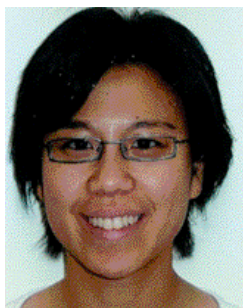


Management of childhood enuresis



PATRINA CALDWELL
BMed, FRACP, PhD



CLAUDIA NG
BMed

Dr Caldwell is a Senior Lecturer, Discipline of Paediatrics and Child Health at the University of Sydney and Staff Specialist, NHMRC Centre for Clinical Research Excellence in Renal Medicine, the Children's Hospital at Westmead. Dr Ng is a Paediatric Trainee at the Children's Hospital at Westmead, Sydney, NSW.

Enuresis is a common childhood complaint. However, with careful assessment, appropriate therapy and effective follow up, it is a condition that can be managed successfully, improving the wellbeing of the child and his or her family.

'Among the functional disorders of childhood, one of the most commonest is enuresis, and I suppose there is hardly any which causes more petty trouble and annoyance to parents than this, at first sight, trivial complaint,' remarked Sir Frederick Still, a physician serving boys' schools earlier this century.¹

Nocturnal enuresis (bedwetting) is not new and doctors have attempted to tackle this problem through the ages. It had once been described that 'the characteristics of the ideal doctor treating wetting, as somebody with the anatomic and physiological expertise of an urologist, the patience of a paediatrician, and the insight of a psychologist'.²

Enuresis is a common childhood complaint. It occurs in up to 18.9% of school-aged children³ and is more common in boys. In most children there is no underlying organic pathology.

The impact of enuresis on both children and their families can be profound. It can affect a child's self-esteem, behaviour, relationships and performance at school.⁴ Recent research has also

shown that children with enuresis have impaired cognitive performance, which improves with the successful treatment of the condition.⁵ However, only 34% of families of children with bedwetting problems seek professional help.³

The correct diagnosis based on a detailed history and examination is essential for selecting appropriate treatment. However, treatment can be challenging, time consuming and arduous for both the child and his or her parents.

Physiology of bladder function

Continence involves the ability to store and empty urine from the bladder at appropriate times. This is co-ordinated by the central and peripheral nervous systems, which control the activity of the smooth and striated muscles of the bladder, urethra and external urethral sphincter. During voiding, contraction of the detrusor muscle and relaxation of the pelvic floor muscles and urethra allow the free flow of urine until complete bladder emptying.

IN SUMMARY

- **Childhood enuresis (bedwetting) is a common complaint occurring in up to 18.9% of school-aged children.**
- **It can affect a child's self-esteem, behaviour, relationships and performance at school.**
- **Monosymptomatic nocturnal enuresis (bedwetting without daytime symptoms) should be distinguished from non-monosymptomatic enuresis (bedwetting with daytime voiding symptoms) as the management differs for each of these conditions.**
- **Causes of childhood enuresis include impaired cortical arousal coupled with reduced bladder capacity and/or nocturnal polyuria.**
- **Alarm therapy is the most effective therapy for managing monosymptomatic nocturnal enuresis, with desmopressin as second-line therapy.**

There is evidence of cortical arousal during sleep in response to filling of the bladder even in newborns.⁶ A conscious awareness of bladder distension develops between the ages of 1 and 2 years. By the age of 2 to 3 years, most children have developed the ability to void or inhibit voiding voluntarily, and normally void between four to seven times during the day. Most children will have achieved both day and night dryness by the age of 3 to 4 years.⁷

Bladder capacity increases over time in children. The normal expected maximum bladder capacity up to the age of 12 years is calculated as $(\text{age} + 1) \times 30 \text{ mL}$.⁷ Children normally produce less urine at night compared with during the day in response to the circadian variation in the level of arginine vasopressin (AVP) released by the pituitary gland.⁸ Cortical arousal, reduced functional bladder capacity and nocturnal polyuria are the most common factors causing enuresis.

Presentation

The age at which a child presents for treatment of enuresis is often influenced by the severity of symptoms and by parental and child concern. Most children with enuresis present with monosymptomatic nocturnal enuresis (79%;³ see the box on page 18 for definitions of different forms of enuresis⁹). Those with non-monosymptomatic nocturnal enuresis (21%) experience symptoms such as frequency (voiding more than seven times per day), urgency (a sudden compelling desire to void, which is difficult to postpone) or daytime incontinence. Parents often accept their child's daytime dampness as either 'normal' or inconsequential or are unaware of their child's daytime symptoms.

The risk of enuresis is increased in children with obstructive sleep apnoea, attention deficit hyperactive disorder and constipation. Constipation can cause daytime symptoms and is generally poorly recognised by parents.¹⁰

The prevalence of nocturnal enuresis is 15 to 20% of 5-year-olds, 5 to 10% of 10-year-olds, 2 to 3% of 12- to 14-year-olds and 1 to 2% of children aged 15 years and over.¹¹ Most children tend to outgrow enuresis, with a spontaneous remission rate of 14% annually among children who bed wet. However, children who are older or with more severe symptoms (bedwetting more than three nights per week) have a greater risk of persistent

Management of childhood enuresis

Copyright restrictions

Enuresis can have a considerable impact on children and their families, affecting a child's self-esteem, performance at school, behaviour and relationships with others. Alarm therapy is the most effective treatment for children with bedwetting problems and no daytime symptoms.

©ISTOCKPHOTO/JLBARRANCO

enuresis into adult life (2 to 3% of the adult population will continue to have enuresis).^{11,12}

Causes

Childhood enuresis is a heterogeneous condition. It is hypothesised that enuresis is caused by a mismatch between a small bladder capacity and/or nocturnal polyuria coupled with an inability to arouse a full bladder sensation.⁸ Many children with nocturnal enuresis have a smaller night-time bladder capacity compared with normal controls.⁶ This may be confined to night time or may occur during the day as well.

Nocturnal polyuria (nocturnal urine output exceeding 130% of age-expected functional bladder capacity) occurs in two-thirds of children with enuresis, resulting from inadequate secretion of AVP during sleep.

Definitions of different forms of enuresis⁹

Enuresis (nocturnal enuresis)

Intermittent urinary incontinence during sleep in the absence of physical disease beyond the age of 5 years.

Primary enuresis

A child who has never been dry at night for more than six months.

Secondary enuresis

Enuresis in a child who has been dry previously for at least six months. This is more likely to be associated with a psychological or organic cause.

Monosymptomatic nocturnal enuresis

Nocturnal enuresis without any (other) lower urinary tract symptoms. This is the most common form of enuresis.

Non-monosymptomatic nocturnal enuresis

Nocturnal enuresis with daytime symptoms such as urgency, frequency or daytime wetting.

Genetic factors also play a role in two-thirds of children with nocturnal enuresis and have been linked to chromosomes 13, 12, 8 and 22 with a predominantly autosomal dominant inheritance.¹¹

Investigations

It is essential to assess for urological, neurological and other pathological causes of enuresis. This includes physical examination of the abdomen (palpate for bladder and faecal masses), neurological examination (deep tendon reflexes and examination of the back for signs of spinal lesions) and genitalia (urinary dribbling). Urinalysis, urine microscopy and culture are useful for detecting urinary tract infections, proteinuria, diabetes and poor hydration.

A frequency volume chart documents the times and volumes of all fluid intake and urine output over 24 hours (see the patient handout on page 23). This information is useful for assessing fluid intake, bladder function (by measuring the child's maximum voided volume and frequency of voids) and nocturnal urinary output (by weighing the nappy or measuring the overnight void plus the first morning void).

Urine flow measurements can provide information on the bladder's ability to contract and relax to allow free urine flow. A post-void bladder ultrasound can give information on the bladder's ability to empty. These tests are available in some specialist continence services. A renal ultrasound is not normally necessary in children with monosymptomatic nocturnal enuresis but is helpful in children with non-monosymptomatic nocturnal enuresis for detecting renal tract abnormalities.

Management

Management of childhood enuresis is based on the accurate assessment of the underlying cause and applying the most appropriate therapy. The engagement, motivation and ability of the child and his or her parents in the management of this condition will also influence the likelihood of treatment success.¹³ An approach to managing a child with wetting problems is given in the flowchart on page 19¹⁴ and also as a case study in the box on page 20.

Management of children with enuresis should ideally involve the GP. The GP is able to provide insight into the psychosocial factors affecting the child and his or her family, as this may impact on management. The GP plays an important role in choosing the most appropriate treatment, supporting and monitoring the progress of the child during treatment and referral of the child to specialist care when necessary.

Monosymptomatic nocturnal enuresis Alarm therapy

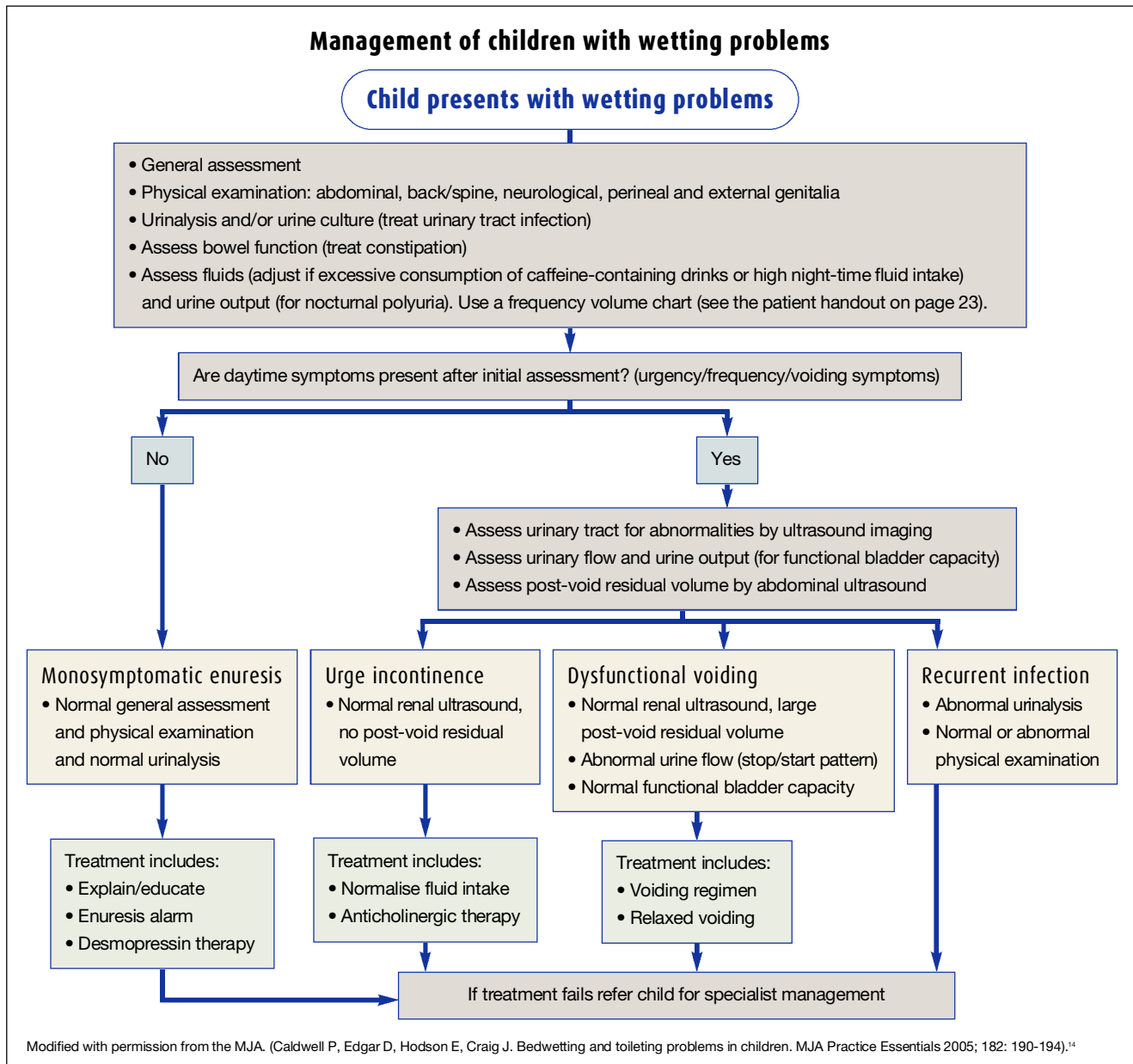
Alarm therapy is the most effective treatment available for childhood nocturnal

enuresis with a cure rate of 65 to 75%.¹⁵ An enuresis alarm is an electronic device that is activated when wetting occurs to give a strong auditory signal (with or without vibration); this trains the child to either wake and void or withhold voiding and sleep through the night.

There are currently two types of enuresis alarms available in Australia. The first is a bell and pad alarm, which comprises of a large sensor mat that is placed on the bed and any liquid triggers the alarm (Figure 1a). The second is a body worn alarm, which is clipped onto the child's underpants or onto a small continence pad placed inside the child's underpants and any liquid triggers the alarm (Figure 1b). Both types of alarm have been shown to be equally effective¹⁵ although more families prefer the body worn alarm. The choice is usually based on availability, cost and personal preference.

The alarm is used until the child has been dry for 14 consecutive nights, which usually takes several months. About half of children who have used the alarm will remain dry after cessation of therapy. Supplementing alarm treatment with overlearning (e.g. giving the child extra fluids at bedtime after achieving night dryness with continued alarm training) may further reduce relapse rates to 25%.¹⁵

Treatment failure is commonly attributed to the child not waking to the alarm, incorrect usage, noncompliance and alarm malfunction. Before commencement of treatment, it is important to discuss with the child's parents the potential difficulties such as the time needed to attain success and disruption to the family. Alarm therapy may be particularly difficult for young children (below the age of 6 to 7 years) and children with developmental or intellectual delay because of poor compliance and lack of motivation. Supporting the family during treatment (troubleshooting for alarm problems), providing feedback and following-up regularly are also essential to treatment success.



Desmopressin

Children with an inadequate rise in nocturnal AVP secretion and nocturnal polyuria are more likely to respond to desmopressin (Minirin Tablets, Minirin Nasal Spray) – a synthetic vasopressin analogue. Monotherapy with desmopressin causes fewer wet nights and also increases the chance of achieving dryness during treatment by up to tenfold.¹⁶ The effects

are almost immediate compared with alarm training but the benefit of the treatment is not sustained with cessation of therapy. It may also be helpful for short-term treatment such as for school camps and sleepovers.

Although desmopressin is available as a nasal spray and in tablet form in Australia, the nasal spray is no longer recommended because of the increase risk of hypona-

traemia compared with the oral formulation.¹⁷ The recommended dose of desmopressin is 200 to 400 µg (one to two tablets) given at bedtime. It is available on the PBS (authority required, streamlined) for children 6 years of age and over for whom an enuresis alarm is contraindicated. Combination therapy with desmopressin and alarm therapy can be used for nonresponders, although results are not conclusive.¹⁵

Case study: management of an 8-year-old boy with a history of bedwetting every night and daytime symptoms

An 8-year-old boy, Jack, presents to you with his mother. He has a history of bedwetting every night, usually completely soaking the bed each time. He does not like to wear pull up training pants to bed and is usually not aware that he has wet during the night. Jack was toilet trained during the day by 3 years of age but has never been dry at night. In the past his parents have tried restricting his evening drinks and taking him to the toilet during the night, which has not helped with his bedwetting.

Jack also has daytime wetting several times per week with leaking through to his outer clothing. He tends to postpone voiding if he is playing and only voids four times per day. Jack also suffers from constipation and opens his bowels twice per week, often needing to strain to defaecate and complaining of pain with defaecation. He does not have problems with soiling. Although Jack's dietary fibre intake is reasonable, his fluid intake is quite poor. Jack has been previously well with no significant family history.

His general examination (including neurological) was entirely normal (including urinalysis), although hard faeces were palpable on abdominal examination.

Clinical impression

You diagnose non-monosymptomatic nocturnal enuresis (bedwetting with daytime symptoms) and constipation.

Management of daytime symptoms

First you address Jack's daytime symptoms and you ask him to:

- increase fluid intake
- address constipation by increasing fibre intake and the addition of a laxative
- encourage regular voiding every two to three hours
- complete a frequency volume chart over three separate days (see

the patient handout on page 23).

You review Jack again four weeks later. He has done extremely well since his last visit. He has increased his daily fluid intake and aims to drink 1.5 L a day. His constipation resolved with treatment. He successfully completed a frequency volume chart, which showed that his largest daytime void was 250 mL but most of his voids were smaller (between 150 and 200 mL). Overnight he produced between 100 and 190 mL of urine, which is normal for his age. He is now completely dry during the day and his night-time wetting has also improved, wetting five nights over the past week.

Clinical impression after management of daytime symptoms

Treatment of constipation and regular voiding has resolved Jack's daytime wetting and has improved his bedwetting. His nocturnal enuresis can now be addressed.

Management of nocturnal enuresis

To manage Jack's wetting you ask him to continue his daily fluid intake and void regularly. You also prescribe an enuresis alarm (with training and a demonstration of how to use the alarm).

Conclusion

Jack initially wet most nights but woke (with his parents' help) to the alarm stimulus. His wetting gradually became less frequent, and the size of the wet patch reduced. It took Jack one month to achieve 14 consecutive dry nights, after which you supplemented his alarm training with overlearning (by giving Jack extra fluids at bedtime). Jack became completely dry at night after one week of overlearning, and remained on overlearning for a further two weeks. You review Jack again one month later and he has remained completely dry at night.

Other therapies

Other pharmacological therapies have been used such as tricyclic antidepressants. Even though 20% of patients become dry on tricyclics, almost all will relapse after treatment cessation.¹⁸ This treatment is no longer recommended for nocturnal enuresis because of the potential cardiotoxic side effects, although it is still sometimes used particularly with treatment failure to enuresis alarms and desmopressin.

There is insufficient evidence to demonstrate the effectiveness of physical

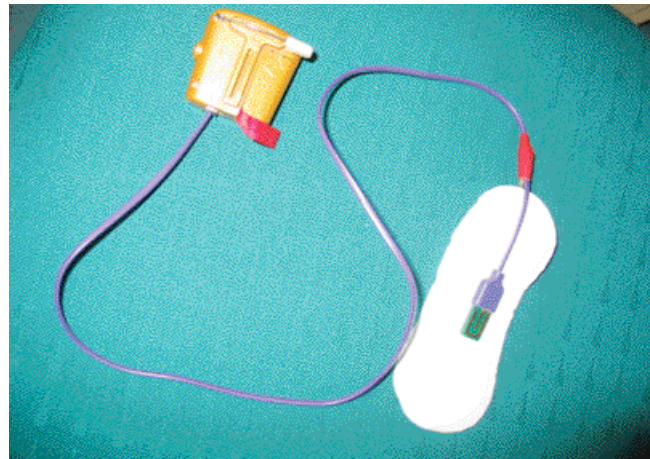
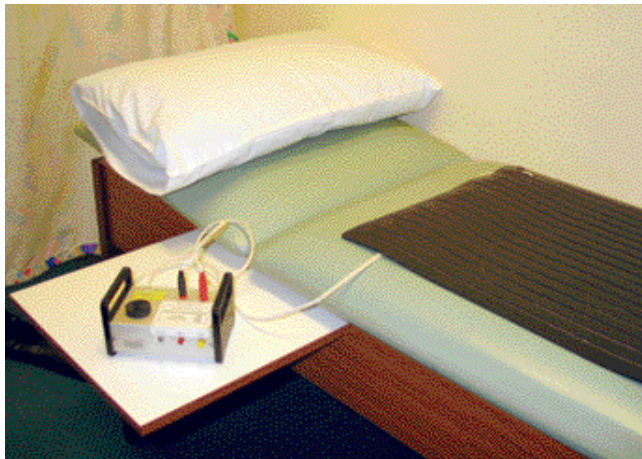
interventions used alone (such as fluid restriction, taking the child to the toilet in the night, scheduled waking, reward systems and retention control training), complex behavioural and educational interventions such as dry-bed training (regular waking at night with reprimand for wetting) and complimentary therapies (such as hypnosis, acupuncture and chiropractics).¹⁹ Full-spectrum home training (combination of alarm therapy with cleanliness training, retention control and overlearning) did not show a benefit over alarm treatment alone.²⁰

Daytime symptoms

Alarm or desmopressin monotherapy are less effective in children with daytime symptoms. The daytime symptoms are usually caused by bladder overactivity or dysfunctional voiding, which should be addressed before commencing therapy for nocturnal enuresis.

Management of bladder overactivity include normalisation of fluid intake, treatment of constipation and reduction in caffeine intake. Anticholinergic medications (oxybutynin [Ditropan], tolterodine [Detrusitol]) are used in children

continued



Figures 1a and b. Two types of alarms for children with nocturnal enuresis. These are electronic devices that are activated when wetting occurs to give a strong auditory signal (with or without vibration); this trains the child to either wake and void or withhold voiding and sleep through the night. (a, left). Bell and pad alarm. (b, right). Body worn alarm.

with bladder overactivity if conservative management is inadequate. Teaching children to relax their pelvic floor muscles during voiding and regular voiding

regimens will help manage dysfunctional voiding.⁷

Rural general practitioners

Monosymptomatic nocturnal enuresis can be managed successfully by a rural GP with access to appropriate resources and/or support from continence advisors and tertiary paediatric services. Information and advice regarding the local availability of continence services can be obtained through the Continence Foundation of Australia (see the box on this page).

When to refer

Referral of children with enuresis for specialist advice is recommended for any of the following:

- suspicion of neurological or urological anomalies
- persistent urinary tract infections
- no response to treatment for bed wetting or daytime incontinence after eight to 12 weeks
- presence of significant daytime incontinence.

Conclusion

Accurate assessment of children with enuresis is essential for successful treatment. Monosymptomatic nocturnal enuresis is

most effectively treated by enuresis alarm therapy, with desmopressin as second-line therapy. The condition can be successfully managed by the GP with support from continence services (see the box on this page for some useful resources). **MT**

A list of references is available on request to the editorial office.

COMPETING INTERESTS: None.

Useful resources for childhood enuresis

The Continence Foundation of Australia
www.continence.org.au
 Helpline number: 1800 330 066
 (provides information on how to purchase or hire enuresis alarms)

The National Continence Management Strategy
www.bladderbowel.gov.au/living/bladder/p/children/default.htm (includes downloadable fact sheets in several languages)

The International Children’s Continence Society
www.i-c-c-s.org

Children’s Hospital at Westmead
www.chw.edu.au/parents/factsheets/bedwetting.htm (includes fact sheets on enuresis and daytime wetting)

Online CPD Journal Program

© ISTOCKPHOTO/JLBARRANCO

Is childhood bedwetting more common in boys or girls?

Review your knowledge of this topic and earn CPD/PDP points by taking part in Medicine Today’s Online CPD Journal Program.

Log on to www.medicinetoday.com.au/cpd

Management of childhood enuresis

PATRINA CALDWELL ^{BMed, FRACP, PhD} CLAUDIA NG ^{BMed}

References

1. Anon. My enuresis. *Arch Dis Child* 1987; 62: 866-868.
2. Evans J, Shenoy M. Disorders of Micturition. In: Webb N, Postlethwaite R, eds. *Clinical Paediatric Nephrology*. Oxford: Oxford University Press; 2003. p. 163-178.
3. Bower W, Morre K, Sihoe JD, Shepherd R, Adams R. The epidemiology of childhood enuresis in Australia. *Br J Urol* 1996; 78: 602-606.
4. Redell S, Collier J. Bedwetting, behaviour and self esteem: a review of the literature. *Child Care Health Dev* 2001; 27: 149-162.
5. New research highlights that bedwetting children suffer from impaired brain function, sleep arousal disturbance and bladder dysfunction. 2008. Available online: www.prnewswire.co.uk/cgi/news/release?id=214072 (accessed July 2008).
9. Neveus T, von Gontard A, Hoebeke P. The standardization of terminology of lower urinary tract function in children and adolescents: report from the Standardisation Committee of the International Children's Continence Society. *J Urol* 2006; 176: 314-324.
6. Kawauchi A, Yamao Y, Nakanishi H, Naito Y, Tanaka Y, Ukimura O. Relationship among nocturnal urinary volume, bladder capacity and nocturia with and without water-load in nonenuretic children. *Urology* 2002; 59: 433.
7. Nijman R, Butler R, Van Gool J. Conservative management of urinary incontinence in childhood. In: Abrams P, Cardozo L, Khoury S, Wein A, eds. *Incontinence*. Plymouth: Health Publication; 2002. p. 513-551.
8. Hjalmas K, Arnold T, Bower W. Nocturnal enuresis: an international evidence based management strategy. *J Urol* 2004; 171: 2545-2561.
10. McGrath K, Caldwell P, Jones M. The frequency of constipation in children with nocturnal enuresis: a comparison with parental reporting. *J Paediatr Child Health* 2008; 44: 19-27.
12. Yeung CK, Sreedhar B, Sihoe JD, Sit FK, Lau J. Differences in characteristics of nocturnal enuresis between children and adolescents: a critical appraisal from a large epidemiological study. *BJU Int* 2006; 97: 1069-1073.
11. Hunsikarr S, Burgoa H, Diokno A. Epidemiology and natural history of urinary incontinence (UI). In: Abrams P, Cardozo L, Khoury S, Wein A, eds. *Incontinence*. Plymouth: Health Publication. 2002. p. 165-210.
13. Morison M. Parents and young people's attitudes towards bedwetting and their influence on behaviour, including readiness to engage in and persist with treatment. *Br J Urol* 1998; 81(Suppl 3): 56-66.
14. Caldwell P, Edgar D, Hodson E, Craig J. Bedwetting and toileting problems in children. *MJA Practice Essentials* 2005; 182: 190-194.
15. Glazener C, Evans J, Peto R. Alarm interventions for nocturnal enuresis in children. *Cochrane Database of Systematic Reviews* 2005, Issue 2: CD002911.
16. Glazener C, Evans J. Desmopressin for nocturnal enuresis in children. *Cochrane Database of Systematic Reviews* 2002, Issue 3. Art. No.: CD002112.
17. Robson WL, Leung AK, Norgaard J. The comparative study of oral versus intranasal desmopressin for the treatment of children with nocturnal enuresis. *J Urol* 2007; 178: 24-30.
18. Glazener C, Evans J, Peto R. Tricyclic and related drugs for nocturnal enuresis in children. *Cochrane Database of Systematic Reviews* 2003, Issue 3: CD002117.
19. Glazener C, Evans J, Cheuk D. Complimentary and miscellaneous interventions for nocturnal enuresis in children. *Cochrane Database of Systematic Reviews* 2005, Issue 2: CD005230.
20. Glazener C, Evans J, Peto R. Complex behavioural and educational interventions for nocturnal enuresis in children. *Cochrane Database of Systematic Reviews* 2004, Issue 1: CD004668.