The purpose of screening children for urologic disease is to identify problems which were not previously known to exist to either the child or parent. Screening implies that the disability is asymptomatic or is interpreted as of insufficient magnitude to warrant seeing a physician. It further implies that mechanisms of disease detection will be performed on a mass basis rather than in the traditional physician-patient relationship. A general concept is that screening is for preventive purposes and particularly against disease with high risk. The cost of screening is not usually borne by the individual, but by governmental agency or private institution. Those organizations involved in screening have an obligation to the public. These obligations may include:

1. Adequate medical knowledge to deal effectively with identified problems
2. Adequate staff to care for problems
3. Adequate follow-up and management of identified disorders
4. Adequate financial resources to pay for all aspects of the screening program

In screening children for urologic disease, it must be pointed out that identified problems must be of recognized significance and that the methodology used in the screening should not carry undue risks or be of great expense. History and physical examination as methods of screening do occasionally uncover significant problems previously unknown to the parents. Most of these problems, however, should best be managed in the traditional relationship rather than as part of a mass screening program.

Important criticisms of this methodology are the subjective interpretation of the significance of some of the physical findings and the medical manpower (and associated costs) required to use this method. An exception to this may be screening for hypertension, since this could be accomplished by a technician and the yield may be sufficient to warrant its use.

The use of radiologic studies to screen children for urologic disease is similarly not warranted. These studies are costly and carry a greater patient risk than is acceptable for a mass screening program. Radiologic and radionuclide studies should be reserved for those children in whom there is specific indication.

There are a number of methods suggested for screening which have not been tried and for which there are not sufficient objective data. Urine concentration tests may be used as a method of screening for renal disease, but this would require a great deal of patient cooperation and so may not be effective. Sampling blood or sputum for urea nitrogen would probably have too low a yield to warrant its use. Bacterial antibody coating should best be utilized as part of screening for bacteriuria.

Urinalysis remains the best device for screening at the present time and this is the method for which the most data are available for analysis. Urine is usually screened for evidence of blood, protein, glucose, or bacteria. Hematuria, proteinuria, and glycosuria are probably most often related to renal pathology and, because of this, statements regarding the efficacy of screening for these disorders should best come from our nephrologic colleagues. Bacteria may result in renal pathology but its origin will have been in the lower urinary tract so that its assessment is within the limits defined by this committee. Adequate data are available on asymptomatic bacteriuria and the remainder of this report will deal with an assessment of those data.

ASYMPTOMATIC BACTERIURIA
Epidemiologic Aspects

Urinary tract infection is a common problem seen in the pediatrician's office, and the ratio of girls to boys with symptomatic urinary tract infection is approximately 20 to 1. This figure is not greatly different from data on asymptomatic
TABLE I
Bacteriuria in Preschool-Age Girls

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Age (yr)</th>
<th>No. of Patients</th>
<th>Bacteriuria</th>
<th>Intravenous Pyelogram</th>
<th>Voiding Cystourethrogram</th>
<th>Pyelonephritis</th>
<th>Reflux</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asscher et al.⁸</td>
<td>5</td>
<td>277</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Davies et al.¹⁰</td>
<td>1-5</td>
<td>507</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Randolph &amp; Greenfield⁴</td>
<td>Infants</td>
<td>200</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Boothman et al.¹¹</td>
<td>1-5</td>
<td>455</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kohler et al.¹²</td>
<td>4</td>
<td>711</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Newcastle Research Group¹³</td>
<td>4-5</td>
<td>1,300</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>5</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3,450</td>
<td>40</td>
<td>36</td>
<td>34</td>
<td>6</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

*Vesicoureteral refluxes = 29%; intravenous pyelograms with pyelonephritis = 17%; bacteriuria = 1%.

bacteriuria. The terminology used in assessing these data will be proposed by Dodge et al.³ Prevalence of bacteriuria is the proportion of the total study population exhibiting bacteriuria at one point in time. The incidence rate is the proportion of the total study population that did not exhibit bacteriuria at the initial examination but does on subsequent examinations. Emergence is the prevalence plus the incidence rate.

Bacteriuria in the newborn is more common in males and its prevalence is about 1% by suprapubic aspiration.² There are a variety of explanations as to the etiology of bacteriuria in this group.

Stamey states that it is most likely secondary to the redundant prepuce and the physiologic phimosis in the newborn boy,⁴ while Bergstrom et al. feel that the route of the infection is hematogenous, secondary to colonization of the large bowel.⁵ The prevalence of bacteriuria is 1.5% in newborn boys and 0.13% in girls.⁴ Shortly after birth this trend reverses, probably in the first three months of life. In 400 children less than 1 year of age, the prevalence of bacteriuria was 2.8% in girls and 0.5% in boys.⁷

Kunin found that the incidence of bacteriuria in preschool girls was about 2%.² This figure is identical to a compilation study in school-age children.⁷ There appears to be a relatively little difference in prevalence of bacteriuria from infancy to sexual maturity in the female. Dodge et al. found that the emergence of bacteriuria in school-age girls was 4.6% by 12 years of age.⁴

Objectives of Screening
As previously stated, the object of screening is to identify problems, previously unknown, that may jeopardize the patient if not discovered. The discovery of insignificant problems or of problems which have a questionable relationship to morbidity and mortality is not the intent of screening. It has been commonly accepted that in screening for bacteriuria the objective is to discover conditions which would predispose the patient to chronic pyelonephritis and end-stage renal disease. The committee report from the National Kidney Foundation concludes that there is no objective justification for screening for mortality, but that screening does uncover predisposing factors to morbidity and that on this basis it can be justified.⁴ Screening does imply prevention, and screening methods which disclose problems that do not have a clear relationship to either morbidity or mortality may be invalid.

Results of Screening for Bacteriuria
The literature has implied that by the time a girl reaches school age, renal damage has frequently already occurred and that its prevention must begin in the younger child. For that reason it is propitious to look at data that are available in the preschool-age girl. Table I represents a compilation of data from six investigators. Less information is available in the preschool-age girl as compared to the school-age girl, making a compilation study even more important. Not all children discovered to be bacteriuric had a radiologic work-up. The prevalence of bacteriuria in the preschool girl is 1%. Of those children who had a radiologic work-up, 17% had evidence of radiographic chronic pyelonephritis (renal scarring) and 29% had vesicoureteral reflux.

There is a wealth of data on bacteriuria in the school-age child. A similar compilation study to that used for preschool children is depicted in Table II. The prevalence of bacteriuria in this group was 2%. Of those children who had a
### TABLE II

**Bacteriuria in School-Age Girls**

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Age (yr)</th>
<th>No. of Patients</th>
<th>Bacteriuria</th>
<th>Intravenous Pyelogram</th>
<th>Voiding Cystourethrogram</th>
<th>Pyelonephritis</th>
<th>Reflux</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asscher et al.⁹</td>
<td>6</td>
<td>757</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>0</td>
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<tr>
<td></td>
<td>7</td>
<td>869</td>
<td>13</td>
<td>13</td>
<td>15</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>899</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>908</td>
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<td>10</td>
<td>866</td>
<td>14</td>
<td>14</td>
<td>2</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>883</td>
<td>19</td>
<td>19</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Meadow et al.¹⁴</td>
<td>5-14</td>
<td>1,026</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Silverberg et al.¹⁵</td>
<td>6-14</td>
<td>23,427</td>
<td>546</td>
<td>190</td>
<td>83</td>
<td>18</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>Kelly et al.¹⁶</td>
<td>5-14</td>
<td>3,902</td>
<td>64</td>
<td>58</td>
<td>58</td>
<td>8</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Newcastle Research Group¹³</td>
<td>6-18</td>
<td>12,164</td>
<td>240</td>
<td>238</td>
<td>738</td>
<td>34</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>45,731</td>
<td>942</td>
<td>578</td>
<td>471</td>
<td>75</td>
<td>107</td>
<td>6</td>
</tr>
</tbody>
</table>

*Vesicoureteral refluxes = 23%; intravenous pyelograms with pyelonephritis = 13%; bacteriuria = 2%.

radiologic work-up, 13% had evidence of chronic radiologic pyelonephritis and 23% had vesicoureteral reflux. These were not the only radiologic findings in either group, as there were a small number of children with abnormalities such as ureteropelvic junction obstruction, dilated ureter, megacystis, and duplication anomalies.

**CONCLUSIONS**

This review is consistent with the available evidence that there exists a strong relationship between chronic pyelonephritis and vesicoureteral reflux.¹⁷-¹⁸ We found no significant difference in the prevalence of reflux or pyelonephritis, however, between the school-age and the preschool-age children, suggesting that pyelonephritis is not less frequent in the preschool child and that if there is an age when discovery and correction of reflux will prevent chronic pyelonephritis, it is probably before age 5. In looking at Table I, one is tempted to discount the Newcastle Studies since it was in this group that the greatest number of children with pyelonephritis was discovered. With this study deleted, however, the differences are still not statistically significant. There is a suggestion that if we could more closely analyze the preschool group there might be an age at which, if reflux were discovered and treated, pyelonephritis might be prevented.

A careful review of the data of Winberg et al. related to symptomatic urinary tract infection indicates that reflux in infants is closely correlated with pyrexia and acute pyelonephritis, that it occurs with greater frequency in infants than in older children, and that renal scarring (almost always associated with reflux) is progressive in a significant number of patients.¹⁹ This study lends substance to the allegation that reflux and bacteriuria may cause progressive renal scarring and that further effort should be encouraged in screening the early preschool-age group. While the methodology and logistics of screening in this group are difficult, home culture programs utilizing parents and low-cost materials may make it feasible.²⁰

The cost-benefit aspects of screening are even harder to assess because data are either lacking or constantly changing. At the present time we do not know the natural history of either reflux or chronic pyelonephritis. It has been implied that chronic pyelonephritis has been overdiagnosed as a cause of end-stage renal failure.²¹ The greatest cost to the public from chronic urinary tract infection may be related to morbidity and particularly related to lost work days. It is quite apparent that most screening programs grossly underestimate the cost of screening, frequently listing only disposable supplies and technician time and failing to account for the tremendous amount of physician time required in planning and evaluation. Two members of this committee (P.M. and F.B.) have been directly involved in screening programs and can confirm this high cost.

There are several intriguing aspects of screening which may have a high yield but which have not yet been tested. The screening of children with genital defects or of defects in other organ systems may yield a higher prevalence of correctable pathology. Children from lower socioeconomic groups frequently have not had the benefit of routine pediatric care and screening programs...
may be of some advantage in this group. A recent proposal has been to look at children with high
culture methods may prove economically and
screening and follow-up of bacteriuric children.

Our results indicate that there are no data
which clearly show that screening of school
children for bacteriuria results in decreased
morbidity or mortality. It has been suggested by
the National Kidney Foundation Committee that
morbidity represents sufficient justification for
screening, but they present no objective data to
indicate a lessened morbidity in those screened.6

Since morbidity implies awareness of the
disease by the patient, the principal method of
insuring a decrease in morbidity should be to
educate the public in the symptoms of urinary
tract infection and the medical profession in the
appropriate evaluation and treatment. This
would eliminate those major concerns expressed
by Dodge and West of a lack of consumer and
physician motivation.23 We agree fully with the
priorities that are set by the National Kidney
Foundation Committee and these are included in
our recommendations.

RECOMMENDATIONS

1. There are no objective data to support
screening school children for urologic disease by
history, physical examination, and radiologic
studies. However, screening for hypertension may
be worthwhile, and the question should be evaluated
by the Section on Nephrology.

2. Screening female school children for bacte-
riuria will disclose a small percentage with
correctable urologic pathology. Mass screening of
female school children, however, is not produc-
tive enough to warrant the expense of initial
screening and follow-up of bacteriuric children.
Screening preschool girls for bacteriuria should
be continued and the results evaluated. Home
culture methods may prove economically and
scientifically feasible in this group. Agencies
sponsoring screening programs should be made
aware of the available results, and those physi-
cians involved in screening should report their
findings in regard to the sponsoring agency’s
original expectations. Ideally, all screening stud-
ies should be coordinated through a central
agency. The appropriate agency in the National
Institutes of Health has demonstrated an interest
in doing this, and all research related to screening
should be channeled through that office. (Contact
Nancy Cummings, M.D., Associate Director for
Kidney, Urologic and Blood Diseases, National
Institute of Arthritis, Metabolism and Digestive
Diseases, National Institutes of Health, Bethesda,
MD 20014.)

3. The priorities proposed by the National
Kidney Foundation Committee are of such a
significance that they bear repeating.8 First
priority is to insure sufficient patient and physi-
cian education and to provide proper diagnosis
and management of the symptomatic patient
with urinary tract infection. The second priority
is to screen patients who have presented to the
physician with other medical problems to insure
that they do not have an associated urinary tract
infection. The third priority is the screening of
asymptomatic patients for bacteriuria.

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MEDICAL FALLIBILITY

At present, the typical patient is systematically encouraged to believe that his physician will not make a mistake, even though what the physician does may not achieve the desired medical objectives, and even though it cannot be denied that some physicians do make mistakes. The encouragement of this inflated belief in the competence of the physician is of course reinforced by the practice of not keeping systematic and accessible records of medical error. Yet everyone knows that this is a false confidence . . . the current high incidence of iatrogenic illness constitutes a medical problem of enormous proportions, well recognized within government agencies and segments of the medical profession, but only dimly suspected by the public at large. There is still a relatively high probability of a patient suffering from medical error.

What patients and the public have to learn is to recognize, accept, and respond reasonably to the necessary fallibility of the individual physician. The physician-patient relationship has to be redefined as one in which necessarily mistakes will be made, sometimes culpably, sometimes because of the state of development of the particular medical sciences at issue, and sometimes, inevitably, because of the inherent limitations in the predictive powers of an enterprise that is concerned essentially with the flourishing of particulars. The patient and the public therefore must also understand that medical science is committed to the patient's prospering and flourishing, and that the treatment of the patient is itself a part of that science and not a mere application of it. The patient thus must learn to see himself as available for clinical study by methods which aim at his good, but which may do him harm. Indeed, the familiar distinction, comfortable to the public but suspect to clinical researchers, between therapeutic medicine and medical research seems utterly to break down. Since the effect of a given therapeutic intervention on a given patient is always to some extent uncertain no matter how much is known about the general characteristics of interventions of that type, every therapeutic intervention is an experiment in regard to the well-being of that individual patient.

All experiments necessarily involve the possibility of failure in the sense that the expected or hypothesized outcome may not occur, whereas other outcomes, unintended and not usually specifiable entirely in advance, may occur. Thus the possibility of failure, and even of damaging failure, is linked conceptually—and not merely contingently—to the notion of experimentation, and therefore to the practice of clinical medicine.

Gorovitz and MacIntyre
Hastings Center Report 5:13, 1975

Noted by Student
Screening School Children for Urologic Disease
R. Dixon Walker, John Duckett, Frank Bartone, Patrick McLin and George Richard

*Pediatrics* 1977;60;239

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