

## Current topic

# Fifty years of enuretic alarms

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Enuresis may be defined as an involuntary discharge of urine by day or night, or by both, in the absence of congenital or acquired defects of the central nervous system or urinary tract in a child aged 5 or over. Oppel *et al* in their study of 859 children showed that 10% were wetting at age 7 and the National Child Development Study of all children born in England during a week in 1958 showed on follow up that approximately 12.5% were wetting at 5 and 10% at 7 years.<sup>1,2</sup>

Ackerson in 1931 stated that despite unremitting efforts to develop a specific form of treatment nocturnal enuresis continued to be regarded as an unsolved problem.<sup>3</sup> In 1950 Crosby commented that medical practitioners had been so discouraged over the results of treatment in the past that there was a widespread tendency to counsel parents 'to wait and let the child grow out of it'.<sup>4</sup>

By 1958 Wickes was able to find only one report detailing the use of an alarm in the United Kingdom and in 1960 Eysenck claimed that not a single child guidance clinic in the British Isles employed the conditioning treatment for enuresis.<sup>5,6</sup> In Canada only 10% of paediatricians at the Montreal Children's Hospital approved of an alarm bell.<sup>6</sup> The eminent adult neurologist Walshe in a letter to the *Lancet* in 1964 was scathing in his criticism of the use of this 'barbarous contraption'.<sup>7</sup> Several psychiatrists were of the same opinion and were probably responsible for curtailing its use and development. Werry wrote in 1966 'Although references to conditioning treatment will be found in most orthodox pediatric texts, the method has never really become popular at least in medical circles and is at best regarded as a last-ditch treatment'.<sup>8</sup> Twenty years later, according to Foxman *et al*, enuresis alarms continued to be recommended by only 3% of American paediatricians.<sup>9</sup>

It seems appropriate, as the 50th anniversary of Mowrer and Mowrer's excellent paper was celebrated recently,<sup>10</sup> that the most successful treatment of nocturnal enuresis to date—that is, the conditioning method—should be reviewed. In 1938, Mowrer and Mowrer argued that 'if some arrangement could be

provided so that the sleeping child would be awakened *just after the onset of urination*, and only at that time, the resulting association of bladder distension and response of awakening and inhibiting further urination should provide precisely the form of training which would seem to be most specifically appropriate'.<sup>10</sup> To this end they designed a pad of bronze screening and absorbent cotton fabric which when wet with urine, activated an electric door bell to waken the child.

Mowrer and Mowrer used this apparatus for three years before publishing their results, at first believing they had pioneered alarm treatment.<sup>10</sup> In 1936, however, Svordlovsk, a Russian scientist, announced his gift to Soviet motherhood—a light which flashes when the baby needs changing. Wires attached to strips of tinfoil in a special packet with cloth sandwiched between, becoming a conductor when dampened and presto a light goes on'.<sup>11</sup> Seiger patented a similar apparatus in the United States in 1936.<sup>12</sup> A more detailed search of the literature showed that Pfaundler, a German paediatrician, had developed equipment in 1902 to signal by a bell that an infant needed changing.<sup>13</sup> He tried it on an enuretic child for a month with appreciable reduction of wet beds, and stated that, in some cases, the knowledge that urination at night would cause the bell to ring henceforth inhibited this act. Genouville and Remy-Roux both used Pfaundler's method and reported good results.<sup>14,15</sup> Genouville found the sound of the bell almost always inhibited further urination even though it did not at first produce wakening.<sup>14</sup> Although Genouville and Remy-Roux claimed considerable success for their treatment, it failed to be taken up, largely because of the cumbersome nature of the equipment and the fact that a considerable amount of urine (20–30 ml) was necessary to activate the electrodes.<sup>14,15</sup>

### Mode of action

The fundamental principle of the alarm is to change the meaning of full bladder sensations from a signal

to urinate to a signal to inhibit urination and waken. Mowrer and Mowrer used a classical conditioning paradigm to explain the action of the alarm. They proposed that sphincter contraction and wakening becomes a conditioned response to bladder distension by association in time with the alarm.<sup>10</sup> This model has been questioned because of the expectation that extinction should occur with the removal of the alarm.

Lovibond viewed the alarm as an aversive stimulus which the child learns to avoid by sphincter contraction and wakening, and thus explained the mode of action as conditioned avoidance.<sup>16</sup> Increased functional bladder capacity has been claimed to occur with alarm treatment,<sup>17</sup> and this may be a consequence of holding.

The typical consequences of a wet bed are what Azrin *et al* call motivational and social variables.<sup>18</sup> They proposed that as wakening to the alarm ensures the consequences occur close to the time of the accident, learning of bladder control is based on operant principles.

### Three types of alarm systems

There are basically three types of alarm systems:

#### (1) THE PAD AND BELL

This was used by Pfaundler, Genouville, Remy-Roux, and Svordlovsk and originally consisted of zinc-copper plated iron ore wire nets, 10" square.<sup>11 13-15</sup> The pads were separated by a linen or cotton sheet. In 1938 Mowrer and Mowrer increased the size of the pads to 28" by 32".<sup>10</sup> Seiger invented and patented a single pad of rubber 8" by 10" with an inlay of parallel wires made of a nickel chrome alloy.<sup>12</sup> This pad was easier to clean and dry and was activated by a smaller amount of urine. However, the pad was small therefore, not surprisingly, when the apparatus was sent to the Quarrier Homes in Scotland in 1949, the size of the rubber pad was increased to 18" by 24" and the nickel wires were arranged in a circular manner 1/2" apart.<sup>19</sup>

Gillison and Skinner showed that it required 5 ml of urine to activate this type of alarm.<sup>20</sup> Wickes introduced gauze pads and later aluminium foil pads were used by McKendry *et al*.<sup>5 21</sup> The original upper aluminum pad had 3/4" perforations, but because of the occurrence of ulcers the perforations were reduced to 1/2" in diameter and set 1 1/4" apart.

Presently the types of detector mats used are (a) a single PVC sheet with stitched circuit or printed circuit, (b) a pair of wire mesh mats, and (c) a pair of conducting sheets, the top perforated with 1/4" holes. Goel *et al* comment that no mats were entirely satisfactory, although clinical personnel preferred the wire mesh type.<sup>22</sup>

#### (2) THE BODY SENSOR PLUS ALARM

This was pioneered by Crosby.<sup>4</sup> For males the sensor was held by a plastic tube attached to the penis and for females the sensor was contained in a sanitary like pad. When the electrodes were activated a light went on at the bedside, the alarm rang and a mild shock was delivered to the loin or lateral abdominal wall. A similar apparatus was used by McKendry *et al*.<sup>23</sup>

#### (3) THE BODY WORN ALARM

According to Schmitt this has 'revolutionised' the treatment of bedwetting.<sup>24</sup> There are basically two formats: (a) two electrodes or sensors attached to the child's underwear by two clips and the buzzer is worn on the wrist and (b) a sensor on a small plastic card that is inserted into a pocket inside the underwear and the buzzer is attached to the pyjama jacket.

### Cost

The pad and bell apparatus range in price from £17 to £52 with a mean of £31.<sup>22</sup> They are supplied with pads, which may require replacing regularly, and a new set is certainly recommended for each patient. A pair of pads may cost up to £7 and thus greatly increases the running cost of the pad and bell.

British versions of the body worn alarm currently cost from £27 (Night Trainer supplied by Nottingham Rehab) to £32 (Mini Dri-Nite supplied by Eastleigh Enuresis Alarms). American versions cost £25, which according to Moffatt *et al* is approximately half the price of the pad and bell apparatus available in the United States.<sup>25</sup>

### Age to begin treatment

Mowrer and Mowrer stated that treatment with the alarm should not be started before 3 years of age.<sup>10</sup> Crosby in his study of 52 children treated five aged 3 to 4 years and Gillison and Skinner treated 19 children between 3 1/2 and 4 years claiming a 74% success rate.<sup>4 20</sup> Young and Morgan maintained that urinary continence is achieved at 3 but did not start treatment until 4 years of age.<sup>26</sup> Forsythe and Redmond used the alarm on selected children at 5, while Meadows recommended its use at 7, and Schmitt at 8 years of age.<sup>27-29</sup> As regards the body worn alarm Schmitt recommended using from the age of 7.<sup>29</sup>

### Advice to parent and child

Before supplying any enuresis alarm it is essential to

obtain an accurate history of sleeping arrangements and toilet facilities. It is imperative to decide who will be responsible for supervising the child when the alarm rings, who will dry and replace the pads, and who will keep the record card (preferably the child supervised by a parent). The apparatus must be demonstrated in the clinic and with the pad and bell the importance of the quality of the separating sheet and placement of the clips must be emphasised. Wire foil pads must be checked daily and replaced if frayed. The parent should be shown how to check the battery. Contact with the therapist once a fortnight during the 16 week treatment period is recommended by Meadows.<sup>28</sup>

Mowrer and Mowrer emphasised the discontinuation of lifting, no fluid restriction, of sleeping nude below the waist, encouraging the child to go to the toilet when the alarm rings, and if not wakened by the bell a parent must waken the child.<sup>10</sup> They also advised practising going to the toilet if the child wakened spontaneously, all of which continues to be good advice today. Detailed procedures for using the pad and bell are outlined in papers by Dische and Butler.<sup>30 31</sup>

### Hazards of enuresis alarms

In 1958 Gillison and Skinner, using a Quarrier type of pad, reported that 23% of their patients developed a rash on the buttock or thigh.<sup>20</sup> They discovered if the bell rang within seconds there was no problem, but if the bell failed to ring a papular rash could occur and in more severe cases punched out superficial ulcers. They recommended covering the upper pad with a double drawsheet and dusting the skin with boric acid powder. Borrie and Fenton reported two children using the same type of pad who developed painless ulcers within 24 hours.<sup>32</sup> They showed ulcers could occur if the battery was faulty or run down, the alarm was not activated, if the patient failed to waken, or if the amount of urine was too small. It was reported that ulcers occurred on all parts of the body in contact with the pad—for example, arm, costal margin, lumbar area, buttocks, etc. Greaves described similar ulceration when aluminium foil pads were used especially when the upper pad had large perforations.<sup>33</sup> Reduction in the size of the perforations to ½" in size and set 1¼" apart lowered the incidence of ulceration, but it did not disappear. Coote showed that perspiration and a pad that crumpled, not urine, could cause weals and ulcers.<sup>34</sup> In order to overcome this problem Coote produced a stiff pad with recessed electrodes.<sup>34</sup>

From the above experience it has been recommended that (a) the battery should not be allowed to

rundown, (b) the child must be awakened when the alarm rings, and (c) the child should not be able to disconnect the alarm system.

### Survey of reported studies

After Mowrer and Mowrer's paper there have been many reports of the enuresis alarm.<sup>10</sup> There is, however, enormous variation in the type of information especially with regard to criteria of arrest and relapse, methods of measuring effectiveness, and adjuncts to alarm treatment. This makes comparison of studies difficult.

Standardisation of criteria is important if progress in our understanding of alarm treatment is to continue. Table 1 shows 34 studies where criteria of initial arrest was stated and subjects numbered 15 or more. A review of the studies suggest important factors in reporting results appear to be:

#### (1) SEVERITY

Dische *et al* stated that the lack of a standard baseline period for the collection of data before treatment is common to many studies.<sup>35</sup> They used a nine week baseline while others such as Sacks and DeLeon and Fielding used a four week baseline.<sup>36 37</sup>

In the literature the degree of severity before alarm treatment has inevitably varied. The criteria of wet nights/week for inclusion in a study have ranged from seven nights a week to one night a week.<sup>37 38</sup> As table 1 shows only 12 (36%) studies reported criteria of severity.

#### (2) ASSOCIATED DIURNAL ENURESIS

Fielding found the enuresis alarm was much less effective with children suffering from both nocturnal and diurnal enuresis when compared with a group of children with nocturnal enuresis.<sup>37</sup> Thus studies including children with nocturnal and diurnal enuresis might be expected to be less effective. Only eight (24%) of the reviewed studies reported whether such children were included in the sample.

#### (3) PREVIOUS ALARM TREATMENT

Fielding discovered that children who had previously been unsuccessfully treated with the alarm were less likely to succeed with a further course of treatment than previously untreated children.<sup>39</sup> Only six (18%) of the reviewed studies made reference to whether children had been treated previously with the alarm; three studies included such children and three studies excluded such children.

#### (4) DURATION OF TREATMENT

In Doley's survey of the pad and bell, treatment

Table 1 Studies of initial arrest, drop out, and relapse in the three types of enuresis alarm

|                                      | Year        | No of children | Age range (years) | No of wet nights/week | Criterion for initial arrest (No of dry nights) | No (%) with initial arrest | No (%) who dropped out | No (%) who failed out |
|--------------------------------------|-------------|----------------|-------------------|-----------------------|---|----------------------------|------------------------|-----------------------|
| <b>Pad and bell</b>                  |             |                |                   |                       |   |                            |                        |                       |
| Mowrer and Mowrer <sup>10</sup>      | 1938        | 30             | 3-13              | -                     | 7   | 30 (100)                   | -                      | 0                     |
| Baller and Schalock <sup>52</sup>    | 1952        | 52             | 5-17              | -                     | 10  | 51 (98)                    | -                      | -                     |
| Behrle <i>et al</i> <sup>53</sup>    | 1956        | 20             | 5-14              | 4-7                   | 7   | 19 (95)                    | 2 (10)                 | 4 (20)                |
| Freyman <sup>54</sup>                | 1963        | 50             | 5-15              | -                     | 14  | 34 (68)                    | -                      | 20 (40)               |
| Taylor <sup>55</sup>                 | 1963        | 94             | 5-15              | -                     | 21  | 64 (67)                    | -                      | 19 (21)               |
| Werry and Cohrren <sup>56</sup>      | 1965        | 22             | -                 | -                     | 28  | 13 (59)                    | 4 (18)                 | -                     |
| Young and Turner <sup>57</sup>       | 1965        | 105            | 4-15              | 3-7                   | 14  | 69 (65)                    | -                      | -                     |
| DeLeon and Mandell <sup>50</sup>     | 1966        | 56             | 6-13              | -                     | 13  | 44 (81)                    | 3 (15)                 | -                     |
| Novick <sup>58</sup>                 | 1966        | 36             | 6-13              | -                     | 14  | 32 (89)                    | -                      | -                     |
| McConaghy <sup>59</sup>              | 1969        | 20             | 4-15              | -                     | 14  | 14 (70)                    | 3 (15)                 | -                     |
| Forsythe and Redmond <sup>27</sup>   | 1970        | 200            | 5-15              | 6-7                   | 28  | 132 (66)                   | -                      | 49 (18)               |
| Turner <i>et al</i> <sup>60</sup>    | 1970        | 15             | 4-15              | 3-7                   | 14  | 12 (80)                    | -                      | -                     |
| Dische <sup>30</sup>                 | 1971        | 84             | 4-15              | 3-7                   | 21  | 70 (83)                    | -                      | 12 (14)               |
| Young and Morgan <sup>48</sup>       | 1972        | 144            | 4-15              | -                     | 14  | 101 (70)                   | 43 (29)                | -                     |
| Collins <sup>61</sup>                | 1973        | 20             | 4-12              | -                     | 10  | 13 (65)                    | -                      | -                     |
| Taylor and Turner <sup>62</sup>      | 1975        | 21             | 4-16              | 1-7                   | 27/28   | 13 (62)                    | -                      | -                     |
| Sacks and DeLeon <sup>36</sup>       | 1978        | 30             | 5-14              | -                     | 13  | 18 (66)                    | 5 (16)                 | -                     |
| Fielding <sup>37</sup>               | 1980        | 75             | 5-15              | 4-7                   | 14  | 35 (47)                    | 23 (30)                | -                     |
| Bollard and Nettelbeck <sup>63</sup> | 1981        | 20             | 5-14              | -                     | 14  | 16 (80)                    | -                      | -                     |
| Berg <i>et al</i> <sup>64</sup>      | 1982        | 54             | 5-14              | -                     | 24/28   | 34 (63)                    | 14 (26)                | -                     |
| Dische <i>et al</i> <sup>35</sup>    | 1983        | 126            | 4-13              | -                     | 21  | 95 (75)                    | 13 (10)                | -                     |
| Sacks and DeLeon <sup>65</sup>       | 1983        | 65             | 5-15              | -                     | 13  | 44 (70)                    | 11 (17)                | -                     |
| Goel <i>et al</i> <sup>22</sup>      | 1984        | 100            | 7-14              | -                     | 24/28   | 45 (45)                    | -                      | -                     |
| Netley <i>et al</i> <sup>66</sup>    | 1984        | 31             | 6-12              | -                     | 56  | 19 (61)                    | -                      | -                     |
| Butler <i>et al</i> <sup>45</sup>    | 1988        | 28             | 6-14              | 4-7                   | 14  | 14 (70)                    | 8 (29)                 | -                     |
| Fordham and Meadow <sup>47</sup>     | 1989        | 27             | 6-16              | 2-7                   | 42  | 4 (15)                     | 10 (37)                | -                     |
| Total                                |             |                | 1525              |                       |   | 1035 (68)                  |                        |                       |
| <b>Body alarm plus sensors</b>       |             |                |                   |                       |   |                            |                        |                       |
| Crosby <sup>4</sup>                  | 1950        | 45             | 3-14              | -                     | 14  | 43 (95)                    | 2 (4)                  | 2 (4)                 |
| McKendry <i>et al</i> <sup>23</sup>  | 1972        | 137            | 5-20              | -                     | 26/28   | 113 (83)                   | 4 (3)                  | 18 (13)               |
| Total                                |             | 182            |                   |                       |   | 156 (86)                   |                        |                       |
| <b>Body worn alarm</b>               |             |                |                   |                       |   |                            |                        |                       |
| Arroe and Rasmussen <sup>67</sup>    | 1979        | 59             | 6-15              | 5-7                   | 14  | 40 (68)                    | -                      | 17 (30)               |
| Shapiro <sup>68</sup>                | 1985        | 200            | 6-16              | -                     | 21  | 140 (70)                   | -                      | 30 (15)               |
| Moffatt <i>et al</i> <sup>25</sup>   | 1987        | 66             | 8-14              | -                     | 14  | 42 (69)                    | -                      | 8 (13)                |
| Dunn*                                | Unpublished | 125            | 5-12              | 3-7                   | 27/28   | 95 (76)                    | -                      | 26 (20)               |
| Butler <i>et al</i> <sup>41</sup>    | 1989        | 44             | 6-15              | 4-7                   | 14  | 34 (77)                    | 3 (7)                  | 7 (16)                |
| Fordham and Meadow <sup>47</sup>     | 1989        | 29             | 6-16              | 2-7                   | 42  | 6 (21)                     | 11 (38)                | -                     |
| Total                                |             | 523            |                   |                       |   | 357 (68)                   |                        | 88 (18)               |

\*Dunn BL. Treatment of enuresis with a portable alarm—a study of 125 children (personal communication).

ranged from five to 12 weeks, while Schmitt's review of American versions of the body worn alarm suggested eight to 12 weeks.<sup>40, 29</sup> Butler and Forsythe found with the British version of the body alarm that 71% of children achieved dryness within eight weeks.<sup>41</sup>

A time limit is important as the longer a child uses an alarm, the less certain we can be that a successful result is due to this treatment because of the spontaneous remission rate.<sup>27</sup> Recent studies have accepted 12 to 16 weeks as the treatment duration, children not reaching the initial arrest criteria during this period being considered failures.

#### (5) DROP OUT

Johnson makes the point that given the effort and patience required to use the alarm efficiently some drop outs would be expected.<sup>42</sup> Drop out has tended to include: (a) patients failing to attend the clinic and (b) patients stopping treatment before a reasonable time has elapsed.

In practice and in the review of studies it has proved difficult to separate the reasons for drop out. Maternal intolerance has been found to be predictive of drop out.<sup>43-45</sup> A problem, highlighted by Johnson in comparing studies, arises where effectiveness is reported after excluding drop outs.<sup>42</sup>

The more accurate results are those that quote success as a percentage of the total sample.

#### (6) EFFECTIVENESS

Early studies of alarm treatment seldom used criteria to discriminate between success and failure, but utilised terms such as 'improved', 'completely dry', and 'temporarily favourable'. Later studies relied on vague or questionable definition—for example, 'stopped altogether or having occasional accidents',<sup>23</sup> 'less than 4 wet in 28 days before treatment stopped'.<sup>22</sup>

Dische *et al* used the term 'initial arrest' to distinguish those children responding initially to the alarm from those failing to respond: this was the time when the alarm was removed.<sup>35</sup> This criteria of initial arrest is based on the achievement of an arbitrary number of consecutive dry nights, which has ranged from seven to 42 nights.<sup>46</sup>

Table 1 shows 16 (49%) of the studies used 13 to 14 consecutive dry nights as an initial arrest, and this might therefore be taken to indicate the criteria to use in the future. It has been suggested the longer the alarm is continued after the child becomes dry the less likelihood of relapse.<sup>27</sup> However, one of us (WIF) has re-examined the record cards of the 200 children included in a previous study plus an additional 75 consecutive children, which has shown that of those children who achieved a week's dryness 44% would have relapsed, two weeks' dryness 18%, three weeks' dryness 16%, and four weeks' dryness 15%.<sup>27</sup> It would appear therefore that no significant benefit is obtained by continuing the alarm for more than two weeks after the child becomes dry. Using the author's own criteria of initial arrest, with the pad and bell in 26 studies there was 68% initial arrest with 1525 children, while with the body alarm plus sensor there was 86% initial arrest in 182 children (two studies) and with the body worn alarm in six studies there was 68% initial arrest with 523 children (see table 1). Thus there appears little to choose between the two commonly used methods in terms of initial effectiveness. A recent comparison of the body worn alarm plus pad and bell by Forham and Meadow confirms this finding, although with an 'unusually stringent' criteria of initial arrest few children in either treatment overcame bedwetting.<sup>47</sup> Butler *et al* in a comparison of the two types of alarm showed little difference in terms of effectiveness, but the body worn alarm was superior in terms of speed of acquisition of dryness.<sup>41</sup>

#### (7) FAILURE

In their study of 30 children, Mowrer and Mowrer stated that all became dry in eight weeks and

relapses were rare.<sup>10</sup> Failures did not appear to occur, which is unusual. A 100% success did not appear in the literature when drop out from treatment and a specified treatment duration were reported.

There are reported failure rates (in 10 studies) with the pad and bell of 17% (range 14–40%), for the body sensor plus alarm (in two studies) of 11% (range 4–13%), and in body worn alarm (in five studies) of 18% (range 13–30%). Again there appears little to choose between the pad and bell or body worn alarm in terms of failure. There are many explanations for failure such as lack of parental supervision, failure to waken, lack of toilet facilities, two sharing a bed, domestic problems, refusal to use the apparatus, inadequate instruction, faulty equipment, the child's lack of interest, to name but a few. Work by Dische *et al* indicates lack of response may be predicted where there are family difficulties and unsatisfactory housing.<sup>35</sup> Even if these factors are considered, however, there is a group of children (approximately 10–15%) who use the pad and bell correctly and do not become dry.

#### (8) RELAPSE

A review of the literature shows little agreement as to what constitutes a relapse. It is therefore not surprising that a comparison between reported relapse with pad and bell and body worn alarm treatment is difficult. Since 1980 studies have reported between 29%, within six months,<sup>48</sup> and 66% within 12 months<sup>37 49</sup> of children returning to bed wetting after initial arrest.

Most relapses are likely to occur in the first six months after initial arrest.<sup>35 40</sup> In order to avoid further confusion one option would be to document the number of bed wetting accidents in the six months following treatment. Thus *continued arrest or six months arrest* would be defined as *no wet nights during the six month follow up*. Adopting such a criteria DeLeon and Mandell found only 20% of children remained free of accidents.<sup>50</sup>

In order to test the feasibility of this definition the record cards of 275 children treated by one of us using a pad and bell alarm with two wire mesh mats were reanalysed.<sup>27</sup> Table 2 shows the results and suggests if those relapsing and treated a second time are included, 160 (58%) children had a 'continued arrest' for six months.

It has not been possible to extract similar information from any of the published reports. Although accepting six months as a 'vulnerable' period for relapse, a two year follow up is essential before relapse can be excluded. For example, Forsythe and Redmond found 10 relapses occurred between seven

Table 2 Summary of 275 children with nocturnal enuresis treated with a pad and bell

|   | No of patients | No (%) dry |
|---|----------------|------------|
| Initial arrest (28 nights)                            | 275            | 166 (60.4) |
| Continued arrest (six months)                         | 275            | 136 (49.5) |
| Relapsed within six months                            | 166            | 30 (18.1)  |
| Initial arrest with second course of treatment        | 30             | 24 (80.0)  |
| Continued arrest with second course of treatment      | 30             | 24 (80.0)  |
| Continued arrest with one or two courses of treatment | 275            | 160 (58.2) |

and 22 months and Bostock, using the 'Crosby' body worn alarm, reported a child who relapsed 30 months after withdrawal of the alarm.<sup>27 51</sup> A two year *accident free period* has been termed by Dische *et al* as 'complete arrest'.<sup>35</sup>

Many parents fail to reattend after a relapse because of uncertainty about the alarm's effectiveness a second time. Approximately 60–82% of children, however, achieve 'continued arrest' with a second course of treatment with the pad and bell. There is no similar information on the body worn alarm. Thus in reporting the results of alarm treatment it is suggested the following information is important:

- Severity—frequency and duration of wet beds before treatment and the criteria of wet nights/week for inclusion in the study.
- Associated diurnal enuresis—percentage of such children included.
- Previous alarm treatment—percentage of such children included.
- Duration of treatment.
- Drop outs from treatment.
- Degree of supervision during treatment.
- Initial arrest criteria.
- Failures to meet the initial arrest criteria.
- Relapse—measured by a criteria of 'continued arrest' (six months) and 'complete arrest' (two years).

### Consumer appeal

Fordham and Meadow found advantages of the body worn alarm over the pad and bell were the small size, rare false alarms, comfort, sensitivity to urination, and cheaper price. The disadvantages of the body worn alarm (Mini Dri-Nite) such as fastenings, detachable leads, and sensor falling out of the pant liner are overcome by the design of the Night Trainer. In the study of Butler *et al*, 24 children had

experience of both the pad and bell and body worn alarm, so were able to make a comparison between both types.<sup>41</sup> Only one child expressed a preference for the pad and bell over the body worn alarm because she slept nude and had nowhere to pin the alarm (a wrist alarm would have overcome this difficulty). Some boys expressed concern at having to wear an absorbent pad, but none refused treatment. Most preferred the body worn alarm because: (1) the small size of the apparatus made it less conspicuous and was more portable going to stay with a friend or on holidays. (2) The child was more involved with all aspects of the procedure. (3) It was more effective waking the child than the pad and bell apparatus. (4) It was more comfortable than lying on gauze mats, etc. (5) It was activated by a smaller amount of urine and on many occasions the bed sheets remained dry.

Although therefore the pad plus bell and body worn alarm appear comparable in terms of initial arrest and failure rates, what evidence there is suggests the body alarm is preferred by those it is designed to help—the children.

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