**Keywords** Urinary incontinence/ Bedwetting/Enuresis alarm/Children

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## In this article...

- Why the enuresis alarm is potentially curative but difficult to use effectively
- How we have tried to address some of the problems with the alarm
- How enuresis alarm therapy guidelines could be modified based on our findings

# Tackling bedwetting: challenges and benefits of the enuresis alarm

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## Key points

**The enuresis alarm needs much work and commitment by the child, family and healthcare providers**

**Published efficacy figures may be inflated, as perhaps only a third of children treated will become dry**

**There is a lack of predictors indicating children for whom the alarm will be worthwhile**

**This research found that the first 3-4 weeks of therapy will predict final treatment response**

**Suggestions are given about changes that could be made to the alarm's instructions**

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**Abstract** The enuresis alarm – the only potentially curative treatment for bedwetting – is limited by problems related to adherence, availability and predictors of treatment success. This is even more problematic as children with neuropsychiatric issues are overrepresented. Our recent research has shown that concomitant daytime incontinence does not diminish the chance of treatment success, the first 3-4 weeks of therapy will predict adherence and final response, and alarm therapy can be managed by families but support by a nurse greatly improves the chances of adherence. By modifying the guidelines, we can reduce the risk of lengthy, unsuccessful treatment without diminishing the chance of making children dry.

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The enuresis alarm is the only old therapy against bedwetting that has more or less stood the test of time. It was first developed in the 19th century (Smith, 1948) and is still recommended by global guidelines as a first-line antienuretic treatment (Nevéus et al, 2020). The principle behind alarm therapy is simple: by consistently waking the child at the moment of enuresis, via a urine detector and a loud signal, he or she is gradually 'trained' not to wet the bed.

Success figures vary widely; percentages of children becoming dry have been reported at 32-84% – such as by Apos et al (2018), Kosilov et al (2018), Caldwell et al (2016), Önol et al (2015), Evans et al (2011), Kwak et al (2010), Pereira et al (2010), Butler et al (2007), Monda and Husmann (1995), Bonde et al (1994) and Devlin and O'Cathain (1990) – with most in the upper range. The substantial difference between studies can be ascribed to several factors:

- Varying inclusion and exclusion criteria have been used – for example, some studies have excluded children with non-monosymptomatic enuresis or previous treatment attempts;
- Some protocols have entailed elaborate voiding diaries or schedules and are likely, therefore, to have only included highly motivated and organised families;
- Not all studies have declared attrition rates;
- Most studies have not included a control group.

The central benefit of the enuresis alarm, which sets it apart from alternatives, is that it is potentially curative. Again, figures vary, but the risk for relapse after successful alarm therapy has been reported at somewhere between 5% and 47% by Apos et al (2018), Kwak et al (2010), Tuncel et al (2008), Monda and Husmann (1995) and Butler et al (1990); the rest can be considered cured of their bedwetting.

Current recommendations for alarm therapy can be summarised as follows:

- Before considering alarm therapy,

daytime incontinence, if present, should be successfully treated;
- The health professional should demonstrate the alarm device for the family, making sure the child is comfortable with the procedure;
- The child should be helped to wake up immediately at the sound of the alarm. This means that a parent usually needs to sleep in the same room, at least during the first week(s) of therapy;
- Treatment needs to be uninterrupted and given every night;
- Treatment should be continued either until 6-8 weeks without success have elapsed or 14 consecutive dry nights have been achieved. In the latter case, the child is assumed to be cured (Nevéus et al, 2020).

## Problems with the enuresis alarm

The enuresis alarm is needed in the treatment arsenal. Basic bladder advice, or urotherapy, that was previously advocated as a first-line therapy has, in randomised studies by Borgström et al (2022) and Cederblad et al (2015), been found to be ineffective; in addition, the pharmacological alternative, desmopressin, only reliably works in a third of patients (Kwak et al, 2010) and is not curative. Second-line therapies, such as anticholinergics or tricyclic antidepressants, either have unimpressive success rates, and/or have risks or side-effects that limit their use (Nevéus, 2006).

The enuresis alarm is not, however, unproblematic. In this article, I outline the main challenges with the method and relate how efforts were made to address some of these problems, leading to proposed modifications of the alarm guidelines and suggestions for further research.

### Hard work required

The major drawback with the enuresis alarm is the amount of consistency and dedication required by the family and the consequent high risk of poor adherence. The sleep of the whole household will probably be disrupted during therapy – possibly every single night – for several months. We should remember that neuropsychiatric conditions, such as attention deficit hyperactivity disorder (ADHD), is overrepresented among children with enuresis (de Sena Oliveira et al, 2021), as well as, presumably, their parents. In many of these families, consistent alarm therapy may simply not be feasible since their neurodevelopmental condition makes adherence difficult.

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*"Enuresis alarm therapy can be managed by the families themselves but support by a nurse greatly improves the chances of adherence"*

The health professional needs to match, if not exceed, the motivation and dedication of the family. The device needs to be explained and demonstrated, and the family needs to be contacted for encouragement and problem solving purposes. Regardless of the model of the alarm chosen, technical problems such as false alarms are common. It is much easier for a nurse to have a doctor prescribe a pill (Perrin et al, 2015).

### Lack of availability

One linked problem is lack of alarm availability. In many countries or regions, the alarm is not offered to families or is only offered by specialised units (personal communication, Jackie Fuidge, ERIC). This is not satisfactory, given the extremely high prevalence of enuresis (Söderstrom et al, 2004), the harmlessness of the therapy and the limited medical evaluation needed. The enuresis alarm should be offered and managed by nurses at outpatient wards, but this is not usually the case.

### Lack of predictors

Another problem is the lack of good predictors of alarm success. This is problematic given the high commitment needed by everyone involved. It would likely be much easier to motivate families for alarm therapy if it were known beforehand whether the therapy would have a high chance of success.

The following can be assumed to be predictors of unfavourable alarm treatment effect:
- Lack of motivation and/or a chaotic family situation (Dische et al, 1983);
- ADHD (Crimmins et al, 2003).

The findings of the studies done have not been unanimous, but it can safely be assumed that untreated ADHD will decrease the chance of the alarm making the child dry as children with ADHD often have sleep problems, and they commonly have difficulties complying with strict routines (Schuster et al, 2021, Kovacevic et al, 2018; Sagie, 1996).

Sporadic enuresis has also been claimed to be a negative predictor (Önol et al, 2015; Jensen and Kristensen, 1999), but this is unclear as treatment efficacy – defined as a reduction in enuresis frequency – is difficult to assess if frequency is low from the start. However, even children who wet their beds only once a fortnight may be severely socially handicapped by their enuresis.

Voiding-chart data, which give predictive information about desmopressin therapy (Rittig et al, 1997), have been much less useful at predicting the response to alarm therapy than the response to desmopressin (Jørgensen et al, 2024). Finally, one study – by Sagie (1996) – claimed that girls have a slightly higher chance of success than boys.

**Theoretical problems**

One problem is that placebo-controlled studies are, due to the nature of the therapy, impossible to perform – it is impossible to hide from the family that the alarm signal is triggered by the wetting of the bed. As such, it is hard to disentangle specific alarm effects from those of a placebo or, indeed, from the effects of good nursing. We do not know how many children of those becoming dry during alarm therapy were about to become dry had they not been given the alarm.

This is linked to another disturbing fact: we do not really know why alarm therapy works (when it does). Perhaps it is advanced placebo effects? This, however, is unlikely. When we made a prospective randomised study comparing intense bladder training with the alarm – two methods with equally high amounts of nurse support and encouragement – the alarm came out much superior (Borgström et al, 2022). Likewise, studies comparing the alarm with hypnotherapy or with scheduled waking of the children at night – namely those by Seabrook et al (2005) and Whelan and Houts (1990) – have both given the prize to the alarm. The waking of the child in immediate conjunction with the enuresis event is crucial for the alarm to have effect.

## The project

We have tried to address some of these problems with a project involving several hundred subjects who have enuresis being treated with the alarm; see Larson et al (2023a) and Larson et al (2023b) for our findings.

**Aims and method**

The project used alarms linked to an online app downloaded to a parent's smartphone. It provided instructions to the users and recorded both baseline data and data gathered during therapy.

The alarm users belonged to two categories:

- Group A – children recruited by, and supported by, nurses at several allied paediatric outpatient wards throughout Sweden;
- Group B – children and, as it turned out, adults in families who purchased the alarm and downloaded the app independently, without contact with healthcare. There was no age requirement for participation in the study but we did not expect so many adults to participate.

Both groups were instructed in accordance with the International Children's Continence Society guidelines (Nevéus et al, 2020), including the instruction to use the alarm for eight weeks and stop treatment after 14 consecutive dry nights. Group A was instructed by the nurses and the app, while group B was only instructed by the app. The methodology of the studies is described in more detail in separate publications (Larsson et al, 2023a; Larsson et al, 2023b).

The central aims of the project were twofold: to look for readily available predictors to alarm treatment success and adherence, and to see whether the therapy could be managed by the families themselves without healthcare support. To get close to a true picture and not just involve highly motivated and well-organised families, we did not demand that they complete any voiding charts or measure nocturnal urine production.

**Findings**

Our first study involved 196 nurse-supported children. The results were disappointing (Larsson et al, 2023a). Only 18.4% became dry, 20.4% had an intermediate response, 22.4% were non-responders, and 38.8% did not manage to adhere to the full treatment.

This success rate is lower than most previously published studies. We do not think that this is due to the alarm device being defective, since the nurses reported that technical issues were not more common than with other alternatives and, in the few cases when technical problems did occur, quick support was provided by the company. Since the purpose of the study was not to test the efficacy of this particular alarm, no control group with another product was included. However, we think that our results reflect clinical reality better than previous reports. The included families did not have to perform any complicated procedures and both alarm use and wet/dry nights were recorded by the app, thus minimising recall bias.

Two interesting extra findings were that:

- Some families continued alarm use after eight weeks of unsuccessful therapy, whereupon some of these children changed from partial to full responders;
- Some families did not stop treatment after 14 consecutive dry nights, whereupon some of these children had early relapses and turned from full to partial responders.

These changes in outcome are shown in Table 1.

Table 1. **Changes in outcome**

| Nature of response | Response after 8-12 weeks, n (%) | Final response, n (%) |
|---|---|---|
| Full response | 51 (26.0) | 36 (18.4) |
| Intermediate response | 28 (14.3) | 40 (20.4) |
| Non-response | 42 (21.4) | 44 (22.4) |
| Dropout | 75 (38.3) | 76 (38.8) |
| Total | 196 | 196 |

When comparing the above nurse-supported children of group A with 202 independent subjects (group B), two findings were clear: the risk for non-adherence was massively greater in group B (38.8% in group A versus 60.4% in group B, p<0.001), but the chance for treatment success, for adherent subjects, was equal in the two groups (full or intermediate response for 63.3% among group A and 62.5% among group B, p=0.91). In short, the nurse is needed for encouragement, but the instructions can just as well be given by an app (Larsson et al, 2023b). This is illustrated more clearly in Fig 1.

Among baseline data gathered for all subjects (groups A and B) were demographic data (age and gender), concomitant urgency or daytime incontinence, baseline enuresis frequency, subjective arousal thresholds, previous treatment with the alarm or desmopressin, and previous dryness. Frustratingly, none of these factors gave any clear predictive information regarding treatment success. Importantly, daytime incontinence did not diminish the chance of the alarm making the subject dry.

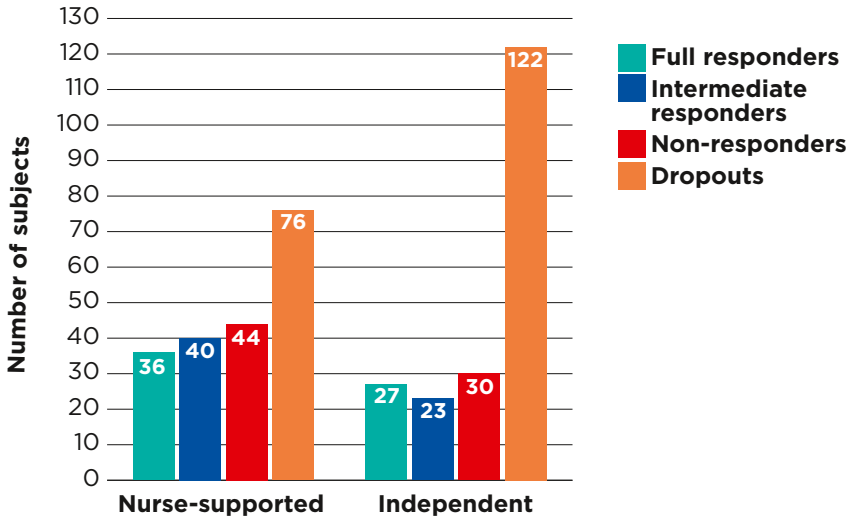
Good predictors of both treatment success and adherence were found when looking at the first few weeks of therapy. Subjects who did not experience a reduction of enuresis frequency (wet nights per week) during the first 3-4 weeks had very little chance of becoming dry in the end, and families who did not manage to use the alarm every, or almost every, night during the first 2-3 weeks were very

unlikely to be able to adhere during the full course of therapy.

All these findings have since been confirmed looking at 122 new subjects in group A and 1,407 new subjects in group B. Thus, the risk for non-adherence was much higher in group B, among which only 18% completed the full treatment course ($p<0.001$), whereas among adherent subjects the chance of treatment success was similar in the two groups ($p=0.55$). In this larger sample, the same predictive value of the enuresis reduction during early treatment as described above was found (week 1 $p=0.16$, week 2 $p=0.032$, week ≥3 $p<0.001$), and the presence of concomitant daytime incontinence still failed to influence the chance for treatment success ($p=0.324$) (Bergsten et al, 2024).

While looking at data from the independent users (group B), we were surprised to find that several of them were adults. Presently, we have data from approximately 200 subjects aged 18 years or above. We plan to publish their results separately but this much is clear: many of them have not been treated before and their results are very poor. The vast majority of adults commencing alarm treatment will not be able to persevere during the full duration of therapy and most of those who do adhere will not be cured from their enuresis.

Fig 1. **Final treatment outcome for nurse-supported versus independent alarm users**




## Discussion

The noninvasiveness of alarm therapy, the lack of dangerous side-effects and its real potential for cure makes the enuresis alarm a necessary part of the antienuretic arsenal. But there are several problems limiting alarm success and usability. With our research reported here, and that of other groups, some light has been thrown on these problems and potential mitigating strategies have been found.

We suspect that the success rate for the enuresis alarm, as reported in the literature, is exaggerated. In clinical reality we can expect the alarm to be successful in perhaps just one-third of patients, while one-third will not become dry and one third will, for various reasons, discontinue therapy prematurely. The reason for this suboptimal situation is manifold:

- Technical problems with the alarm devices;
- Behavioural issues of the child;
- The family situation;
- 'True' non-response – the fact that the alarm will not cure everyone even under optimal circumstances.

In addition, early relapse after the achievement of 14 consecutive dry nights is not uncommon and some subjects will need more than eight weeks to become dry.

*"The major drawback with the enuresis alarm is the amount of consistency and dedication required by the family"*

Apart from the reasonable expectation of a poor treatment effect and/or adherence in children with neuropsychiatric disorders such as ADHD, at least if not successfully treated, and in socioeconomically challenged families, there is no clear and reliable way to predict if alarm therapy will work. The predictive value of voided volumes is limited, and we should remember that many families will not be able to provide reliable voiding chart data. This situation is especially frustrating given the hard work and the social disruption resulting from alarm therapy. The many children undergoing months of therapy just to end up where they started will not be motivated to try again anytime soon.

However, a way forward is provided by the finding of the clear predictive value of the first 3-4 weeks of therapy. This way, children with a poor chance of success or adherence can be advised to stop treatment. Perhaps the users can be better motivated if they know that they will only have to endure the hardship for one month. No child should have to have sleep disrupted every single night for more than four weeks.

Also, the findings regarding early relapse and the need for some children to prolong therapy is useful. The instruction to wait until 28 dry nights instead of 14 will not add much to the family burden (most or all of the extra nights will be dry), and only children with a clear chance of cure will need to prolong therapy more than the previous 6-8 weeks. Again, these are all children who have achieved a reduced enuresis frequency, so these extra weeks of therapy will not be too hard.

The availability problem mentioned in the introduction is difficult to solve, but we have shown that the alarm can be managed by the families themselves, although adherence is an even greater problem in this group. Perhaps the alarm, and attached online apps, can be modified to better motivate independent users.

But, until then, it is clear that the nurse is an indispensable resource in enuresis alarm therapy, not so much as a source of information and instruction as an ally providing encouragement during the difficult part of the treatment process.

Contrary to common belief, enuresis is not rare among adults (Baek et al, 2013; Hirasing et al, 1997). This is a neglected group who try to hide their condition and may be severely socially disadvantaged. Their enuresis is not likely to remit spontaneously, and the enuresis alarm is probably not very useful for them.

## Recommended new guidelines

Based on our research, and previous studies, we propose that the standard

guidelines for enuresis alarm therapy be modified in the following way:

- Daytime incontinence should not be a contraindication to alarm therapy. Both conditions could be treated simultaneously, or one could start with what is most distressing for the individual child;
- The child and family should be encouraged to use the alarm for every night during four weeks, after which treatment should be reevaluated;
- Children who, after these four weeks, have had no reduction in the number of wet nights per week, or families who have not managed to use the alarm all, or almost all, nights, should be recommended to stop alarm therapy and be offered other antienuretic therapies;
- Children whose enuresis frequency has been reduced during the first four weeks should be encouraged to continue therapy until either 28 consecutive dry nights have been achieved or several weeks have passed without further improvement.

*"In clinical reality we can expect the alarm to be successful in perhaps just one third of patients"*

## Recommended further studies

The following are some suggestions regarding further research:

- We need to explore new and improved ways to motivate the child and families. One ingenious way may be that the actual alarm signal be changed from just a scary and boring ring signal to a recorded parent's voice. Or why not let the child record a personal wake-up call themselves before going to bed? Randomised comparisons of the effectiveness of these methods could be performed;
- Better and more engaging enuresis alarm apps should be developed and tested. The support provided by the app could be more personalised to the subject, perhaps with the help of artificial intelligence. We are working with an alarm manufacturer along these lines;
- Randomised, placebo-controlled studies of the addition of desmopressin to the enuresis alarm to subjects with suboptimal response to either therapy are sorely needed. Perhaps this may turn desmopressin non-responders into responders?

## Conclusion

The situation for children (and adults) suffering from enuresis is far from perfect: both first-line therapies – the enuresis alarm and desmopressin – can be expected to be fully successful in just one-third of patients, and these lucky thirds probably overlap as well, so perhaps just half of the children can be helped to consistently dry nights. And, as we have seen, not all children who need the enuresis alarm will be offered it from healthcare providers. Both policy changes and more research, as outlined in this article, are needed. **NT**

**References**

**Apos E et al** (2018) Enuresis management in children: retrospective clinical audit of 2861 cases treated with practitioner-assisted bell-and-pad alarm. *The Journal of Pediatrics;* 193: 211-216.
**Baek M et al** (2013) A nationwide epidemiological study of nocturnal enuresis in Korean adolescents and adults: population based cross sectional study. *Journal of Korean Medical Science;* 28: 7, 1065-1070.
**Bergsten A et al** (2024) Predictors of response and adherence to enuresis alarm therapy: a confirmatory study. *Acta Paediatrica;* 113: 3, 573-579.
**Bonde HV et al** (1994) Nocturnal enuresis: change of nocturnal voiding pattern during alarm treatment. *Scandinavian Journal of Urology and Nephrology;* 28: 4, 349-352.
**Borgström M et al** (2022) Daytime urotherapy in nocturnal enuresis: a randomised, controlled trial. *Archives of Disease in Childhood;* 107: 6, 570-574.
**Butler RJ et al** (2007) Exploring potential mechanisms in alarm treatment for primary nocturnal enuresis. *Scandinavian Journal of Urology and Nephrology;* 41: 5, 407-413.
**Butler RJ et al** (1990) The body-worn alarm in the treatment of childhood enuresis. *British Journal of Clinical Practice;* 44: 6, 237-241.
**Caldwell PHY et al** (2016) A randomised controlled trial of a code-word enuresis alarm. *Archives of Disease in Childhood;* 101: 326-331.
**Cederblad M et al** (2015) No effect of basic bladder advice in enuresis: a randomised controlled trial. *Journal of Pediatric Urology;* 11: 3, e1-e153.
**Crimmins CR et al** (2003) Management of urinary incontinence and nocturnal enuresis in attention-deficit hyperactivity disorder. *The Journal of Urology;* 170: 4 Pt 1, 1347-1350.
**de Sena Oliveira AC et al** (2021) Attention deficit and hyperactivity disorder and nocturnal enuresis co-occurrence in the pediatric population: a systematic review and meta-analysis. *Pediatric Nephrology;* 36: 3547-3559.
**Devlin JB, O'Cathain C** (1990) Predicting treatment outcome in nocturnal enuresis. *Archives of Disease in Childhood;* 65: 10, 1158-1161.
**Dische S et al** (1983) Childhood nocturnal enuresis: factors associated with outcome of treatment with an enuresis alarm. *Developmental Medicine and Child Neurology;* 25: 1, 67-80.
**Evans J et al** (2011) Randomized comparison of long-term desmopressin and alarm treatment for bedwetting. *Journal of Pediatric Urology;* 7: 1, 21-29.
**Hirasing RA et al** (1997) Enuresis nocturna in adults. *Scandinavian Journal of Urology and Nephrology;* 31: 6, 533-536.
**Jensen IN, Kristensen G** (1999) Alarm treatment: analyses of response and relapse. *Scandinavian Journal of Urology and Nephrology;* 33: 202, 73-75.
**Jørgensen CS et al** (2024) Development of a novel prediction tool for response to first-line treatments of monosymptomatic nocturnal enuresis: a randomized, controlled international multicenter study (DRYCHILD). *The Journal of Urology;* 10.1097/JU.0000000000004129 [epub ahead of print].
**Kosilov KV et al** (2018) The optimal duration of alarm therapy use in children with primary monosymptomatic nocturnal enuresis. *Journal of Pediatric Urology;* 14: 5, 447.e1-447.e6.
**Kovacevic L et al** (2018) Children with nocturnal enuresis and attention deficit hyperactivity disorder: a separate entity? *Journal of Pediatric Urology;* 14: 1, 47.e1-46.e6.
**Kwak KW et al** (2010) Efficacy of desmopressin and enuresis alarm as first and second line treatment for primary monosymptomatic nocturnal enuresis: prospective randomized crossover study. *The Journal of Urology;* 184: 6, 2521-2526.
**Larsson J et al** (2023a) The value of case history and early treatment data as predictors of enuresis alarm therapy response. *Journal of Pediatric Urology;* 19: 2, 173.e1-173.e7.
**Larsson J et al** (2023b) Can enuresis alarm therapy be managed by the families without the support of a nurse? A prospective study of a real-world sample. *Acta Paediatrica;* 112: 3, 537-542.
**Monda JM, Husmann DA** (1995) Primary nocturnal enuresis: a comparison among observation, imipramine, desmopressin acetate and bed-wetting alarm systems. *The Journal of Urology;* 154: 2, 745-748.
**Nevéus T et al** (2020) Management and treatment of nocturnal enuresis: an updated standardization document from the International Children's Continence Society. *Journal of Pediatric Urology;* 16: 1, 10-19.
**Nevéus T** (2006) The evaluation and treatment of therapy-resistant enuresis: a review. *Upsala Journal of Medical Sciences;* 111: 1, 61-72.
**Önol FF et al** (2015) Comparison of long-term efficacy of desmopressin lyophilisate and enuretic alarm for monosymptomatic enuresis and assessment of predictive factors for success: a randomized prospective trial. *The Journal of Urology;* 193: 2, 655-661.
**Pereira RF et al** (2010) Behavioral alarm treatment for nocturnal enuresis. *International Brazilian Journal of Urology;* 36: 332-338.
**Perrin N et al** (2015) The efficacy of alarm therapy versus desmopressin therapy in the treatment of primary mono-symptomatic nocturnal enuresis: a systematic review. *Primary Health Care Research and Development;* 16: 1, 21-31.
**Rittig S et al** (1997) Long-term home studies of water balance in patients with nocturnal enuresis. *Scandinavian Journal of Urology and Nephrology;* 183: 25-26.
**Sagie J** (1996) The relationship between nocturnal enuresis, time of night and waking response in the process of treatment with enuresis alarm. *Children's Hospital Quarterly;* 8: 1, 7-9.
**Schuster S et al** (2021) Treating enuresis in children with neurodevelopmental disorders using bell and pad alarm. *Journal of Pediatric Urology;* 17: 5, 645.e1-645.e8.
**Seabrook JA et al** (2005) Treatment of primary nocturnal enuresis: a randomized clinical trial comparing hypnotherapy and alarm therapy. *Paediatrics and Child Health;* 10: 10, 609-610.
**Smith S** (1948) *The Psychological Origin and Treatment of Enuresis: A Practical Discussion of Bed-wetting.* University of Washington Press.
**Söderstrom U et al** (2004) Urinary and faecal incontinence: a population-based study. *Acta Paediatrica;* 93: 3, 386-389.
**Tuncel A et al** (2008) Long-term follow-up of enuretic alarm treatment in enuresis nocturna. *Scandinavian Journal of Urology and Nephrology;* 42: 5, 449-454.
**Whelan JP, Houts AC** (1990) Effects of a waking schedule on primary enuretic children treated with full-spectrum home training. *Health Psychology;* 9: 2, 164-176.