

Psychiatric disturbance, urgency, and bacteriuria in children with day and night wetting

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SUMMARY Forty children with day and night wetting were compared with 46 with night wetting only to see if day wetting was then associated with particular clinical features. Interviews with mothers, questionnaires completed by teachers, physical investigations, and measurement of functional bladder capacities were used. Day wetting combined with bed wetting occurred equally in boys and girls and was associated with daytime urgency and greater frequency of psychiatric disturbance. In boys, soiling was also associated. In girls, bacteriuria, which appeared to be caused by the day wetting, occurred in about 50%. Neither daytime frequency nor small functional bladder capacity were specifically related to day wetting.

There is a need to look at children who wet the bed and who have particular associated clinical features. Much research into the problem of enuresis, including epidemiological surveys, has suggested that there may be several varieties each with its own clinical features, causative factors, and outcome (Kolvin *et al.*, 1973).

It has been suggested that one kind of enuresis can be identified by the combination of wetting during the day and bed wetting. There are then other associated features which make the disorder different from uncomplicated nocturnal enuresis. Affected children are more likely to be girls, to have associated psychiatric disturbance, daytime urgency and frequency, soiling, and unusually small functional bladder capacities (Hallgren, 1956; Zaleski *et al.*, 1973). Clinical descriptions stress the importance of the child experiencing an overpowering urge to pass water which may result in wetting before the child can reach the toilet (Williams, 1968; De Jonge, 1973). Physiological measurements of bladder volumes and pressures have indicated that diurnal enuresis accompanying nocturnal enuresis is associated with abnormal detrusor functioning (Whiteside and Arnold, 1973). Few such studies of day and night wetting have so far been carried out.* We report a study in which 40 children with daytime as well as

bed wetting were compared with 46 children who only wet at night to see if day wetting was in fact associated with particular clinical features.

Methods

Selection of cases. The 40 day and night wetters were referred to a child psychiatrist (I.B.) mainly by paediatricians. Of those with night wetting only, 17 were consecutive referrals with this problem to a child psychiatric clinic at a children's hospital (I.B.), and 29 were consecutive referrals with nocturnal enuresis only to a paediatric clinic at an undergraduate teaching hospital (R.M.).

Day wetting was said to be present when the child wet during the day at least once a week and was of sufficient severity to concern the parent. Its severity varied from damp underwear to much more obvious voiding. Likewise, night wetting was said to exist when the bed was wet at least once a week. In the night wetting group, parents and children did not report any daytime wetting despite close questioning.

Questionnaire administered to mothers. Mothers were interviewed by one of us (D.F.) using a standard set of questions. In 10 instances both inter-rater and test-retest reliability checks were carried out with the help of one other author (I.B.). The information obtained was reduced to 70 variables covering details of the wetting problem, associated behaviour problems, and the social background (see Appendix).

Received 16 January 1977

*A recent MEDLARS search using the titles 'day wetting' and 'diurnal enuresis' turned up only one paper and this was in Russian (Pugachev *et al.*, 1974).

Teachers' questionnaire. In about half the cases it was possible to arrange for schools to be visited so that a Rutter's Scale B Teacher's Questionnaire (Rutter, 1967) could be filled in on the affected child and on the next child of the same sex on the class register to act as a control. This was carried out on consecutive referrals when a psychologist was available who was able to visit schools.

Maximal functional bladder capacities [MBCs]. Most of the children had their MBCs estimated in the clinic in the manner described by Starfield (1967). Nurses were trained to carry out the procedure. MBCs could not be estimated in some cases when these nurses were not available. In brief, the MBC was measured by giving the child a drink amounting to 30 ml fluid/kg to a maximum of half a litre. The child was allowed to play in a room full of toys. Requests to use the toilet were met with a plea to hold off as long as possible. When the child insisted, the volume of urine was measured. The child returned to the play room and the procedure was continued until half the oral load was excreted. The largest volume produced was taken as the MBC. The cases who were referred to the paediatrician were asked to measure urine volumes produced at home during the course of one week.

A control group of 88 normal schoolchildren stratified according to sex and age (age groups 5–12 years inclusive) had their MBCs measured at school. 40 of them were selected at random, stratified for age and sex, to have their MBCs measured again after an interval of about 6 weeks. 37 of the 88 controls measured urine volumes produced at home during one week.

Physical examination and investigation. The children had full physical examinations and examinations of their urine. In 40 cases this had been carried out by the referring paediatrician and was not repeated. The other 46 children were examined by one of us (R.M.). In them, a fresh midstream specimen of urine was tested by Dipstix for glucose, protein, and blood. It

was also examined by microscopy for bacteria, cells, and casts before bacterial colony count culture. Urinary tract infection was considered to be present in those cases when two or more consecutive urine specimens yielded >100 000 organisms/ml of one organism in pure growth. An intravenous urogram was done on those children who had, or had had, a definite urinary tract infection. Also, a voiding cystourethrogram was done on children who had a urinary tract infection at the time of this assessment.

Data analysis. Data were analysed on the University of Leeds 1906A ICL computer using a standard set of programs (Hamilton *et al.*, 1965). χ^2 tests and analyses of variance were performed. A principal component factor analysis (Hope, 1968) was carried out on data obtained from the questionnaire given to mothers. 16 variables were selected to cover important clinical features and a sum of behaviour scores made a seventeenth (Appendix: variables 1, 4, 9, 10, 12, 15, 18, 29, 33, 34, 38, 40, 41, 43, 48, and the sum of 49–70).

Results

Information from mothers. The 40 day and night wetters were compared to the 46 with night wetting only on the variables derived from the questionnaire used with mothers. Sex, age, social class, and the various other family variables did not show any significant differences between these two groups. Mean age of those with day wetting was 8.5 years (SD 2.0).

There were proportionately more girls in the day and night wetters (Table 1) but the difference was not significant. A history of nocturnal enuresis in one of the parents was not significantly different and occurred in almost half of both groups. Fewer of the day and night wetters had been admitted to hospital previously under a paediatrician ($P < 0.05$) and fewer had been treated with drugs ($P < 0.05$).

In the group of day and night wetters, urgency ($P < 0.01$), parental urging to use the toilet ($P < 0.001$), and soiling ($P < 0.05$) were all more

Table 1 40 Children with day and night wetting and 46 with night wetting only, comparing 5 clinical features using χ^2 tests

Clinical features	Day and night wetters (n=40)	Night wetters (n=46)	Significance of difference P
Sex			
Boys/girls	17/23	28/18	None
Urgency			
Present/absent	34/6	20/26	<0.001
Mother urging child to use toilet			
Present/absent	19/21	5/42	<0.001
Occurrence of soiling			
Present/absent	10/30	2/44	<0.05
Complaint of disobedience			
Present/absent	10/30	4/42	Just short of significance

frequent (Table 1). 7 of the 17 boy day and night wetters had soiling, but only 3 of the 23 girls. Onset enuresis was not associated with day wetting. Daytime frequency occurred in about one-third of day and night wetters and in a similar proportion of night wetters. Of the 28 children with frequency in the total group of wetters, 25 of them had urgency ($\chi^2=10.9$, $P<0.001$). 29 had urgency without frequency. Of all the behaviour problems inquired about (Appendix: variables 49–70) only *disobedience* came close to being significantly more frequent in the group of day and night wetters (Table 1).

The occurrence of these variables in the day and night wetters was compared with that in the night wetters referred to a child psychiatrist and those referred to a paediatrician, separately: 85% of day and night wetters had urgency compared with 60% of night wetters referred to a psychiatrist and 40% of night wetters referred to a paediatrician. These differences were highly significant ($P<0.001$). The equivalent percentages for parental urging to visit the toilet were 50, 25, and 5 ($P<0.001$); for soiling 30, 3, 3 ($P<0.01$). Fears were significantly more frequent in the night wetting group referred to a psychiatrist ($P<0.05$) compared with the other two groups. Summing the behaviour disorder scores, it was found that the night wetters referred to a paediatrician had a significantly smaller total score than the other two groups ($P<0.01$).

Correlations between the 17 variables selected for factor analysis were generally of a low order. The first two principal components accounted for nearly a quarter of total variance.* Factor 1 had the following loadings: day wetting 0.8, urgency 0.7, excessive day wetting 0.7, soiling 0.4, frequency 0.3, behaviour problems 0.2. The loadings on factor 2 were excessive night wetting 0.5, parental wetting 0.5, deep sleep 0.5, does not use the toilet at night 0.5, older mother 0.4, excess of boys 0.4, and eldest child 0.4. Factor scores of each child were plotted in the form of a scatter diagram using the two independent components as the co-ordinates (Eysenck, 1970). There was no evidence that individuals clustered in two distinct groups.

Teachers' questionnaires. Of the 25 day and night wetters (11 boys, 14 girls) whose teachers completed questionnaires, 16 had total scores greater than 9, which is the cut-off point used to select psychiatrically disturbed children (Rutter *et al.*, 1970). Only one boy and one girl in the corresponding group of normal school controls had total scores over 9. 5 of the 7 boys with scores over 9 had antisocial disorders and only one had a neurotic disturbance. This was

*Details of the correlation matrix and the complete set of factor loadings can be obtained from I.B.

decided on the basis of which was higher, the neurotic or the antisocial subscale score (Rutter *et al.*, 1970). 6 of the 9 girls with scores over 9 had neurotic disorders and 2 had antisocial problems. Of the 20 night wetters (11 boys, 9 girls) whose teachers had completed questionnaires on them, 8 had total scores greater than 9. Only 2 boys and 1 girl in the corresponding controls had total scores over 9.

The mean total score of the 25 day and night wetters was 12.4, which was greater ($P<0.001$) than the normal school controls (mean 4.2). The mean antisocial score of the day and night wetters was 2.5, which was higher ($P<0.01$) than that of the controls (mean 0.7). The mean neurotic score was 2.0, which was higher ($P<0.01$) than that of the controls (mean 0.8). The mean total (9.8) antisocial (1.4) and neurotic (2.1) scores of the 20 night wetters only, though they tended to be higher, were not significantly different from the corresponding normal controls (5.7, 1.2, and 1.3 respectively).

MBCs. Taking boys and girls and two age groups, 7 and 8 year olds and children 9, 10 or older, separately, it was found that the MBCs of the day and night wetters and those of children with night wetting only were significantly lower than normal schoolchildren. There was an insufficient number of children aged 5 or 6 in the night wetting only group to make a comparison. Day and night wetting boys aged 5 or 6 also had lower MBCs than the controls. Day and night wetting girls aged 5 or 6 did not. No significant differences in MBC emerged between the day and night and night wetting only cases.

There was no significant difference, using a *t* test for correlated means, between MBCs of 40 of the 88 normal school controls randomly selected and stratified for sex and age, estimated on the first occasion and after an interval of several weeks. The two sets of paired values correlated $r=0.7$.

The mean maximum volume produced by the 37 controls at home during a week was 252 ml (SD 127). The mean average volume at home was 134 ml (SD 60). The mean maximum functional bladder capacity was 240 ml (SD 87).

Urinary tract infection. Infection was found to be present in 10 of the 46 children examined by one of us (R.M.). 9 of the 17 girls with day and night wetting had infected urine at the time of examination (Table 2) and a tenth gave a clear history of infections despite the fact that her urine was normal when she was assessed. Intravenous urograms were normal in all the children with infected urine, except that one girl had vesicoureteric reflux. In 7 out of the 9 girls with urinary tract infection, day wetting persisted for

Table 2 Children with day and night wetting (n=25) and night wetting only (n=21) examined for urinary tract infection in a standard fashion when first referred (24 boys, 22 girls)

	Type of wetting	Total no.	No. with urinary tract infection
Boys	Day and night	8	1
	Night only	16	0
Girls	Day and night	17	9
	Night only	5	0
Total		46	10

at least several months after eradication of the bacteriuria.

Information obtained from referring paediatricians in the remaining 40 children also indicated a high incidence of urinary tract infection in girls with both day and night wetting. However, varying methods of investigation and criteria for diagnosis of infection make it difficult to evaluate their findings.

Discussion

Hallgren (1956) investigated a group of children who wet both by day and at night. It contained equal numbers of boys and girls. Many of the boys were soilers. Daytime frequency occurred in about one-third. These findings were confirmed in our study. However, the preponderance of boys in the group of children who only wet at night did not quite reach the ratio of 2 boys to 1 girl that Hallgren found. It is known that enuretic girls tend to be more disturbed psychiatrically (Rutter *et al.*, 1973). Nevertheless, this slight excess of girls in the night wetters compared to the Swedish study was not caused by the inclusion of psychiatric referrals. Also, the children who only wet at night had daytime frequency in a third of cases. This was twice the incidence found by Hallgren. Psychiatric referrals with night wetting did not have more daytime frequency than paediatric referrals. This difference between the two studies was not therefore explicable in terms of psychiatric cases being included in the investigation reported here.

The finding of a marked association between urgency and day and night wetting in our study is in keeping with the views of Whiteside and Arnold (1975) who carried out an investigation of night wetters and day and night wetters using urodynamic methods. In their study, bladder volumes and pressures were recorded; 25 of the cases were aged from 6 to 20 years. It was found that night wetters had quite normal physiological responses to these tests. Day and night wetters on the other hand had abnormal responses in 36 out of 37 cases of all ages. They showed inhibited bladder contractions which they could not prevent voluntarily. The term 'unstable bladder' was used to describe these abnormalities. Urgency and daytime frequency

occurred in many of them. They found it difficult to hold their water for more than a short time.

The term 'urge incontinence' has been used for difficulty in preventing the passage of urine once a sensation of bladder fullness has been experienced (Williams, 1968). There may be some wetting before the toilet can be reached. Frequency is associated. Some children try to control sudden severe urges to pass water by crossing their legs or holding themselves. This has been called the urge syndrome (De Jonge, 1973). Wetting can occur when these manoeuvres are unsuccessful.

One hypothesis used to explain the occurrence of urgency is that the affected individual does not feel a desire to void until after major bladder contractions have begun to occur. This theory does not require any increase in daytime frequency to support it (Yeates, 1973). The finding that urgency and not frequency was strongly associated with daytime wetting fits in nicely with this hypothesis. Frequency was practically always associated with urgency though urgency often occurred on its own. Zaleski *et al.* (1973) reported smaller average urine volumes produced at home in day wetters than in night wetters. This could be explained at least in part by the day wetting itself reducing the amount of urine collected. They did not present data on the equivalent maximum functional bladder capacities. In our study bladder capacity did not emerge as a factor in the causation of day wetting associated with bed wetting in children. Although it was possible to confirm the findings of workers that functional bladder capacities are smaller in children who wet the bed than in those who do not (Hallman, 1950; Vulliamy, 1956; Starfield and Mellits, 1968), the presence of daytime wetting and urgency did not result in an even smaller functional bladder capacity. MBCs were used in preference to home volumes* because of the greater ease in which they could be obtained and because of the influence of the day wetting on home volumes. The maximum home volumes in the control group tended to be a little higher than the MBC but this difference was not significant, in contrast to the experience of Zaleski

*The maximum volume produced at home, when measuring the amount voided on each occasion over the period of one week.

et al. (1973). Estimation of the MBC was satisfactorily reliable. Failure to find a smaller mean MBC in the day and night wetting girls aged 5 or 6 seems to be due to an anomalous control group of this age and sex. The mean MBC in the control girls aged 5 or 6 was only 125 ml. This is much smaller than what would have been expected by comparison with the boys. It is also much smaller than that reported by Jones *et al.* (1972) who are the only workers to give sufficient information on normal controls to make a detailed comparison of MBCs possible.

The finding that about half the girls with day and night wetting had significant bacteriuria, that is a urinary tract infection, is supported by some previous studies. Investigations into the prevalence of asymptomatic bacteriuria in schoolchildren have shown that most girls with infections have associated wetting, especially daytime dribbling (Meadow, 1973; Savage *et al.*, 1969). However, bacteriuria is said to occur in only 6% of girls with bed wetting (Dodge *et al.*, 1970).

It is likely that the symptom of day wetting leads to the occurrence of urinary tract infection in these girls. The fact that the wetting tended to persist after treatment, which is in line with previous work (Stansfeld, 1973), agrees with this view. A perpetually moist perineum could provide a convenient breeding ground for bacteria. Also it has been found (Jones *et al.*, 1972) that a small functional bladder capacity is associated with enuresis and not with urinary tract infection *per se*. This would suggest that the girls with day and night wetting described here were primarily enuretic and became secondarily infected. A third factor is the low incidence of vesicoureteric reflux that was found in our study. About one-third of children with urinary tract infections are normally found to have reflux. It may be that bacteriuria caused by day wetting is not so often associated with reflux.

The finding of Hallgren (1956) that children who wet both during the day and at night are more disturbed psychiatrically, as judged from information given by mothers, than those who only wet the bed was confirmed. As far as it could be ascertained, the day and night wetters had not been selected because they showed associated psychiatric problems. Yet they were found to be as disturbed as a group of children with night wetting only who were referred to a child psychiatrist and who presumably were selected on the basis of being psychiatrically disturbed. Also, they were more disturbed than children who only wet the bed, who were referred to a paediatrician, and who presumably were not selected because they showed psychiatric problems. The higher incidence of mother urging the child to use the toilet in the day and night wetters can probably be explained in terms of the mother's reaction to the day wetting and an

attempt to try and prevent the problem. The tendency for the day and night wetters to be considered as disobedient may be partly explained in the same way. One explanation for the occurrence of day wetting that has been given is that the child fails to respond to sensations of bladder fullness sufficiently quickly to get to the toilet and avoid wetting (Williams, 1968). This may easily be interpreted as non-cooperation on the part of the child.

The information on psychiatric disturbance obtained from teachers was particularly useful since it was probably less coloured by knowledge of the child's wetting problems than that given by the parents. Day and night wetters were again shown to be more psychiatrically disturbed than children who only wet at night. The predominance of antisocial disorders in boys and neurotic disorders in girls is in keeping with epidemiological research findings using the same teacher's questionnaire (Rutter *et al.*, 1973). It was not possible to confirm the view derived from these population surveys that enuretic girls are more likely to be disturbed psychiatrically than boys who are similarly affected particularly when day wetting is associated (Rutter *et al.*, 1976).

It has been suggested that two varieties of enuresis may exist (Rutter *et al.*, 1973). One has been termed a *developmental disorder* (Rutter, 1975) since it occurs more commonly in boys, affects other members of the same family and is characterized by *night wetting only*, without associated psychiatric disturbance. The other type of enuresis is commoner in girls, and is characterized by *day wetting* and psychiatric disturbance. The factor analysis of the questionnaire data obtained from mothers sheds some light on this problem, though the findings must be accepted with reservation until they are replicated. The somewhat arbitrary choice of variables, the way in which the data had been scored, and the nature of the sample used may have distorted the resulting factors. Although this statistical procedure showed that the clinical features of wetters do tend to cluster to some extent into two independent groups, one in the nature of a developmental disorder and the other recalling the urge syndrome, there was no evidence that wetting children fall neatly into one or other of these categories. The day wetters were therefore not found to be a completely distinct group of cases.

We thank Professor Max Hamilton, Department of Psychiatry, University of Leeds, for use of computing facilities; the Yorkshire Regional Health Authority for a research grant; Mrs. Pat Conroy and Mrs. Catherine Mullen for help in collating data; paediatric colleagues who referred cases, especially Drs. M. Arthurton, N. Boyle, I. Forsythe, and J. Littlewood; Dr. D. Shaffer of the London University

Institute of Psychiatry, for comments; and the Librarian of Charing Cross Hospital, London, for searching the literature.

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Appendix

70 variables derived from questionnaire administered to mothers

- 1 Boy or girl (1 = boy)
- 2 Age < 5 years
- 3 Age 5, 6 or 7
- 4 Age 8, 9 or 10
- 5 Age > 10
- 6 Referred by GP
- 7 Referred by child psychiatrist
- 8 Referred by paediatrician
- 9 Child with 2 natural parents
- 10 Eldest in family
- 11 Youngest in family
- 12 Family size > 3
- 13 Own bedroom
- 14 Father > 40 years
- 15 Mother > 40 years
- 16 Social class I or II
- 17 Social class III
- 18 Social class IV or V
- 19 Previous treatment GP only
- 20 Previous treatment GP + outpatient
- 21 Previous treatment GP + outpatient + inpatient (paediatric)
- 22 Previous treatment GP + outpatient + inpatient (psychiatric)
- 23 Previous treatment—drugs
- 24 Previous treatment—pad and bell
- 25 Day wetting (at least once a week)
- 26 Continuous day wetting
- 27 Circumstance present
- 28 Dry spell of more than 1 month by day

- | | |
|---|--|
| 29 Frequency of day wetting 5+ per week | 52 Tempers |
| 30 Moderate wetting | 53 Unhappy at school |
| 31 Does not report wetting and hides pants | 54 Refusal to go to school |
| 32 Much urging to visit toilet (parents report that 'the child needs much urging to go to the toilet') | 55 Poor relationship with sibs |
| 33 Frequency: 5+ visits to WC (parents report that child visits the toilet more than they think is normal and this must exceed 5 times a day) | 56 Poor relationship with parents |
| 34 Urgency (affirmative answer to the questions: Does the child go to the toilet more urgently than normal? and Does the child run for the toilet? Negative response to the question: Is the child able to postpone going to the toilet for more than a few minutes?) | 57 Speech difficulty |
| 35 Signs prior to wetting | 58 Stealing |
| 36 Night wetting (at least once a week) | 59 Eating difficulties |
| 37 Continuous night wetting | 60 Sleeping difficulties |
| 38 5+ times a week | 61 Destructiveness |
| 39 Circumstance present | 62 Fighting |
| 40 Visits toilet at night | 63 Poor relationship with other children |
| 41 Deep sleep | 64 Bullied |
| 42 Dry spell more than 1 month at night | 65 Bullies |
| 43 Soiling | 66 Worries |
| 44 Soiling once or twice a week | 67 Irritable and moody |
| 45 Soiling > twice a week | 68 Unhappy |
| 46 Continuous soiling | 69 Disobedience |
| 47 Circumstance present | 70 Fears |
| 48 Mother or father wet | |

Reliability

Inter-rater reliability was estimated on 23 of the variables indicated above (no. 21–23 inclusive and 38–57 inclusive). One of us (D.F.) asked the questions and recorded the responses while another (I.B.) independently made his own records. The mothers of 10-day wetters were interviewed in this way. They were consecutive clinic attenders.

No discrepancies occurred in the assessment of either urgency or frequency. Urging to go to the toilet was less reliable in that there were two disagreements. There were differences between the two raters in only three other variables, all concerned with behaviour problems. These were in 3 different children. In fact only one discrepancy per child occurred with any variable in the 10 cases.

All the following refer to the previous 6 months. Problems must be frequent (at least once a week) and severe

- 49 Headache
- 50 Stomach ache
- 51 Bilious