long time before asking for help. Other factors that may play a role are a strict approach (mental and/or physical punishment), the language barrier and the situation at home (with several children often sleeping in one room), including low economic situation.[26] For treatment with the enuresis alarm, good explanation (for example in their own language from community educators) and intensive supervision are necessary. The parents must above all be convinced of the importance of a positive approach and rewards. If this is not the case, the chance of successful alarm therapy is small and treatment with desmopressin will often be the only suitable method.

Adolescents and adults
This group of patients with nocturnal enuresis often lack the motivation required for the use of the alarm. Adolescents and adults usually opt for the relatively simple option of treatment with desmopressin.[27,28] Where there is enough motivation for the enuresis alarm, this treatment has proven effective for bedwetting in 30-40% of adolescents and adults.[29,30]

Conclusion

The use of data from an extensive patient history and the micturition diary often allow professionals to identify the factors that play a role in bedwetting and the reason why previous treatment has failed. Specific treatment/repeat treatment with the enuresis alarm, desmopressin and/or an anticholinergic drug can still result in a cure. However, despite all our current understanding and treatments, bedwetting will persist in some patients.

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Chapter 9

GENERAL DISCUSSION

General discussion

The main focus of this thesis is to provide more insight into enuresis by answering the research questions addressed in the Introduction. The first part of this General Discussion deals with the epidemiology and detection of enuresis from a population-based perspective, and the second part concerns the (initiation of) treatment for enuresis within the Youth Health Care (YHC) system.

1. Epidemiology and detection

Enuresis is an unnecessary burden for the affected children and their families.
In the population-based surveys carried out in the Netherlands described in Chapters 2, 3, and 4 of this thesis, we established the prevalence of daytime and/or night-time wetting.[1-3]

What is the prevalence of daytime wetting, night-time wetting and the combination of daytime and night-time wetting in children in the Netherlands?

In our population-based study of schoolchildren aged 4-12 years (Chapter 2), the prevalence of bedwetting was found to be 6.0% (6.8% in boys and 5.1% in girls). The prevalence of daytime wetting was 4.3% (4.8% in boys and 3.6% in girls) and the prevalence of a combination of daytime and night-time wetting was 2.5% (3.1% in boys and 1.7% in girls).[1] These figures make it clear that night-time wetting is frequently combined with daytime wetting.

What is the prevalence of bedwetting in adults in the Netherlands?

In our population-based study, 0.5% of the adults between 18 and 65 years of age had wet their bed at least once in the previous four weeks (Chapter 3).[2]

What is the relationship between Attention Problems and bedwetting?

The literature suggests that Attention-Deficit Hyperactivity Disorder (ADHD) and enuresis are associated. However, the evidence is mostly case-related, and limited to small clinical samples.[4-10]
Our population-based study shows a relationship between the score on the Attention Problems scale of the Child Behaviour Check List (CBCL) and the combination of daytime and night-time wetting in girls only, not in boys (Chapter 4).[3] No relationship between a high score for Attention Problems scale of the CBCL and isolated daytime or night-time wetting was found in this population-based study. It is unclear why only girls with a combination of daytime and night-time wetting have more problems indicating ADHD. More studies of larger groups of children with both conditions and with other instruments for diagnosing ADHD and enuresis are necessary to confirm our findings. The main focus of treatment for children with both enuresis and ADHD should be to treat both conditions at the same time. Whether or not the two conditions are or are not related to each other is a merely academic discussion.[11] Both conditions need special attention, and relieving the symptoms of either bedwetting or ADHD gives children more energy to deal with any other condition(s) they might have.

2. Treating enuresis

The second part of this thesis (Chapters 5-8) deals with treatment options for enuresis.[12-15] The focus of research is on optimising treatment for enuretic children so that it can be incorporated in the YHC and primary care systems. From the YHC

point of view, Monosymptomatic Nocturnal Enuresis (MNE) needs to be treated in both YHC and primary care. Treating nocturnal enuresis is equivalent to the primary prevention of behavioural and/or emotional problems.[16]

What is the long-term effect of alarm treatment on children with MNE?
The professional standard in the Netherlands assigns an important role to alarm treatment for bedwetting.[17] Although some impressive overviews of the literature on alarm treatment have recently been published,[18-20] the results with regard to long-term effectiveness are conflicting.[21-24]
The results of our study indicate a success rate of 85.5% immediately after alarm treatment. Including those with an initial failure after alarm treatment, 76.7% of the children (boys 76.1% and girls 77.9%) were dry after two years (Chapter 5).[12] Children who do not become dry after the initial alarm treatment and children who relapse after initially becoming dry require extra attention, and perhaps renewed medical investigation and individualised treatment provided by professionals with specific interest in the field of enuresis. Children in the first group are non-responders to alarm treatment who require one of the other forms of treatment, and the children in the relapse group respond to alarm treatment, but only for a short time. This group might need reinforcement to consolidate the initial result. As far as we know, it is still not possible to identify the children who are prone to relapse after successful alarm treatment. Over-learning is recommended to reduce the rate of relapse in children who respond quickly to this treatment (some children respond without triggering the alarm, or after doing so only once or twice).[25] Fortunately, after a relapse, reintroducing the alarm often resolves the enuresis. To prevent another relapse, reinforcements like the Dry Bed Training (DBT) programme and over-learning are a wise precaution for children who need repeated alarm treatment.[25]
A simple explanation that is often used to explain how alarm treatment works is that it teaches children to wake up in response to the signal of a full bladder (an effect on arousal). This changes nocturnal bedwetting into nocturia. In our study, however, quite a large percentage of the children slept through the night after alarm treatment. This suggests that the mode of action of the enuresis alarm is more complex than was previously thought.[12,26] Apparently, the alarm also enhances functional bladder capacity and/or reduces nocturnal urine production. Further study of this phenomenon, perhaps in combination with functional imaging of the brain, may lead to a better understanding of the different factors that cause enuresis and incontinence and the factors that play a role in the amelioration or the alleviation of the symptoms.

What is the effect of alarm treatment on children with daytime and night-time wetting?
Literature dealing with a combination of both daytime and night-time wetting often states that treatment of night-time wetting cannot be successful before the child is dry during the day.[27,28]
Our study showed no significant differences between the success rates for becoming dry at night between the group with daytime and night-time wetting (but with no other signs of pathology) and the group with night-time wetting only (65% and 76%), or between the different age groups within the two groups. Of the children with both daytime and night-time wetting who became dry at night after alarm treatment, 42% also became dry during the daytime (Chapter 6).[13] Most children were dry after two years. This concurs with the long-term results of alarm treatment for children with MNE only.[12,13] The implications of our research are that, contrary to the general

belief, daytime wetting does not interfere with alarm treatment for night-time wetting. In fact, the majority of children with a combination of daytime and night-time wetting but with no other signs of pathology can become dry, just like children with night-time wetting only. The current recommendations state that clinical assessment is required for all children with a combination of daytime and night-time wetting. Our results show that this is only necessary for 35% at most of the group with the combination of daytime and night-time wetting and the group with other pathology. These findings lead us to repeat the statement we made about the combination of enuresis and ADHD: the main focus of treatment for children with both daytime and night-time wetting should be to treat both conditions at the same time. Whether the two conditions are related or not is a merely academic discussion. In the majority of cases, a possible link is not important. Both conditions need special attention. In the majority of children it is possible to relieve the symptoms of either night-time or daytime wetting, or both, thus giving these children more energy to deal with any other condition(s) they might have.

What is the effect of Dry Bed Training on behavioural problems in children with MNE?
As children with enuresis have more behavioural and/or emotional problems [29-32], alarm treatment is only justified if it results in the alleviation of enuresis and if there is no symptom substitution (the emergence of another symptom because the underlying psychological problem has not been solved).
Of the children in our study with behavioural and/or emotional problems in the borderline or clinical range of the CBCL, 92% became dry and 58% improved to the normal range. These children seemed to suffer less internal distress, to have fewer problems with other people, and to be less anxious and/or depressed. Children with behavioural and/or emotional problems who wet their beds do not need to be treated beforehand for their behavioural and/or emotional problems (Chapter 7).[14] Reintroducing the alarm with a reinforcement programme such as DBT is therefore effective in children for whom previous treatment has failed, and DBT has a positive effect on the concomitant behavioural and/or emotional symptoms.[14] Why this reinforcement programme is effective, even if the preceding treatment is not, should be the focus of further (clinical) research. An understanding of this phenomenon might allow us to establish more personalised treatment that can prevent prolonged night-time incontinence in children.

What is the appropriate treatment for children with persistent bedwetting?
Since 1994, a step-by-step approach for the diagnosis and treatment of nocturnal enuresis has been available for practitioners in the Dutch YHC and primary care systems.[33] In a minority of cases (20-30%), the step-by-step procedure did not have the desired result.[14,20,34,35] With the help of a group of experts in the field of enuresis, the existing professional standard has been updated, particularly for children with persistent bedwetting (Chapter 8).[15]
The use of data from an extensive patient history and the micturition diary often enables professionals to identify the factors that play a role in bedwetting and the reasons for the failure of the previous treatment. Specific treatment or repeated treatment with the enuresis alarm, desmopressin and/or an anticholinergic drug can still lead to a cure. However, despite all our current understanding and treatment options, bedwetting still persists in some patients.[15] This should encourage caregivers and researchers to continue their work on the development and evaluation of new treatment options.

Limitations of the studies

Most of the limitations of the studies described in this thesis have been discussed in the previous chapters, but some general remarks are appropriate here.

Questionnaires

Although all the epidemiological studies described in this thesis were based on anonymous questionnaires, it is possible (because of the taboo on incontinence) that adults and parents of children with incontinence may refuse to admit that they have this problem. If this response bias is present, the results underestimate the prevalence of the various types of incontinence.

In the intervention studies, response bias could have resulted in a higher success rate than in the general population, because only motivated parents participated in the studies. There may have been a response bias, but the effect found in all of the studies is still so much higher than the rate of spontaneous cure that our conclusions are unaffected.

The questionnaires used in the epidemiological and intervention studies described in this thesis were all in Dutch. Language barriers may have influenced the results, because one inclusion criteria was the ability to understand and complete the Dutch questionnaires. Alarm treatment, for example, may be less helpful for children from different ethnic backgrounds who have problems with the leaflets, the instructions and the help desks in the alarm companies. In the only study investigating differences between Dutch and non-Dutch parents (non-Dutch parents seek less help for their children's incontinence problems than Dutch parents, Chapter 2)[1], a possible bias due to language barriers would have led to an underestimation of the difference. So there is a major problem with regard to Dutch parents not seeking help, but the problem among non-Dutch parents may be even more widespread than indicated by our results.

Study design

None of the studies in this thesis are randomised controlled trials (RCTs). RCTs are often considered to be the "gold standard" for evaluating the effectiveness of interventions because they are the best way of defining causality and determining which treatment modality has the highest effect. However, RCTs have limitations which make them difficult to conduct within the YHC system, or which limit applicability to routine practice in the system.[36,37] Not treating motivated children with enuresis, and therefore failing to tackle one of their major problems, is hardly ethical, even within the framework of a scientific study, when the rate of spontaneous cure is already known and is almost the same world-wide.[3,38-42] However, most present studies fail to compare their result to the spontaneous cure rate. Comparing the effects of an intervention (alarm treatment) that can be integrated in the YHC system with the known rate of spontaneous cure therefore seemed to be the appropriate study design.

Power of the studies

The study populations in the epidemiological studies described first in this thesis were all large populations (between 3,642 and 13,081 subjects), and the response rate was high in all studies (between 77.9% and 95%). Nevertheless, when trying to determine a relationship between two disorders in different age groups and genders within a study population (e.g. night-time and daytime incontinence or night-time

incontinence and ADHD), even large populations with high response rates lack the power to identify statistically significant differences if there are any. Multivariate testing was often impossible because of the small numbers. On the other hand, in even larger populations, the differences between the sub-groups might have become more significant, but it is doubtful whether these differences would become clinically relevant. The absence of differences in our large study populations means that it is also doubtful whether the differences often found in studies with small clinical samples have any relevance for the general population.
The confidence intervals found in the intervention studies were often large. Larger populations in the intervention studies would have resulted in smaller confidence intervals and might have resulted in significant differences, but it is also doubtful whether these differences would have become clinically relevant. The differences in the main results in our intervention studies were statistically significant, but the confidence intervals were also large. In larger populations, our conclusions would probably have remained the same, but the confidence intervals would have been smaller.

Is there a role for the Youth Health Care system in the diagnosis and treatment of nocturnal enuresis?
In Chapter 1, the screening principles developed by Wilson and Jungner were used to confirm that the diagnosis and treatment of nocturnal enuresis in the YHC system seems possible, necessary and useful.[43]

On the basis of the same principles, we will discuss the questions answered by the research described in this thesis. The focus remains on the care that can be provided within the YHC system in the Netherlands. We also apply the principles to identify the type of problems that remain unsolved, and the new questions that remain unanswered.

1. *The condition sought should be an important health problem (for the individual and for the community).*

Very few problems are more common in childhood than nocturnal enuresis. Even in adulthood, 1 in 200 people still wet their beds.[2] Compared to some other serious problems, enuresis is a very prevalent, yet hidden, disorder in all age groups. The high prevalence of nocturnal enuresis can be considered to be a serious issue for YHC. Bedwetting in adults has been found to be associated with considerable psychosocial effects.[2] For the affected children and adults, it is one of the worst things that can happen to them, and it has many consequences (particularly psychosocial) for their daily lives.[16,41]

2. *There should be an accepted treatment for patients with recognised disease (or some other form of useful intervention should be available).*

Alarm treatment is effective in the short term, and remains effective after two years.[12,23] It is just as effective for 5-7 year-olds as for older children.[44] It is also as effective for children with a combination of daytime and night-time wetting, but with no other signs of pathology, as it is for children with night-time wetting only.[13] Alarm treatment, and even intensive types of therapy such as DBT, can be recommended and provided within the YHC system in the Netherlands.[21]

There has also been progress in the pharmacological treatment of enuresis and the combination of alarm treatment with pharmacological treatment.[15] In 2004, almost all children with nocturnal enuresis can be treated, but is the available treatment also acceptable? There are now cordless alarms that are much more practical, and the modern alarms also look trendy. There are several good alarms available in the Netherlands from different companies with relatively good help desks. The available treatment is also acceptable for most children (and adults) with daytime and/or night-time incontinence.
However, alarm treatment is not acceptable for everyone, for example for some bedwetting adolescents or adults, or in families where the bedwetting child has to share a bedroom with one or more siblings.[45] The alternative – pharmacological treatment – is not acceptable for everyone either, for example because of the high relapse rate for bedwetting after the cessation of treatment, the contra-indications, the possible adverse effects, and the limitations with regard to drinking.[19,46]
Alternative treatment strategies should therefore be developed.
At present, most parents do not seek counselling for a child with daytime and/or night-time incontinence. Parents of non-Dutch children seek even less counselling for daytime and/or night-time incontinence.[1] Moreover, almost half of the bedwetting adults have never consulted a care provider.[2] So bedwetting is not always a "self-limiting disease". In order to improve this situation, we should investigate why so few people with these problems (patients and parents) seek counselling.

3. *Facilities for diagnosis and treatment should be available (for the patients uncovered by this programme).*

Diagnostic and treatment procedures are readily available in the Netherlands.[15,33] With the standardised questionnaires, a physical examination and a simple urine analysis, it is not necessary to refer children with nocturnal enuresis, but with no other signs of pathology, to clinical settings.[15,33,47]
In the Netherlands, there is also a Knowledge Centre for Nocturnal Enuresis (KennisCentrum Bedplassen), which has opened a website with information for professionals as well for children and their parents (www.bedplassen.org). This website has already provided information for a vast number of people. In 2003, the number of hits ranged from 7,000 to some 14,000 a month.
Since there are approximately 200,000 people with nocturnal enuresis in the Netherlands, further efforts should focus on implementation of the existing knowledge and professional standards by all the organisations and professionals that have dealings with nocturnal enuresis.

4. *There should be a recognisable latent or early symptomatic stage.*

Bedwetting is perceived by children as one of the worst things that can happen to them.[41] In children who may develop psychosocial problems due to enuresis, the diagnosis of nocturnal enuresis is equivalent to the identification of the latent stage of the psychosocial problems. In our studies, we established that, in most cases, the psychosocial problems of bedwetting children are the result, and not the cause, of the bedwetting.[14,16] It is therefore necessary to identify nocturnal enuresis before psychosocial problems develop, and to prevent these problems by resolving the enuresis in an early stage and by offering professional advice. If necessary, professionals who are active in the YHC system should try to enhance the motivation of the parents (and sometimes also the child) to invest time and effort in bladder control. This can be seen in the same way as sports training. A lot of practice is

needed to reach the desired goal, and the results will be better with the aid of a supportive coach and trainer.[45]

5. *There should be a suitable test or examination (for detecting the disease at an early or latent stage).*

Enuresis can be diagnosed by YHC physicians and GPs, and also by specialised nurses with the help of the professional standard questionnaires.[15,33] These questionnaires are suitable for use by professionals, and are acceptable to the population. The Basic Tasks for YHC include the detection of enuresis and the provision of professional advice.[48]

6. *The test should be acceptable to the population.*

The diagnosis of MNE by physicians and by specialised nurses, as well as the use of the standardised questionnaires, is acceptable to the population because the procedure is non-invasive (anamnesis and a simple physical examination combined with simple urine analysis).[15,33,47]

7. *The natural history of the condition, including development from latent to declared disease, should be adequately understood.*

Our study of the prevalence of nocturnal enuresis in adults in a population-based sample was one of the first to show the natural course of enuresis, not only into adolescence, but also into adulthood.[2] At present, there is no way of predicting exactly which children will suffer prolonged bedwetting with or without psychosocial problems or continue bedwetting into adulthood. We presume that the prevalence of bedwetting in adults will decrease in the future if most of the current bedwetters receive optimal treatment. It is one of the main reasons why children with enuresis should be treated as early as possible.

8. *There should be an agreed policy on whom to treat as patients (and the treatment at the pre-symptomatic stage of the disease should benefit course and prognosis).*

The step-by-step approach and the professional standard for children with persistent bedwetting facilitates the identification of children with MNE, as distinct from those with other forms of incontinence.[15,33] The same instruments can be used for almost all children with nocturnal enuresis within the YHC system or in general practice. Only those with symptoms or signs of other pathology should be referred for further analysis and treatment to a professional with a specific interest, and experience, in the field of enuresis. A child who remains incontinent after careful examination and treatment by YHC professionals should also be referred if it is not clear why the treatment strategy does not work for that particular child.[15,13] We should determine whether it is possible to refer directly from the YHC system to professionals with a specific interest, and experience, in the field of enuresis. This could minimise the delay in treatment. We should also determine whether it is possible for experienced YHC physicians to prescribe pharmacological treatment, such as desmopressin, for children with nocturnal enuresis. A protocol needs to be developed for this variety of treatment, as well as an agreement between the YHC professionals, GPs and clinical specialists.

Standardisation in the YHC system is necessary, and guidelines should be issued, implemented and used by the YHC professionals.[49,50] This will ensure that every

child in the Netherlands with nocturnal enuresis receives the best treatment that is currently available.[49]
The Municipal Health Authorities in Amsterdam have issued a protocol that is straightforward, practical and feasible. The main component is that the parents of every 5 year-old are asked whether their child wets the bed. If so, the child is registered. When these children are 7 years old the parents are asked whether their child still wets the bed. If so, the parents and the child are offered active help and provided with an enuresis alarm.[51] If the child and the parents are strongly motivated, treatment is already possible from the age of 5 onwards.[23, 44, 12] Behavioural and/or emotional problems become more pronounced as nocturnal enuresis persists.[52,53] It is possible to cure bedwetting in children with and without behavioural and/or emotional problems. Curing the bedwetting results in fewer behavioural and/or emotional problems in the children, and therefore benefits course and prognosis.[14,16]

9. *The cost of case finding (including the diagnosis and treatment of patients diagnosed) should be proportional to possible expenditure on medical care as a whole (and the cost of treatment if the patient does not present until the disease reaches the symptomatic stage).*

The Dutch YHC system provides a considerable amount of care with a relatively low budget.[54] The diagnosis and the initiation of treatment for nocturnal enuresis is part of the normal procedure in the YHC system.[48] If all children with nocturnal enuresis receive the best possible care within the YHC system, this will be much cheaper than the present situation, in which most parents of children with enuresis seek no help at all, resulting in an unnecessary delay in treatment and more psychosocial problems.[1,16,55] Some parents consult their GP or even seek specialist care in a hospital for their child, so we presume that the diagnosis and the initiation of treatment for nocturnal enuresis in the YHC system is cost-effective. However, more research into the cost-effectiveness of this programme is necessary.

10. *Case finding should be a continuing process and not a "once and for all" project.*

Although enquiries about success in becoming dry is one of the basic tasks of YHC[48], some YHC managers do not see the logical next step – the initiation of the treatment – as an obligatory task. The evidence in this thesis should lead to a change in the text of the Basic Tasks for YHC: they should include not only detection but also the treatment of enuresis in children as an obligatory task.
Contrary to the opinion that is frequently expressed in the literature that all bedwetting children (especially when the bedwetting is accompanied by daytime incontinence) should be clinically assessed to establish which children need clinical treatment[56], we are now of the opinion that all bedwetting children (with or without daytime incontinence) can be assessed by YHC professionals or GPs. They can establish, with the help of the questionnaires in the appendices to this thesis, which children have concomitant pathology that needs to be treated in a clinical setting.[33] For all other children, treatment can start in the YHC or primary care, depending on the guidelines.[15,33] This treatment will be successful in most cases, and only those children who do not respond to individualised treatment need to be referred for further clinical assessment.

After reviewing the international evidence and the evidence presented in this thesis, we can now answer the question raised on the cover of this thesis. Enuresis can, in

most children, be thought of as a simple developmental delay. With the right diagnosis and treatment, most children can achieve bladder control. However, if not treated in time, enuresis will become a major problem for many children (and adults). This involves implications for future research: which questions still require answers? There are also practical implications: what can the YHC system do with the results of the studies described in this thesis? These implications will be discussed in the following section.

Perspectives and implications for research

This thesis has evaluated some epidemiological and intervention studies focusing on enuresis. Some questions remain unanswered, and some new questions have emerged.

- More research is necessary to determine why so few Dutch parents seek counselling for the incontinence problems of their children and why non-Dutch parents seek even less counselling. Are there ways to improve this situation?
- We need more and new insights into possible links between different forms of developmental delay and enuresis. The relationship we found between attention problems and the combination of daytime and night-time incontinence in girls, but not in boys, and not in daytime or night-time incontinence alone, is one of the aspects that needs further investigation in larger groups with a clinical diagnosis of ADHD. Genetic studies and studies using functional imaging of the brain (especially the locus coeruleus) might result in new explanations of common disorders and (ab)normal development.
- Why, after successful alarm treatment, do a substantial percentage of the children not wake up at night to go to the toilet, but sleep on through the night? Answering this question could lead to a better understanding of how alarm treatment works.
- On the basis of the research described in this thesis, we now know that most of the children with a combination of daytime and night-time wetting can be cured with alarm treatment, so we also need to know the effect of clinical diagnosis and treatment on children with the combination of daytime and night-time incontinence who stay wet after alarm treatment. We also need to know whether the Dry Bed Training programme can be used for children with a combination of daytime and night-time incontinence, after they have completed the alarm treatment without success.
- We challenge researchers in the field of enuresis to optimise the treatment options for all children with daytime and/or night-time incontinence. Can we achieve success for almost all children who want to get rid of one of their major problems? Will the prevalence of nocturnal enuresis in adults decrease in the future if all bedwetting children receive optimal treatment?
- Young people at the beginning of the 21st century spend many hours each week watching computers. Is it possible to develop a form of 'e-health' for MNE (providing personalised advice and treatment through internet or electronic mail)? What is the effect, and what are the shortcomings?
- To acquire further evidence that the YHC is the right setting for the detection and treatment of enuresis, we need to establish how cost-effective it is to diagnose and treat nocturnal enuresis within the YHC system.

Implications for Youth Health Care

This thesis shows clearly that it is possible, necessary and useful to diagnose and treat nocturnal enuresis within the YHC system.

Incontinence in children is not only common at night, but also during the day. Quite a large number of children suffer from a combination of daytime and night-time incontinence. Even in adulthood, bedwetting is more prevalent than previously thought. Daytime and/or night-time incontinence cause problems for children and adults, including behavioural and emotional difficulties. YHC professionals and managers, and also the government authorities providing the finance, should be aware of the impact of enuresis.

Bedwetting in children should be perceived by the general public as a simple developmental delay, just like delays in acquiring motor skills, language skills or cognitive skills: nothing to be ashamed of. But just as delayed motor, language or cognitive skills require professional advice and sometimes treatment, bedwetting also requires extra attention and advice. Most cases of bedwetting can be treated within the YHC system and, as has been known for the past few decades, alarm treatment is the most effective type of treatment for MNE. This thesis shows that the long-term effect of alarm treatment is also good. For children with a combination of daytime and night-time wetting, but with no signs of pathology, alarm treatment is also the treatment of choice. Many of these children even become dry during the day with alarm treatment at night.

In children with persistent bedwetting, who have tried many forms of treatment without success, Dry Bed Training – a special intensive form of alarm treatment – has proven successful. DBT even led to an improvement in these children's existing behavioural problems. These results justify the introduction/reintroduction of the DBT programme in every YHC department.

A professional standard has been formulated for the diagnosis and treatment of children with MNE, as well as a more detailed protocol for the diagnosis and treatment of children with persistent bedwetting for YHC professionals, GPs and specialists.

Although some questions still remain unanswered (see implications for research), this thesis provides enough evidence to justify the active identification and treatment of all children with nocturnal enuresis within the YHC system. Where appropriate, YHC can refer children with concomitant pathology or children for whom alarm treatment has been unsuccessful to a GP or a specialist. There is now enough evidence to issue and implement professional guidelines for the treatment of nocturnal enuresis by YHC professionals.

It is our task to bring this evidence to the attention of local and central government authorities and politicians so that they can make the right decisions about spending scarce resources on evidence-based and important programmes that safeguard the normal development of all children.[57] The text of the Basic Tasks for Youth Health Care should also be amended accordingly.[48] Curing enuresis is good YHC practice, it is evidence-based, and it is very important for the affected children.

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Chapter 10

SUMMARY

Summary

Chapter 1 of this thesis starts with a description of the normal development of bladder control. This is followed by a description of the definitions used in the several studies that form the basis of this thesis and the epidemiology, aetiology and problems associated with persistent enuresis reported in the international literature before our research began.
The criteria developed by Wilson and Junger are used to check the usefulness of the diagnosis and treatment of monosymptomatic nocturnal enuresis in the Public Health setting.
Treatment strategies focusing on alarm treatment and pharmacological therapy are then discussed, and the Introduction ends with a list of the research questions addressed in this thesis.

Chapter 2 presents the results of our study on voiding patterns and counselling for incontinence problems in a population-based sample of 2836 school children between 4 and 12 years of age in the Netherlands.
The aim of the study was to assess the prevalence of daytime and/or night-time incontinence and to determine possible associations with age, gender, frequencies of incontinence, constipation and counselling for the incontinence.
170 children (6.0%) had night-time incontinence only, 121 (4.3%) had daytime incontinence only and 70 (2.5%) had a combination of both. The prevalence rates in boys and younger children were higher than in girls and older children respectively. Frequent voiding (8 times or more) was most prevalent in children with a combination of daytime and night-time incontinence, whereas infrequent voiding (3 times or less) was most prevalent in children with daytime incontinence only. There was no difference in voiding problems between dry children and children with isolated nigh-time incontinence. Parentally reported urinary tract infections were not found to be related to any form of day- and/or night-time incontinence. Most children with parentally reported constipation had normal defecation frequency and most children with a defecation frequency of three times a week or less had no parentally reported constipation. Both parentally reported constipation and defecation frequency were also not related to any form of day- and/or night-time incontinence. Parents sought counselling for 6.6% of the children with night-time incontinence only, 29.7% of the children with daytime incontinence only, and 33.3% of the children with a combination of both. Non-Dutch parents seek less help than Dutch parents. Preventive Health Care and primary care physicians should be more aware of the possible presence of these problems, and especially the combination of these problems. Because 'simple' treatment is possible for the majority of children, they should actively inform the parents and the children about these problems, and assist them with structured treatment plans.

Chapter 3 presents the results of our study on the prevalence of bedwetting in adults. In January - March 1996, a random sample of 13,081 non-institutionalised adults (18-64 years old) in the Netherlands were asked to complete a self-administered personal computer questionnaire consisting of 23 questions about the frequency of bedwetting, daytime wetting, treatment and perceived impact. Any respondent reporting bedwetting at least once during the previous 4 weeks was considered to have nocturnal enuresis.

The overall prevalence of nocturnal enuresis was 0.5%. 50% of the men and 19% of the women who reported nocturnal enuresis had primary nocturnal enuresis. 12% of the men and 29% of the women with nocturnal enuresis always had daytime incontinence. 50% of the men and 35% of the women had never consulted a care provider for their bedwetting, and 38% of the men and 26% of the women had done nothing to achieve bladder control. Only 30% believed that bedwetting could be treated. Bedwetting was found to be associated with several psychosocial problems. Nocturnal enuresis is common in adults, and may lead to embarrassment and discomfort. It can affect careers, social life and personal relationships. More information should be provided to make adults more aware that bedwetting is a problem that can be treated.

Chapter 4 describes our study of the relationship between attention problems, as an indication of Attention-Deficit Hyperactivity Disorder (ADHD) and day- and/or night-time incontinence.
The parents of 4,171 children (2,069 boys and 2,102 girls) between 4 and 15 years of age completed the Dutch version of the Child Behaviour Check List (CBCL). Mean age was 9.3 years. Daytime and night-time incontincence were assessed with the CBCL items "daytime wetting" and "bedwetting" respectively. We used the CBCL Attention Problems syndrome scale to assess attention problems.
The prevalence of daytime incontinence in this population-based study was 2.3%, of night-time incontinence 9.3% and of the combination of day- and night-time incontinence 1.2% (statistically significant higher in boys and in younger children). For children with a clinical score on the Attention Problems scale, parents reported daytime incontinence in 4.5% (2.4% of the boys and 8.0% of the girls), night-time incontinence in 12.1% (12.2% in boys and 12.0% in girls) and the combination of day- and night-time incontinence in 3.0% (0% of the boys and 8.0% of the girls). For children with a normal score, parents reported daytime incontinence in 2.2%, night-time incontinence in 9.2% and the combination of day- and night-time incontinence in 1.2%. The difference with children with a clinical score is not significant with the exception of girls with the combination of day- and night-time incontinence.
There is no relation between day- or night-time incontinence separately and Attention Problems. These findings need to be confirmed in large studies with a clinical assessment of Attention-Deficit Hyperactivity Disorder.

Chapter 5 presented the results of our study on the long-term effect of alarm treatment.
In 1997, 241 children from different parts of the Netherlands received alarm treatment for nocturnal enuresis. After 2 years, the data were available for 223 children (92.5%). Immediately after the alarm treatment, 85.5% of the children were dry. Including those with an initial failure after alarm treatment, 76.7% of the children were dry after two years; 70% of the children with initial success were dry after two years. The overall success rate after two years in the different age categories ranged from 76.5 to 77.3 (not significant). The success rate was 76.1 for boys and 77.9 for girls. 15.2% of the dry children woke up every night to urinate (compared to 3.9% of the wet children) and 51.5% sometimes woke up to urinate (compared to 27.5% of the wet children).
The long-term results are good compared to the rate of spontaneous cure. Alarm treatment is the most effective means of eliminating bedwetting. Extra attention is required for the group of children who are not dry after the initial alarm treatment and

for the group of children who suffer a relapse after being dry. More medical investigation and individualised treatment provided by professionals with a specific interest in the field of enuresis may also be required for these children.

Chapter 6 describes our study of the effect of alarm treatment in children with daytime and night-time wetting.
In this study, 37 consecutive children (25 boys and 12 girls), all of whom suffered from both daytime and night-time wetting, were compared to a group of 21 boys and 16 girls with nocturnal enuresis only. In both groups, the ages ranged from 5 to 13 years.
65% of the children with daytime and night-time wetting became dry at night, and the average time needed was 49 days (range 22-134 days). 76% of the children in the night-time wetting only group became dry at night, and the average time needed was 52 days (range 22-121 days). No significant differences were found between the success rates for the two groups or between the different age categories in the two groups. 42% of the children with daytime and night-time wetting who became dry at night after alarm treatment also became dry during the daytime. Two years after alarm treatment, 15 of the 16 children who could be traced were still dry at night, and all 10 children who were traced were still dry during the daytime. The results are good compared to the rate of spontaneous cure.

Chapter 7 presents the results of our study of the effect of Dry Bed Training (DBT) on behavioural problems.
To assess the course of the behavioural problems, especially when the children became dry after DBT, the study included children with nocturnal enuresis (n=91) selected by school doctors in the Netherlands from 1991 to 1994.
Prior to the DBT (T1), 88 parents (96%) completed the CBCL questionnaire and 83 (91%) completed it six months after the DBT (T2). The mean CBCL Total Problem score at T1 – 24.0 (range 2-91, SD 16) – was significantly higher than that of a Dutch norm group: 20.45 ($p=0.025$). Compared to T1, the mean CBCL Total Problem score at T2 was lower: 16.8 (range 0-73; SD 14.7; $p<0.0001$). Of the children with CBCL Total Problem scores at T1 in the borderline or clinical range, 92% became dry and 58% improved to the normal range. At T2, the children seemed to have less internal distress, fewer problems with other people, and they were less anxious and/or depressed. It is not necessary to treat bedwetting children first for their behavioural/emotional problems. Bedwetting can be treated successfully with DBT if other treatment such as alarm treatment has failed, and alarm treatment/DBT can positively influence behavioural/emotional problems.

Chapter 8 presents our proposed guidelines for the diagnosis and treatment of children with persistent bedwetting.
To achieve bladder control in children who suffer from persistent bedwetting, it is important to find out which factors play a role in their bedwetting and why previous treatment has failed. The use of a micturition diary is essential. The children's problems and needs have to be identified and treated individually. The enuresis alarm, with proper guidance, is the preferred form of initial treatment. Desmopressin is particularly suitable in cases of nocturnal polyuria, or if alarm treatment is not feasible. Both the dose and the time at which the medicine is taken determine the result. If alarm treatment does not have any effect within two weeks, or if a rapid result is important, a combination of desmopressin and alarm treatment is advisable.

Bedwetting combined with daytime micturition problems is often indicative of a small bladder capacity and/or detrusor hyperactivity. Bladder training and/or treatment with an anticholinergic drug (possibly combined with desmopressin) may be effective for these children.

In Chapter 9, the screening principles developed by Wilson and Jungner are applied again to discuss whether it is still possible, necessary and useful, in the YHC setting, to diagnose and to provide initial treatment for children with enuresis, now that the results presented in this thesis are available.
The answer is affirmative: to diagnose and to provide initial treatment for children with enuresis is indeed possible, necessary and useful.
The thesis ends with some implications for future research and for routine practice in the YHC system.

Chapter 11

SAMENVATTING

Samenvatting

In hoofdstuk 1 van dit proefschrift wordt eerst de normale ontwikkeling van het droog worden beschreven. Vervolgens worden de definities genoemd die gebruikt worden in de verschillende studies van dit proefschrift, gevolgd door de epidemiologie, etiologie en geassocieerde problemen bij nat blijven zoals die beschreven zijn in de internationale literatuur voor de start van onze onderzoeken.
De criteria van Wilson en Jungner zijn gebruikt om de bruikbaarheid te bepalen van diagnostische en behandelings-procedures voor monosymptomatische enuresis nocturna in de Jeugdgezondheidszorg setting.
Vervolgens wordt de behandelings-strategie, met name de plaswekker-therapie en medicamenteuse therapie, besproken.
De introductie eindigt met de onderzoeksvragen die wij proberen te beantwoorden in dit proefschrift.

In hoofdstuk 2 wordt onze studie beschreven naar mictiepatronen en hulpvragen voor plasproblemen in een populatie-steekproef van 2836 Nederlandse schoolkinderen tussen de 4 en 12 jaar oud.
Het doel van deze studie was de prevalentie vast te stellen van broek en/of bedplassen en eventuele associaties te bepalen met leeftijd, geslacht, aantal malen plassen, obstipatie en hulp vragen voor plasproblemen.
170 kinderen (6,0%) hadden geïsoleerd bedplassen, 121 (4,3%) hadden geïsoleerd broekplassen en 70 (2,5%) hadden de combinatie van beiden. Jongens respectievelijk jongere kinderen hadden significant hogere percentages dan meisjes respectievelijk oudere kinderen. Kinderen met de combinatie van broek- en bedplassen hadden de hoogste prevalentie van frequent plassen (8 of meer keer per dag), terwijl kinderen met alleen broekplassen de hoogste prevalentie hadden van weinig plassen (3 keer of minder per dag). De prevalentie van plasproblemen was niet verschillend tussen kinderen kinderen met bedplassen en kinderen die droog waren. Door ouders gerapporteede urineweginfecties bleken geen relatie te hebben met broek- en/of bedplassen. De meeste kinderen met door ouders gerapporteerde obstipatie hadden een normaal ontlastingspatroon en de meeste kinderen met een ontlastingspatroon van drie keer per week of minder hadden geen obstipatie volgens de ouders. Zowel door ouders gerapporteerde obstipatie als ontlastingspatroon bleken ook niet gerelateerd aan broek- en/of bedplassen. 6,6% van de ouders van kinderen met alleen bedplassen, 29,7% van de ouders van kinderen met alleen broekplassen en 33,3% van de ouders van kinderen met de combinatie van beiden zochten hulp. Ouders van allochtone kinderen zochten minder hulp dan ouders van autochtone kinderen.
Artsen in de preventieve gezondheidszorg en huisartsen zouden meer alert moeten zijn op de mogelijke aanwezigheid van deze problemen en speciaal de combinatie van deze problemen. Omdat 'eenvoudige' behandeling voor deze problemen mogelijk is voor het merendeel van de getroffen kinderen, zouden de artsen actief moeten vragen naar de aanwezigheid van deze problemen en ouders en kinderen hun hulp moeten aanbieden met een gestructureerd plan om deze problemen te doen verdwijnen.

In hoofdstuk 3 wordt onze studie naar de prevalentie van bedplassen bij volwassenen beschreven.

Een willekeurige steekproef van 13081 volwassenen (18-64 jaar oud) in Nederland, niet wonende in instellingen, werd gedurende de maanden januari tot en met maart 1996 gevraagd zelfstandig een vragenlijst op een computer in te vullen. Deze vragenlijst bevatte o.a. 23 vragen over hoe vaak bedplassen en broekplassen voor kwam, welke behandeling ondergaan was en wat de ondervonden impact van de problemen was. Elke respondent die aangaf tenminste één maal gedurende de afgelopen 4 weken in bed te hebben geplast werd benoemd als iemand met enuresis nocturna.
De prevalentie van enuresis nocturna in de totale groep was 0.5%. 50% van de mannen en 19% van de vrouwen met enuresis nocturna hadden primaire enuresis nocturna. Van de mannen met enuresis nocturna had 12% elke dag tevens broekplassen, bij de vrouwen was dit 29%. Van de mannen had 50% en van de vrouwen 35% nog nooit een hulpverlener geconsulteerd voor hun bedplassen. 38% van de mannen en 26% van de vrouwen hadden geen behandeling gehad om droog te worden. Slechts 30% geloofde dat bedplassen behandelbaar was. Bedplassen was geassocieerd met diverse psychosociale problemen.
Enuresis nocturna komt regelmatig voor bij volwassenen en kan leiden tot in verlegenheid gebracht worden en onbehaaglijkheid. Het kan carrières, het sociale leven en persoonlijke relaties negatief beïnvloeden. Volwassenen zouden duidelijker gemaakt moeten worden dat bedplassen een behandelbaar probleem is. Meer informatie over dit onderwerp zou verstrekt moeten worden.

In hoofdstuk 4 wordt onze studie naar de relatie tussen aandachtsproblemen (als indicatie voor ADHD) en incontinentie voor urine beschreven.
Ouders van 4171 kinderen (2069 jongens en 2102 meisjes) tussen de 4 en 15 jaar oud vulden de Nederlandse versie van de Child Behaviour Ceck List (CBCL) in. De gemiddelde leeftijd van de kinderen was 9,3 jaar. Als operationalisatie van incontinentie voor urine gebruikten we de onderdelen broekplassen en bedplassen van de CBCL. Als operationalisatie van aandachtsproblemen gebruikten we de syndroomschaal Aandachtsproblemen van de CBCL.
De prevalentie van broek- en/of bedplassen in deze populatie-studie was 2,3% voor broekplassen, 9,3% voor bedplassen en 1,2% voor de combinatie van broek- en bedplassen (statistisch significant hoger bij jongens en bij jongere kinderen). Bij kinderen met een klinische score op de syndroomschaal Aandachtsproblemen rapporteerden ouders broekplassen bij 4,5 % (2,4% van de jongens en 8,0% van de meisjes), bedplassen bij 12,1% (12,2% van de jongens en 12,0% van de meisjes) en de combinatie van broek- en bedplassen bij 3,0% (0% van de jongens en 8,0% van de meisjes). Bij kinderen met een normale score rapporteerden ouders broekplassen bij 2,2%, bedplassen bij 9,2% en de combinatie van broek- en bedplassen bij 1,2%. Het verschil met kinderen met een klinische score is niet significant met uitzondering bij meisjes met de combinatie van broek- en bedplassen.
Deze uitkomsten dienen bevestigd te worden in grotere studies met een klinische diagnose van ADHD.

In hoofdstuk 5 wordt onze studie naar de lange-termijn effecten van plaswekkerbehandeling beschreven.
241 kinderen uit verschillende delen van Nederland werden in 1997 behandeld met een plaswekker voor enuresis nocturna. Na 2 jaar waren de gegevens van 223 (92,5%) van de kinderen beschikbaar. Onmiddellijk na plaswekkerbehandeling was 85,5% van de kinderen droog. Inclusief de kinderen die niet succesvol waren direct

na plaswekkerbehandeling was na twee jaar 76,7% van de kinderen droog. Van de kinderen die onmiddellijk droog waren na plaswekkerbehandeling was 70,0% droog na twee jaar. Het totale succes percentage na twee jaar in de verschillende leeftijdscategorieën varieerde van 76,5 tot 77,3 (niet significant verschil). Het succes percentage was 76,1 voor jongens en 77,9 voor meisjes. Van de droge kinderen werd 15,2% elke nacht wakker om te plassen (tegenover 3,9% van de kinderen die nat waren) en 51,5% werd soms wakker (tegenover 27,5% van de kinderen die nat waren).
De lange-termijn resultaten zijn goed, vergeleken met het spontane genezingspercentage. De plaswekker is de meest effectieve manier om bedplassen te bestrijden. Extra aandacht is nodig voor de groep die niet droog wordt na de plaswekker behandeling en de groep die een terugval heeft nadat ze eerst droog zijn geworden. Nader medisch onderzoek en behandeling op maat door deskundigen met een speciale interesse in het gebied van bedplassen zou nodig kunnen zijn voor deze groepen.

In hoofdstuk 6 wordt onze studie naar het effect van de plaswekker bij kinderen met de combinatie van broek- en bedplassen beschreven.
In deze studie werden 37 opeenvolgende kinderen (25 jongens en 12 meisjes) die last hadden van de combinatie van broek- en bedplassen, vergeleken met een groep van 21 jongens en 16 meisjes met alleen enuresis nocturna. In beide groepen variëerde de leeftijd tussen de 5 en de 13 jaar. 65% van de kinderen met de combinatie van broek- en bedplassen werd 's nachts droog. De gemiddelde tijd die hiervoor nodig was, bedroeg 49 dagen (minimum 22 dagen, maximum 134 dagen). 76% van de kinderen in de groep met alleen bedplassen werden 's nachts droog. De tijd die zij gemiddeld nodig hadden bedroeg 52 dagen (minimum 22 dagen, maximum 121 dagen). Wij vonden geen significante verschillen in de succespercentages tussen de twee groepen of tussen de verschillende leeftijdscategorieën van de twee groepen. Van de kinderen met de combinatie van broek- en bedplassen die droog worden na plaswekkerbehandeling werd 42% tevens overdag droog. Twee jaar na de plaswekkerbehandeling waren 15 van de 16 getraceerde kinderen die 's nachts droog waren nog steeds 's nachts droog en alle 10 getraceerde kinderen die overdag droog waren geworden waren nog steeds overdag droog. De resultaten zijn goed, vergeleken met het spontane genezingspercentage.

In hoofdstuk 7 wordt onze studie naar het effect van de Droge Bed Training op gedragsproblemen beschreven.
Om het verloop van gedragsproblemen na te gaan, speciaal bij kinderen die droog worden na Droge Bed Training (DBT), werden 91 kinderen met enuresis nocturna, geselecteerd door schoolartsen in Nederland, tussen 1991 en 1994 opgenomen in het onderzoek. Voorafgaand aan de DBT (tijdstip 1) vulden 88 ouders (96%) de complete CBCL in en 83 (91%) zes maanden na de DBT (tijdstip 2). De gemiddelde CBCL totale probleem score op tijdstip 1 : 24,0 (minimum 2, maximum 91, standaard deviatie 16) was significant hoger dan de Nederlandse norm groep: 20,45 ($p=0,025$). Vergeleken met tijdstip 1, was de gemiddelde CBCL totale probleem score op tijdstip 2 16,8 (minimum 0, maximum 73, standaard deviatie 14,7 ; $p<0,0001$). Van de kinderen met een CBCL totale probleem score op tijdstip 1 in het klinische of grensgebied werd 92% droog en 58% verbeterde naar het normale gebied van de CBCL totale probleem score. Op tijdstip 2 leken de kinderen minder interne angst, minder problemen met andere mensen te hebben en minder angstig en/of depressief

te zijn. De conclusie uit dit onderzoek is dat het niet nodig is kinderen met gedrags- en/of emotionele problemen die in hun bed plassen eerst te behandelen voor hun gedrags- en/of emotionele problemen. Bedplassen kan succesvol behandeld worden met DBT, zelfs als andere behandelingen zoals de normale plaswekkerbehandeling mislukt zijn en plaswekkerbehandeling/DBT kan een positieve invloed hebben op de gedrags- en/of emotionele problemen.

In hoofdstuk 8 wordt ons voorstel voor een richtsnoer voor de diagnose en behandeling van kinderen met hardnekkig bedplassen beschreven.
Om kinderen die last hebben van hardnekkig bedplassen droog te krijgen is het belangrijk om na te gaan welke factoren een rol spelen bij het bedplassen en waarom eerdere behandelingen zijn mislukt. Het gebruik van een mictielijst is hierbij onmisbaar. De behandeling moet op maat worden gegeven. De plaswekker met juiste begeleiding heeft de voorkeur. Desmopressine is met name geschikt bij nachtelijke polyurie of als door omstandigheden de plaswekker weinig kans van slagen heeft. Zowel de dosis als het tijdstip van inname is bepalend voor het resultaat. Als de plaswekker niet binnen twee weken tot resultaat leidt of als een snel effect van belang is, is de combinatie van desmopressine met de plaswekker zinvol. Bedplassen gecombineerd met mictieproblemen overdag wijst vaak op een geringe blaascapaciteit en/of op -instabiliteit. Bij deze kinderen kan blaastraining en/of behandeling met een anticholinergicum (eventueel gecombineerd met desmopressine) zinvol zijn.

In hoofdstuk 9 worden de screeningsprincipes van Wilson en Jungner opnieuw gebruikt om te bepalen of het in het licht van de nieuwste inzichten nog steeds mogelijk, nodig en bruikbaar is om diagnostiek en (start van de) behandeling uit te voeren in de Jeugdgezondheidszorg.
Bovenstaande vragen worden positief beantwoord: het is mogelijk, nodig en bruikbaar om de diagnostiek en de (start van de) behandeling van enuresis nocturna uit te voeren in de Jeugdgezondheidszorg.
Dit proefschrift eindigt met enkele implicaties voor verder onderzoek en implicaties voor het veld van de Jeugdgezondheidszorg.

Appendices

I. Questionnaire I.

*History checklist I: differentiating between MNE and other forms of incontinence in children with night-time incontinence**	yes	Unknown	no
Only wet spots in pants during the day			
Dry periods during the day are shorter than 30 minutes			
Voiding frequency during the day is 8 or more			
Voiding frequency during the day is 3 or less			
Often unable to retain urine**			
Squats down or squeezes to retain urine			
Strains during voiding			
Has an interrupted or staccato flow			
Has a weak flow			
Has post-void dribbling			
Periods of painful urination			
Has had blood in urine once			
Has had an urinary tract infection at least once			
Gets out of bed at night to drink			
Regular days without defecation			
Has only wet spots in bed (not a complete micturition)			
* *if answers to all questions are 'no', probability of MNE is very high.* ** *fill in 'yes' if the child is often unable to retain urine and 'no' if the child is often able to retain urine.*			

II. Questionnaire II

History checklist II: assessing nature and seriousness of night-time incontinence in children in order to choose treatment and evaluate the effect.

1. How many times on average has the child wetted the bed in the past 4 weeks?
2. Has the child ever been dry for at least 6 months in a row?
   If so, when and for how long?
3. Are there more children in the family older than 6?
   If so, are they dry?
   If so, at what age?
4. When was the father dry?
   When was the mother dry?
5. What has been done so far to stop the night-time incontinence?
6. Is the child still wearing a diaper at night?
7. How wet is the child at night?
8. How many times is the child wet at night?
9. Is the child easy/difficult/impossible to arouse at night?
10. Does the child have other problems at school and/or home?
    If so, what kind of problems?
11. Is the child also wet during the day?

If the answer to this question is 'no', there is no need to answer the following questions.

12. Since when has the child had incontinence during the day?
13. How many times has the child had incontinence during the day?
14. Is the incontinence during the day linked to:
    - intensive playing (play enuresis)
    - laughing, giggling
    - other reasons, namely...
15. How wet is the child during the day?
    - just the underpants
    - underpants and part of the clothes
    - completely wet

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Frank Froeling, ook bestuurslid van het KennisCentrum Bedplassen. Niet alleen onze voornaam (zelfs drie van onze voorletters), maar ook onze interesse in kinderen met bedplassen komt overeen. We gaan samen nog meer artikelen schrijven;
Marianne Vijverberg, zeer actief en gewaardeerd bestuurslid van het KennisCentrum Bedplassen. Samen (jij 11/12, ik 1/12) hebben we een aantal jaren de vragen beantwoord van onze uitstekende website www.bedplassen.org die mede daarom tot een van de beste sites op het gebied van bedplassen behoort. Jij weet als geen ander kinderen die last hebben van bedplassen te motiveren om succesvol aan hun probleem te gaan werken.
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Frank van Leerdam.
februari 2005.

V. Curriculum Vitae

Franciscus Johannes Maria van Leerdam was born on 5 April 1963 in Utrecht in the Netherlands. He attended primary school from 1969 to 1975 at the St. Agnes and St. Jozef school in De Goorn and secondary school from 1975 until 1981 at the St. Werenfridus high school in Hoorn. Between 1981 and 1989, he studied medicine at the VU University of Amsterdam. From December 1989 to January 1998, he worked full-time as a school doctor for the Municipal Health Authority of Westfriesland. From 1992 to 1994, he specialised in Social Medicine as a Youth Health Care specialist at TNO Prevention and Health in Leiden. Since January 1998, he has continued to work for one day a week as a Youth Health Care specialist for the Municipal Health Authority of Westfriesland. Between January 1998 and January 2004, he worked four days a week (and one day a week for the last eight months) at TNO Prevention and Health in Leiden as a senior researcher and project manager for the development of Youth Health Care guidelines. Since May 2003 (for three days a week during the first eight months), he works as an academic teacher and researcher in the field of Youth Health Care for four days a week at the VU University Medical Centre, department of Public and Occupational Health, section Youth Health Care / the Institute for Research in Extramural Medicine in Amsterdam. Since 2002, he has also been one of the editors of the Dutch/Flemish Journal of Youth Health Care.
He has been engaged in research on the field of enuresis since 1993, together with his supervisor Remy HiraSing. Since its establishment, he has been the secretary of the Dutch Knowledge Centre for Nocturnal Enuresis. He gives lectures about the diagnosis and management of enuresis at specialist training institutions for Youth Health Care specialists and Youth Health Care nurses and organises state-of-the-art conferences on the subject of incontinence problems.
He lives in De Goorn, is married to José and is the father of Stefanie (who is four years old).

Franciscus Johannes Maria van Leerdam is geboren op 5 april 1963 in Utrecht. Hij volgde de lagere school van 1969 tot 1975 op de St. Agnes en St. Jozef school in De Goorn en middelbare school van 1975 tot 1981 op de St. Werenfridus scholengemeenschap in Hoorn. Van 1981 tot 1989 studeerde hij geneeskunde aan de Vrije Universiteit in Amsterdam. Van december 1989 tot januari 1998 werkte hij als schoolarts bij de GGD-Westfriesland. Van 1992 tot 1994 volgde hij zijn specialisatie in de Sociale Geneeskunde, tak Jeugdgezondheidszorg bij TNO Preventie en Gezondheid in Leiden. Sinds januari 1998 werkt hij nog één dag per week als jeugdarts bij de GGD-Westfriesland. Van januari 1998 tot januari 2004 werkte hij vier dagen per week (de laatste 8 maanden één dag per week) bij TNO Preventie en Gezondheid in Leiden als senior wetenschappelijk medewerker en projectleider van de ontwikkeling van JGZ-Standaarden. Vanaf mei 2003 (de eerste 8 maanden drie dagen per week) werkt hij vier dagen per week bij het VU medisch centrum, afdeling Sociale Geneeskunde, sectie JGZ / het EMGO-Instituut (extramuraal geneeskundig onderzoek) in Amsterdam als universitair docent en coördinator academisering Jeugdgezondheidszorg. Sinds 2002 is hij tevens een van de redacteuren van het Nederlands/Vlaamse Tijdschrift Jeugdgezondheidszorg. Sinds 1993 heeft hij meegewerkt aan onderzoek op het gebied van enuresis, samen met zijn promotor Remy HiraSing. Sinds de start is hij de secretaris van het

KennisCentrum Bedplassen. Hij geeft les over de diagnose en begeleiding van kinderen met enuresis aan de opleidingen voor Jeugdarts, arts Jeugdgezondheidszorg en Jeugdverpleegkundige en organiseert conferenties over de laatste stand van zaken rond zindelijkheid en plasproblemen.
Hij woont in De Goorn, is getrouwd met José en vader van Stefanie (vier jaar oud).


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