



Prevalence of Hematuria among School Children in Shueub and Bani al-Harith in Sana'a city, Yemen

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Abstract

Objective: Screening of kidney diseases by urinalysis in school children has been approved in many parts of the world with inexpensive tools such as urinary dipsticks. In this study, we investigated the prevalence of hematuria in a large sample of 6 to 15-year-old Yemeni school students in Shueub (located in the northeast of Sana'a city) and Bani al-Harith (located in the north of Sana'a city).

Design: A total population of 12,347 Yemeni students in primary and middle schools in Shueub and Bani al-Harith were investigated for hematuria during 2021. There were 7,299 students from Shueub and the remaining 5,048 were from Bani al-Harith, aged from 6 to 15 years old. All the examined children were apparently healthy and asymptomatic. Parents' consents were taken prior to the test. A random fresh mid-stream urine was collected to complete the urine analysis (by dipstick and microscopy) to detect microscopic hematuria, albuminuria, or pus cells for each student.

Results: Among the 12,347 students screened and urine samples provided, 2,745 (22.23%) of the total population had hematuria, 1,822 (14.76%) from Shueub and 923 (7.48%) from Bani al-Harith. Analysis of the prevalence of hematuria in students in Shueub and Bani al-Harith showed that there was a very highly significant difference between the two areas (P value = 0.0000). There were 842 students (7% of the total population) had positive hematuria and 2,678 students (22%) had negative hematuria with a highly statistically significant difference between positive hematuria students and negative hematuria students (P value = 0.0044).

Conclusion: Asymptomatic hematuria might be detected by the school screening program and should be considered as an inexpensive way for early management of some renal diseases.

Keywords: Hematuria, dipstick, urinalysis, proteinuria, glucosuria

Introduction

The detection of even microscopic amounts of blood in a child's urine alarms the patient, parents, and physician, and often prompts the performance of many laboratory studies. Hematuria is one of the most important signs of renal or bladder disease, but proteinuria is a more important diagnostic and prognostic finding, except in the case of calculi or malignancies. Hematuria is almost never a cause of anemia. The physician should ensure that serious conditions are not overlooked, avoid unnecessary and often expensive laboratory studies, reassure the family, and provide guidelines for additional studies if there is a change in the child's course [1]. This article provides an approach to the evaluation and management of hematuria in a child [2,3]. Many tests have been recommended for the child with hematuria, but no consensus exists on a stepwise evaluation. Although more research is needed to resolve certain controversies in management, the suggested approach aims to detect major or treatable problems and limit the anxiety, cost, and energy required by unnecessary testing.

Hematuria is the most frequently caused by urinary tract infections (UTIs). A UTI is an infection anywhere in the urinary tract, which is made up of the bladder, ureters, and kidneys. Cystitis refers to an infection of the bladder, while pyelonephritis refers to an infection of the kidney [3]. One of the most typical causes of persistent microscopic hematuria is hypercalciuria [2]. Hypercalciuria known in children more than 2 years of age as a urine calcium/creatinine ratio more than 0.2 (mg/mg), has been

linked to ongoing asymptomatic microscopic hematuria [1]. Screening of kidney diseases has been of interest to many investigators for the last three decades. For example, Japan [4] and the USA [5] used urinalysis for screening in children and adolescents primarily with the commonly used dip and read test strips (dipsticks), mainly to detect hematuria. Several studies have demonstrated that urinalysis is the simplest and least expensive method for screening healthy children. Mass screening has been performed in Japan for the early diagnosis of chronic renal diseases since 1973 [4,6].

Hematuria is usually seen in the primary period of systemic diseases and kidney diseases, such as acute glomerulonephritis and UTI [5]. Early detection of these findings and diagnosis of the disease may facilitate preventing, halting, and deferring the progression of some diseases. The aim of the current study was to screen the prevalence of hematuria and urine abnormalities among 12,347 school students in Shueub and Bani al-Harith, Yemen.

Incidence and prevalence

Pediatricians frequently encounter hematuria in children. Macroscopic hematuria has an estimated incidence of 1.3 per 1000 [2]. Microscopic hematuria, although more common than gross hematuria, has a variably reported incidence depending on the definition used for making the diagnosis. The incidence of microscopic hematuria in schoolchildren was estimated at 0.41% when four urine samples per child were collected and 0.32% in girls and 0.14% in

boys when five consecutive urine specimens were analyzed over 5 years [10,11]. Microscopic hematuria in two or more urine samples are found in 1% to 2% of children 6 to 15 years of age.

Study Objectives

To assess the prevalence of hematuria in Yemeni school students aged from 6 to 15 years old in Shueub and Bani al-Harith.

Study Settings

The study was conducted in Sana'a, the capital of Yemen, in schools of Shueub and Bani al-Harith among students aged between 6 - 15 years.

Study period: The study was conducted between October 2021 and December 2021.

Literature Review

To the best of knowledge of the researchers, no previous study has been conducted on this subject in Yemen. On the other hand, a cross-sectional study was conducted in 8 intermediate public schools in Jeddah, Saudi Arabia between (March 2015 and June 2015). The study included healthy kids, ages 11 to 18, in the population. Children with known renal conditions, hypertension, or other concomitant conditions were not included in the study. There were 401 children in the overall sample (201 girls and 200 boys). In Jeddah, one public school was chosen at random from each area (for both genders). This study included 401 children (200 males) with a mean (SD) age of 13.87 (1.27). 17.2% of the participants had hypertension, and the male to female ratio was 1.4:1. 4.2% of the participants had pre-hypertension, with a male to female ratio of 2.1:1. A male was found to be obese in 19.2% of cases. It was shown that there is a

positive correlation between adolescent hypertension and the prevalence of obesity. Additionally substantial levels of hematuria and proteinuria were detected. Thus, screening, and preventative measures were advised [13].

A descriptive study was conducted for 661 public school children in Healthy School Children in Pakistan (2013). The study aimed to ascertain the prevalence of high blood pressure (BP), its correlation with a high body mass index (BMI), asymptomatic hematuria, and Proteinuria in healthy school-aged Pakistani children, by measuring their body weight, height, blood pressure, and performed a single urine dipstick test for hematuria. This study showed a prevalence of Asymptomatic proteinuria and hematuria were detected in 31 (4.7%) and eight (1.2%) children, respectively. The independent risk factors for hypertension and pre-hypertension were age of the child (RR 1.2 95% CI 1–1.4), gender (RR 2.0 for being female 95% CI 1–4.4), BMI >25 (RR for BMI 25–30 = 2.6 and RR for BMI>30 = 4.3), positive urine dipstick for proteinuria (RR = 2.3, 95% CI 0.7–7.7) and positive urine dipstick for hematuria (RR 1.0, 95% CI 0.2–8.3). The study concluded that community-based screening programs for children should target high-risk populations for early identification and lifestyle changes and should include blood pressure monitoring, BMI measurement, and urine dipstick analysis [17]

Methodology

This is a cross sectional descriptive prospective study where 12,347 Yemeni school students were randomly recruited

from 44 schools in Shueub and 40 schools in Bani al-Harith. The sample consisted of 7,299 students (59.1%) from Shueub while the remaining 5,048 students (40.8%) were from Bani al-Harith, aged from 6 to 15 years old.

All the selected students were given a questionnaire to be filled out by their parents, regarding the child's age, gender, and health conditions. Measurements were taken by trained volunteers in a consistent and standardized manner. The patients were categorized according to the presence of hematuria in urinary sediment into three groups as (Normal, Abnormal, Controversial) and sorted according to their gender and geographic distribution. Abnormal means that there are 5 or more RBCs per high power field in the urine, in the other hand the controversial are the results which are in doubt when there are 4 to 6 RBCs per high power field in the urine. The clinical manifestation was classified dependently according to the presence or absence of hematuria in urinalysis. After collecting the results from urine analysis tests, the SPSS program was used to analyze the data.

Urine specimens were obtained from each student, tested with urine dipsticks for hematuria, proteinuria and glucosuria. If positive results were confirmed, a microscope was used to examine a urine sample. The ages of the participant students were from 6-15 years, both sexes were represented, and all were asymptomatic and healthy at inclusion. The children who had any of the following disorders were excluded: non-orthostatic proteinuria, previous urolithiasis, documented urinary tract infection (UTI), acute or chronic

glomerulopathies, sickle cell disease, known bleeding diathesis and chronic systemic illness.

Study Sampling

A stratified random sampling system was followed, adopting the systematic approach.

Statistical Methodology

Numbers and percentages for all the measurements were calculated and demonstrated in frequency tables. Comparability tests were measured among students of the two areas of the study using chi-square test for categorical variables, such as gender type, and t-test for continuous variables, such as age level. Significance was detected at P value < 0.05 .

Ethical Considerations

A written ethical clearance that allows using consent for this study was obtained from the concerned education office. All the study participants were fully informed about the purpose of the study. Consent was obtained from the legal guardian for those respondents who were less than 15 years old. They were informed that the provided information will be kept confidential and used only for research purposes.

Results

Urine analysis

A very highly significant difference was detected between Shueub students and Bani al-Harith students in the prevalence of hematuria (P value = 0.000). Out of the total participants, 1,300 (10.53%) of Shueub boy-students, 522 (4.23%) of Shueub girl-students, 670 (5.43%) of Bani al-Harith boy-students and 253 (2.04%) of Bani al-Harith girl-students had hematuria respectively.

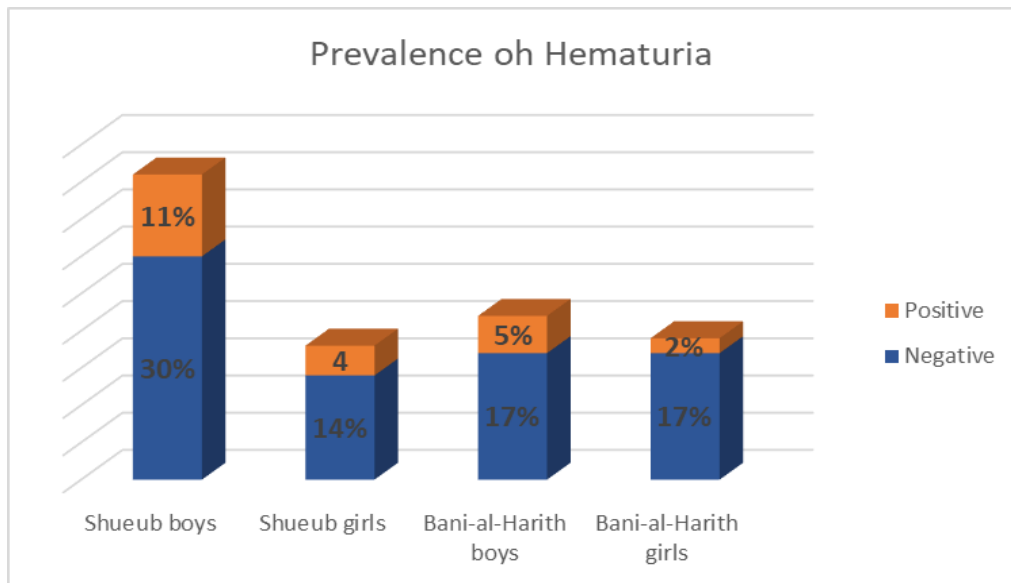


Figure (1): The prevalence of hematuria between students in Shueub and Bani al-Harith

In addition, there was a very high statistically significant difference between Shueub students and Bani al-Harith students in the prevalence of proteinuria (P value = 0.0000), were 4,285 (34.70%) boy-students

and 1,065 (8.63%) girl-students in Shueub had proteinuria, while only 81 (0.66%) boy-students and 37 (0.3%) girl-students in Bani al-Harith had proteinuria.

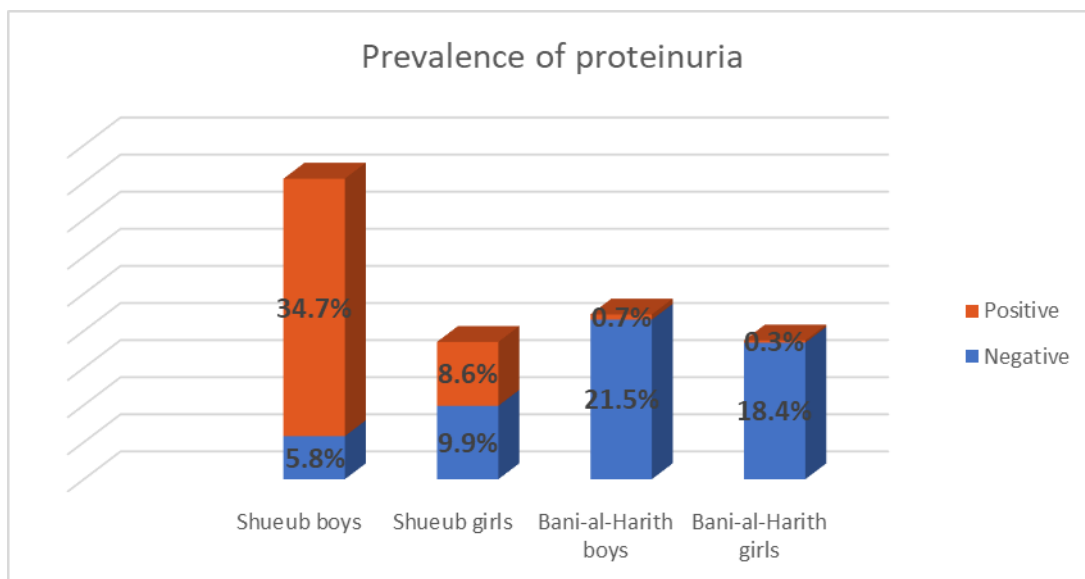


Figure (2): The prevalence of proteinuria between students in Shueub and Bani al-Harith

Regarding glucosuria, there was a very highly significant difference between Shueub and Bani al-Harith students in prevalence (P value = 0.0000), as 36

(0.29%) boy-students and 13 (0.11%) girl-students in Shueub had glucosuria, while only one student had glucosuria in Bani al-Harith.

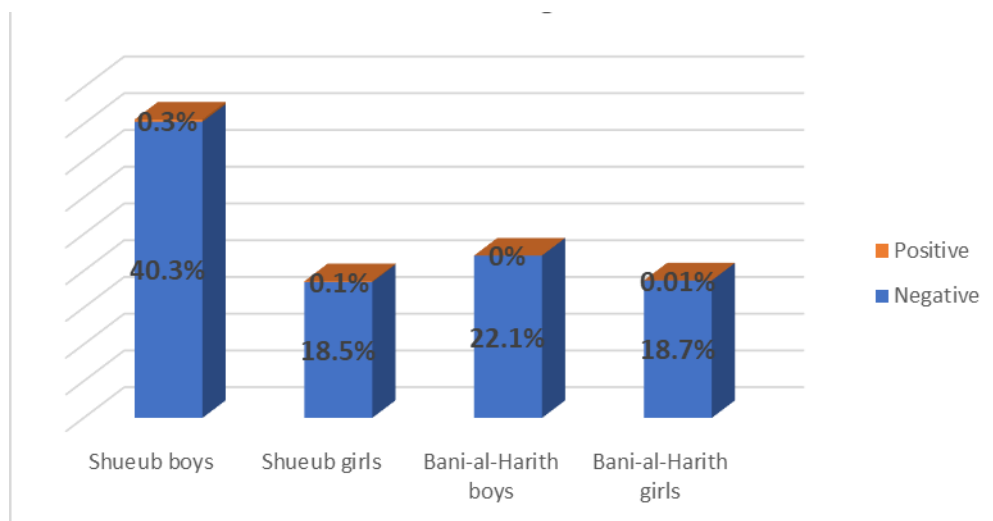


Figure (3): The prevalence of glucosuria between students in Shueub and Bani al-Harith

There was a very highly statistical difference between Shueub students and Bani al-Harith students in specific gravity, PH measurements, leucocyte, nitrite, ketone,

and bilirubin (P value = 0.000). The data also showed a high statistical difference in urobilinogen measurements (P value = 0.005) among the study groups.

Table (1): Detailed urine analysis

| | | Overall | Shueub | | Bani al Harith | | P |
|-------------------------|---------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|
| | | | Boys | Girls | Boys | Girls | |
| Specific Gravity | Mean \pm SE | 1.02 \pm 0.00 | 1.02 \pm 0.00 | 1.02 \pm 0.00 | 1.02 \pm 0.00 | 1.02 \pm 0.00 | 0.000 |
| | Range | 0.025 – 1.25 | 0.025 – 1.25 | 1 – 1.03 | 1 – 1.25 | 1 – 1.03 | |
| PH | Mean \pm SE | 5.45 \pm 0.01 | 5.42 \pm 0.01 | 5.42 \pm 0.01 | 5.45 \pm 0.02 | 5.54 \pm 0.02 | 0.000 |
| | Range | 5 – 10 | 5 – 9 | 5 – 9 | 5 – 10 | 5 – 9 | |
| Leucocyte | Negative | 11373 (92%) | 4533 (91%) | 1869 (82%) | 2722 (99.6%) | 2249 (97%) | 0.000 |
| | Positive | 974 (8%) | 474 (9%) | 423 (18%) | 12 (0.4%) | 65 (3%) | |
| Nitrite | Negative | 11978 (97%) | 4738 (95%) | 2247 (98%) | 2715 (99%) | 2278 (98%) | 0.000 |
| | Positive | 369 (3%) | 269 (5%) | 45 (2%) | 19 (1%) | 36 (2%) | |
| Ketone | Negative | 11944 (97%) | 4693 (94%) | 2227 (97%) | 2710 (99%) | 2314 (100%) | 0.000 |
| | Positive | 403 (3%) | 314 (6%) | 65 (3%) | 24 (1%) | 0 (0%) | |
| Urobilinogen | Negative | 12254 (99%) | 4944 (99%) | 2287 (99.8%) | 2734 (100%) | 2289 (99%) | 0.005 |
| | Positive | 93 (1%) | 63 (1%) | 5 (0.2%) | 0 (0%) | 25 (1%) | |
| Bilirubin | Negative | 11456 (93%) | 4340 (87%) | 2209 (96%) | 2635 (96%) | 2272 (98%) | 0.000 |
| | Positive | 891 (7%) | 667 (13%) | 83 (4%) | 99 (4%) | 42 (2%) | |

Discussion

This study was designed to find out the differences in the prevalence of hematuria among Yemeni school students at Shueub and Bani al-Harith. Hematuria was measured in this study with a urine dipstick and microscopy. Hematuria was also defined as the presence of 5 or more red blood cells (RBCs) per high-power field.

The survey revealed that 1,822 Shueub students (14.75% of the total population) had hematuria versus 923 Bani al-Harith students (7.47% of the total population) with very highly statistically significant difference between them with P value= 0.000. The predisposing factors and the relation of renal stones with the prevalence of hematuria will be discussed in a forthcoming study.

A cross-sectional study was conducted in 8 intermediate public schools in Jeddah, Saudi Arabia

. The study included healthy kids, aged between 11 to 18 years. Children with known renal conditions, hypertension, or other concomitant conditions were not included in the study. There were 401 children in the overall sample (201 girls and 200 boys). In Jeddah, one public school was chosen at random from each area (for both genders). This study included a total of 401 children (200 males) with a mean (SD) age of 13.87 (1.27). 17.2% of sample had hypertension, and the male to female ratio was 1.4:1. 4.2% of the participants had pre-hypertension, with a male to female ratio of 2.1:1. A male was found to be obese in 19.2% of cases. It was shown that there is a positive correlation between adolescent hypertension and the prevalence of obesity.

Additionally substantial levels of hematuria and proteinuria were detected. Thus, screening, and preventative measures are advised.

Murakami M. et al found that the annual incidence of urinary abnormality in elementary school children from 6 to 10 years old was 0.19% for hematuria [4]. Another study showed that the cumulative occurrence of hematuria was high, greater than 6% [12]. The study made by Vehaskari et al screened an unselected population for hematuria; four urine specimens from each were examined and microscopic hematuria was found in one or more specimens in 4.1%, and in two or more specimens in 1.1% of the studied children [7]. Dodge et al conducted urinalyses on 6- to 12-year-old children and found hematuria in 0.34% of females and 0.12% of male [14].

The study carried out by Park identified a total of 1,044 school children with hematuria and/or proteinuria during a mass school urine screening test and they were referred to pediatric nephrologists at 13 hospitals in Korea. These children had isolated hematuria (IH) (60.1%), isolated proteinuria (IP) or combined hematuria and proteinuria (CHP) (13.5%). This study showed that the use of a mass school urine screening program can detect chronic renal disease in its early stage [4].

Although Kaplan and colleagues stated that multiple screening dipstick urinalyses in asymptomatic pediatric patients are costly and should be discontinued, they proposed a single screening dipstick urinalysis to be obtained at school entry age, between 5 and 6 years, in all asymptomatic children [8].

Kawasaki et al found that early identification by yearly school urinary

screening may enable early management and improve prognosis for renal diseases in children [11].

Although our study revealed a higher prevalence rate, unlike the above-mentioned statistics, the detected abnormalities in the present study can be used to indicate its impact. Screening tests, such as blood pressure, growth and development, and general physical examination are being conducted in all preschool children. If dipstick urinalysis with its inexpensive costs could be added to our country screening program, it could contribute to the detection of the affected children in their early stages of renal diseases, resulting in the survival of kidneys at risk.

Limitations of the Study

Delayed authorizations from the education office to conduct this research, taking approximately a period of one month.

Most of people are illiterate or do not understand the objectives of our research, which resulted in the difficulty of getting approval to take urine samples or providing stool samples instead of urine sample, and this requires more explanation and much time to clarify the objectives and purpose of the current research.

Conclusion

The findings pertaining to prevalence of hematuria in Yemeni school students in Shueub and Bani al-Harith showed higher rates rather higher than found in other related studies. It was also found that it would be possible to screen a large population of children at a relatively low cost, providing the framework for further actions that may lead to the prevention and timely diagnosis of renal diseases.

References

1. Viteri B, Reid-Adam J. Hematuria and Proteinuria in Children. *Pediatr Rev.* 2018 Dec;39(12):573-587. doi: 10.1542/pir.2017-0300. PMID: 30504250; PMCID: PMC6494107.
2. Issler N, Dufek S, Kleta R, Bockenbauer D, Smeulders N, Van't Hoff W. Epidemiology of paediatric renal stone disease: a 22-year single centre experience in the UK. *BMC Nephrol* 2017;18(1):136. [PMC free article] [PubMed] [Google Scholar] [Ref list]
3. Parekh DJ, Pope JC 4th, Adams MC, Brock JW 3rd: The association of an increased urinary calcium-to-creatinine ratio, and asymptomatic gross and microscopic hematuria in children. *J Urol* 167: 272–274, 2002 [PubMed] [Google Scholar] [Ref list]
4. Murakami M, Yamamoto H, Ueda Y, et al. Urinary screening of elementary and junior high-school children over a 13-year period in Tokyo. *Pediatr Nephrol.* 1991; 5(1):50–3.
5. Shaw JF, Duncan JS, PM (Eds). *Guidelines for Health Supervision of Infants, Children, and Adolescents*, 3rd ed. Hagan, American Academy of Pediatrics, Elk Grove Village, IL 2008. American, Academy of Family Physicians.
6. Fraser CG, Smith BC, Peake MJ. Effectiveness of an outpatient urine-screening program. *Clin Chem* 1991; 23: 2216–2218.
7. Kitagawa T. Lessons learned from the Japanese nephritis screening study. *Pediatr Nephrol* 1988; 2: 256–263.
8. Kaplan R, Springate J, Felp L. Screening dipstick urinalysis: A time to change. *Pediatrics.* 1997; 100(6); 919-21.
9. Hogg RJ, Portman RJ, Milliner D, et al. Evaluation and management of proteinuria

and nephrotic syndrome in children: recommendations from a pediatric nephrology panel established at the National Kidney Foundation conference on proteinuria, albuminuria, risk, assessment, detection, and elimination (PARADE). *Pediatrics* 2000; 105(6):1242-9.

10. Park YH, Choi JY, Chung HS. Hematuria and proteinuria in a mass school urine-screening test. *Pediatr Nephrol* 1991; 20(8): 1126–30. 10.
11. Kwasaki Y, Suzuki J, Nozawa R, et al. Efficacy of school urinary screening for Membranoproliferative Glomerulonephritis Type 1; *Arch Dis Child* 2002; 86(1): 21-5.
12. Levy FL, Adams-Huet B, Pak CY. Ambulatory evaluation of nephrolithiasis: An update of a 1980 protocol. *Am J Med* 1995; 98:50.
13. Vehaskari VM, Rapola J, Koskimies O. Microscopic hematuria in school children: epidemiology and clinicopathologic evaluation. *J Pediatr* 1979; 95: 676-84.
14. Dodge WF. Cost effectiveness of renal disease screening. *Am J Dis Child* 1991; 131(11):1274-80.