

## A Survey of Bacteriuria in 2,234 Schoolgirls in a Scottish New Town

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**Summary.** The prevalence of urinary tract infection in a modern Scottish town has been ascertained in female school children aged 5–12. In 2,234 girls the initial prevalence of urinary tract infection is 3.3%. In addition to the information on urinary tract infection the social and personal history was available including data on incontinence, enuresis and current antibiotic therapy. The necessity to have a system available which allows a cheap and rapid assessment of population surveys is made.

**Key words:** Bacteriuria, Social habits, Incontinence, School-girls.

### Introduction

Rapid method analyses of urine allow population screening to be undertaken in large numbers of school children. Previous screening methods have usually employed conventional plate techniques which are time consuming and costly.

### Population Studied

All female school children between 5 and 12 years of age who were currently attending the local schools in Cumbernauld were invited to participate in the study. Of 2,234 subjects in the group studied only 4 were excluded because of lack of information on the documents returned by these individuals.

### Method

All the children attended local authority schools in Cumbernauld the population of which had previously been investigated for adult stone disease by part of the same team. Along with an explanatory

leaflet a specially prepared computerised form was pre-circulated to the parents. This allowed details of the child's social and personal history to be ascertained. Factors included in the survey were details of continence, enuresis, family size, sleeping habits, current medications and previous history of urinary tract infections. All the above data was analysed on an ICL 2980 computer using the Statistical Package for Social Sciences Program [17].

The children were invited to produce a mid-stream specimen of urine in the school medical room in the presence of a specially trained school nurse. The urine was transported to the laboratory within two hours of collection and was subsequently analysed by (1) fluorescent staining in a special Bactoscan counting machine and, (2) by two conventional laboratory methods viz (a) dip slide and, (b) routine bacteriological plate culture methods.

### Age Distribution

The greatest number of children participating in the survey were aged 10 years (Fig. 1). Nineteen children were under 5 years and 46 were older than 12 years. This reflects the entry system to school in this area and promotion to senior secondary schools after primary education.

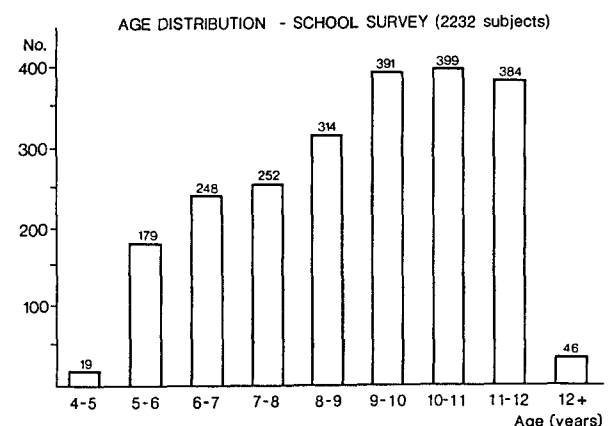


Fig. 1. Age distribution in years showing maximum number at age 10–11

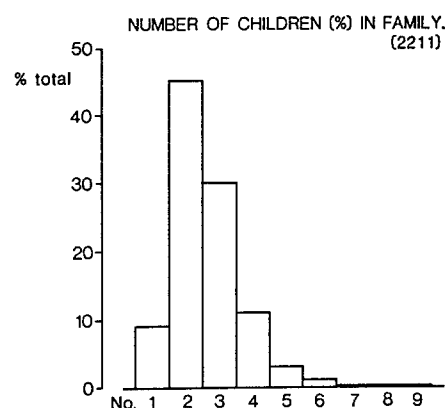


Fig. 2 Numbers (%) of children in families confirming that most children belong to a family containing 2 children (valid cases)

Table 1. Sleeping accommodation (valid cases 2,226)

	Number	%
Child sleeps alone	1,302	58
Child shares room	928	42
Child shares bed	173	8
Child sleeps in dark	1,813	81
Child sleeps with light	55	3
Child sleeps with partial light	365	16

### Family Structure

In 990 (45%) of the households the number of children per house was 2. The largest number of children in any one house was 9 (Fig. 2). This information was obtained from 2,211 valid returned questionnaires.

### Children's Sleeping Accommodation

Because of an interest in the prevalence of enuresis enquiry was made into the sleeping habits of the children. More than half of the children (58%) had their own bedrooms and 81% slept in the dark (Table 1). Very few children (8%) required to share a bed with another child, but 42% shared a room with at least one other child. Fifty-five (3%) required to sleep with illumination in the room throughout the night and 365 (16%) required some form of illumination for part of the night.

### Nocturnal Enuresis/Diurnal Incontinence

Sixty-four children (3%) were troubled with diurnal incontinence and 149 (7%) had some form of nocturnal incontinence (Table 2). In order to check this latter finding the

Table 2. Prevalence of incontinence (Valid cases 2,220)

	Number	%
Nocturnal incontinence	149	7
Diurnal incontinence	64	3
Problems with bed wetting	155	7

Table 3. Symptoms indicating possible previous UTI (Valid cases 2,174)

	No.	%
Previous investigation of possible UTI	307	14
Burning pain on passing urine	79	4
Pain on passing urine	48	2
Blood in urine	2	0.01

enquiry about enuresis was asked at two different parts of the questionnaire but using different phraseology. One hundred and fifty-five gave a positive response to the question when asked specifically about bed wetting which gives a 7% total which is the same value obtained by asking whether or not the child was dry at night.

### Past History of Medical Conditions

As a general indicator of previous health problems an enquiry was made as to whether or not the child had ever been admitted to a hospital. Six hundred and eighty-six (31%) children had at some time required hospital admission. Of this total 574 (84%) had been in hospital on only one occasion.

### Previous Investigation for Urinary Tract Infection

Three hundred and seven (14%) of the total survey had been investigated for possible urinary tract infection (Table 3). Surprisingly when enquiries were made into symptoms which might indicate a possible urinary tract infection only 79 (26%) of these children indicated that they had had a burning sensation on micturition.

### Current Medication

At the time of the survey 174 (8%) of the children were receiving some form of therapy. In 170 subjects an accurate indication of the therapy was available (Table 4) and within this group 54 subjects were receiving antibiotics and another drug. It is apparent that 64 (2.8%) of the total sample were receiving some form of antibiotic at the time of urine sampling.

**Table 4.** Current therapy at time of urine sampling (174 cases)

Type	Number	%
Antibiotic	54	32
Expectorants	32	19
Bronchodilators	25	15
Antihistamines	14	8
Antibiotic and expectorant	10	6
Tranquillisers	8	5
Tonic	7	4
Laxatives	6	4
Anticonvulsants	4	2
Analgesics	3	2
Insulin	3	2
Anti-inflammatory	1	1

**Table 5.** Sibling with problem (Valid cases 373)

Type of problem	Number	%
Enuresis (E)	163	44
Possible urinary tract infection (UTI)	66	18
Previous investigation -- ?UTI (PI)	46	12
Continent UTI + PI	35	9
Continent UTI + E	13	3
Continent PI + E	30	8
Continent UTI + PI + E	20	5

**Table 6.** Biochemical analysis of urine (2,230 samples)

Abnormality on urinalysis	Number of subjects	%
Protein	127	5.7
Ketones	20	0.9
Blood	18	0.8
Bilirubin	16	0.7
Nitrite	8	1.7
Urobilinogen	8	0.3
Glucose	4	0.1

### Possible Problems in Siblings

In 392 subjects there were urinary tract problems in at least one sibling. In a further 13 subjects more than one sibling had urinary problems. Good information was available about the nature of the problem in 373 cases (Table 5).

### Biochemical Analysis of Urine

Urine was analysed using a Multistix technique (Table 6). 5.7% of the subjects had detectable proteinuria and 0.1% had glycosuria. One of the children with glycosuria was known to be a diabetic.

**Table 7.** Results of cultures (2,230 samples)

Growth	Number	%
No growth	582	26.0
No significant growth	1,108	56.9
Contaminated	465	13.9
Mixed (significant)	6	0.2
Pure growth (significant)	69	3.0

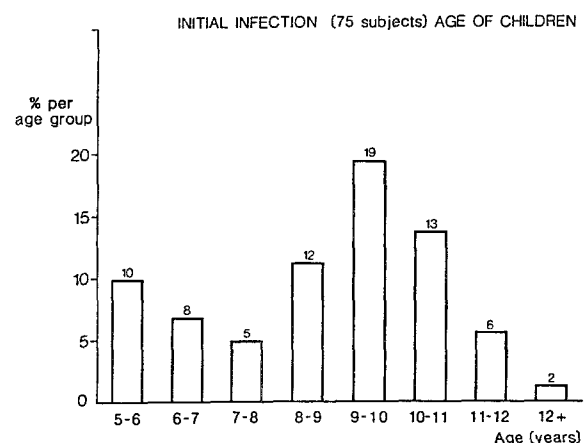
### Bacteriological Analysis of Urine

Urine samples were cultured using routine bacteriological techniques employing MacConkey and CLED agar plates. These samples were examined simultaneously using a fluorescent stain employing a Bactoscan counting device [20]. A total of 2,230 urine samples was examined (Table 7). Four samples were found to be insufficient in volume to allow any type of analysis.

### Initial Urine (Positive Infection)

In 75 (3.3%) subjects the most common age at which an infected urine was found was 9 years on the initial examination of urine (Fig. 3). Within the age groups studied the greatest percentage with an infected urine (5.6%) was found in those aged 5–6 (Fig. 4).

Using computer stored data it was possible to compare a variety of different factors between the total survey and with the group having an infected urine (Table 8). A greater proportion (4% vs. 2%) of those with infected urine were receiving antibiotics when examined initially. An awareness of a possible problem both by parents and general practitioners was apparent when the numbers who had been investigated for possible UTI were compared between these two groups (38% vs. 14%).



**Fig. 3.** The greatest number of children with a significant infection were found in the age group 9–10 years

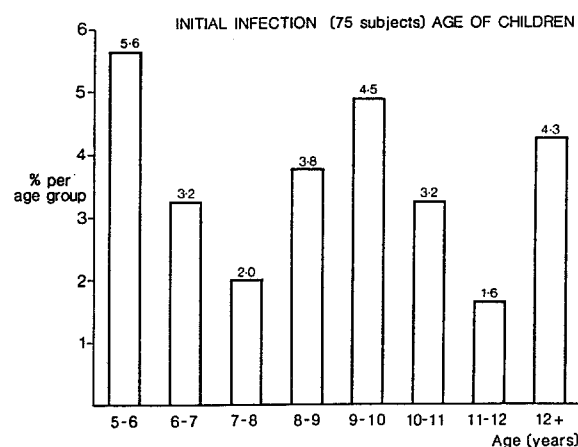


Fig. 4. The greatest % of any one age group with a positive infection was found in those aged 5–6 years

Table 8. Comparison of General Survey subjects with infected urine subjects

	General Survey		Infected Urine <sup>a</sup>	
	Number	%	Number	%
Current medicine	174	8	8	11
Antibiotic	54	2	3	4
Investigated UTI	307	14	28	38
Loss of control (day)	64	3	10	13
Loss of control (night)	149	7	18	24
Bed wetting	155	7	19	25

<sup>a</sup> Several subjects had more than one factor

That infection was a possible contributing factor in causing urinary tract symptomatology such as enuresis is also very clearly demonstrated when the groups are compared (25% vs. 7%).

## Discussion

The present study has been undertaken with two main objectives in view viz: to evaluate the prevalence of urinary tract infection in a contemporary group of school children, and to compare a standard bacteriological culture technique with a newly developed rapid method using automated direct fluorescent microscopy (D.F.M) [20]. In the past various surveys with similar objectives have been undertaken. In Dundee in 1968 it was established that 2.1% of school children had urinary tract infection [19], a figure not dissimilar to other similar studies [2].

Relatively few studies have been undertaken in pre-school children but those which have been undertaken have shown that under the age of 2 years boys as well as girls are as likely to have an infected urine [3, 6, 7]. With

increasing age the rate of infection in girls rapidly exceeds that in boys and it is in these subjects that renal damage in the form of kidney scarring or retarded kidney growth occurs [2, 11, 13] and these changes may be serious in the long term [3].

Perhaps because the detection of infection may be too late to prevent renal damage some authors have recommended that screening of school children should not be undertaken to establish whether or not asymptomatic bacteriuria is present or absent [11]. Other factors in such considerations must be the cost of the method [5], the rate of false positive and false negative results [8] and the extent of inaccuracies introduced by the taking of antibiotics which can result in a 20% error in results [15].

Despite the many contrary opinions there is good evidence that as far as the individual subject is concerned, then the presence of asymptomatic bacteriuria could be particularly important. In the first instance the awareness of the presence of a UTI and the treatment of the same may greatly reduce the damaging effects of reflux [8]. Another aspect of treatment is shown when it is realized that in children given antibiotics 77% are free of infection on follow up as compared with 26% of those who are left untreated [4]. It is possible to greatly reduce the potential deterioration of kidneys which have established radiological abnormalities secondary to infection and reflux [2].

Recently it has been shown that the presence of infection in the urinary tract in women is associated with increased mortality [10] and with an expected annual rate of 1.4% urinary tract infection in general practice [16] it is clear that any steps taken to identify the presence of infection in schoolgirls is of importance. The major drawbacks to wider surveys must rest on the organisation and cost of the methods [18].

If a screening program confirms by the simplest testing that a child has persistent proteinuria then the presence of an obstructive uropathy should be eliminated [12]. If in addition to screening for proteinuria it is possible cheaply and accurately to eliminate asymptomatic bacteriuria then such a wide programme has distinct advantages.

The present survey has on initial plate culture of one sample shown a prevalence of infection of 3.3% which is slightly higher than the figure obtained in the Dundee survey. The study has given some very useful information on a variety of different aspects of the population such as the social structure of the community. With over 90% of the children clearly well accommodated (Table 1) it is unlikely that a low general state of socio/economic development could be a factor likely to affect the child's individual, social and educational attainments.

It is interesting to show that 7% of children (Table 2) had a problem related to enuresis which clearly could affect their schooling. Such children have been investigated as a separate group and where indicated treatment has been instituted. Only 2.8% of children were receiving an antibiotic at the time of the survey which is a much smaller proportion than the estimated 20% in another series [5]. Children

with abnormalities in the first urine sample, such as proteinuria or glycosuria were invited to return for repeat sampling. Those children with a positive infection were further investigated by the survey team and their progress will be discussed subsequently.

The present survey using a routine plate culture technique is time consuming and costly and a major factor in preventing widespread screening of school children. The application of a rapid method screening system, especially if cost effective, would render repeat population surveys of considerable value.

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