



# **Dipstick urinalysis for screening of childhood urinary tract infection**

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## SUMMARY STATEMENT

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## REQUEST

Is dipstick urinalysis an appropriate method of screening for urinary tract infection in children?

## REQUESTED BY

**Dr Pamela Rosengarten**, Director, Emergency Department, Monash Medical Centre, Clayton.

## METHODOLOGY

### Search Strategy

The Centre for Clinical Effectiveness defines the 'best available evidence' as that research we can identify that is least susceptible to bias.

First, we search for systematic reviews, evidence based clinical practice guidelines, health technology assessments. Then we identify diagnostic studies with independent blind comparison of an appropriate spectrum of consecutive patients, who have undergone both the diagnostic test and the reference standard. If we identify sound, relevant material of this type, the search stops. Otherwise, our search strategy broadens to include studies that are more prone to bias, less generalisable, or have other methodologic difficulties. While we cite observational and case series studies, and narrative reviews and consensus statements, in our reports we do not critically appraise them. Some studies can produce accurate results but they are generally too prone to bias to allow determination of their validity beyond their immediate setting.

### Details of Evidence Request

Patients (Subjects):	Children aged <2 years, and 2-10 years old
Diagnostic test:	Dipstick screening for nitrites, blood and leukocytes
Reference test:	Laboratory culture of urine specimen
Diagnosis:	Urinary tract infection

### Search terms

(see Appendix 2 for exact search strategy)

Patient (Subject):	Children
Diagnostic test:	Dipstick, reagent strip, dip slides, urinalysis
Reference test:	
Diagnosis:	Urinary tract infection

## Resources Searched

We searched the following databases and internet websites:

The Cochrane Library Issue 1, 2003

Premedline (OVID) – April 3<sup>rd</sup>, 2003

Medline (OVID)- 1996 to March Week 4 2003

EBM Reviews- Cochrane DSR, ACP Journal Club, DARE, and CCTR (OVID)- 1<sup>st</sup> Quarter 2003

CINAHL (OVID)- 1982 to February Week 2 2003

Current Contents (ISI Web of Knowledge)- to April 3<sup>rd</sup>, 2003

Australian Medical Index - accessed 3<sup>rd</sup> April 2003

PubMed – National Library of Medicine – accessed 3<sup>rd</sup> April 2003

UK National Research Register – accessed 4<sup>th</sup> April 2003

## Refinements, Searching & Reporting Constraints

We included items of evidence that were available to us on April 4<sup>th</sup>, 2003. We only included articles published in the last 20 years. Literature searching was restricted to the subset of studies published in English.

## RESULTS:

From our sources we identified 27 potentially relevant articles. We obtained the full text of these articles to determine their relevance.

After examination of the 27 articles, the following were excluded as follows:

Reason for exclusion	Number
Data previously appraised in identified systematic review	12
Adult subjects or paediatric data not reported separately	3
Data reported not relevant to clinical practice	4
Gold standard (urine culture) not used as reference test	1
<b>Total</b>	<b>20</b>

7 articles then remained for appraisal. These studies are classified as follows:

Study Design	Number included
Systematic reviews or meta-analyses	1
Evidence-based clinical practice guidelines	1
Diagnostic cross sectional study	2
Retrospective analysis of medical records	3
<b>Total</b>	<b>7</b>

Based on our refinements, searching and reporting constraints we are reasonably confident these articles represent the most relevant findings published to date.

A further one systematic review and one diagnostic cross sectional study were identified as being currently underway, or recently completed, but not published. Reference details for these research projects are also provided.

There is a consensus in the literature that dipstick urinalysis is not an appropriate method for **diagnosing** childhood urinary tract infection.

The literature appraised suggests that there is good evidence that in children aged 2-10 years old, dipstick urinalysis combining leukocyte and nitrite testing is an effective and appropriate **screening** method for urinary tract infection (UTI). The studies appraised suggest that unless a patient in this age group is strongly symptomatic a urine culture is not necessary when dipstick urinalysis is negative.

There is less homogeneity in the literature regarding the use of dipstick urinalysis as a **screening** method for UTI in children under 2 years old. While Bachur and Harper (2001) suggest that "in the absence of empiric antibiotic therapy, if the prevalence of UTI is less than 2% in a given population, the risk of missing a UTI as a result of a false negative UA result is acceptable", Doley and Nelligan (2003) argue that "that in children of less than 2 years of age for whom there is any concern about the possibility of UTI, a urine specimen should be collected for microscopy and culture."

The American Academy of Pediatrics Practice Parameter (1999) states "The urinalysis cannot substitute for a urine culture to document the presence of UTI, but the urinalysis can be valuable in selecting individuals for prompt initiation of treatment while waiting for the results of the urine culture."

## EVIDENCE SUMMARIES

<p><b>Evidence Summary Systematic Review</b></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Dipstick urinalysis for screening of childhood urinary tract infection </div>	<p style="text-align: center;"><b>Systematic Review 1</b></p> <p style="text-align: center;">Gorelick MH &amp; Shaw KN (1999). Screening Tests for Urinary Tract Infection in Children: A Meta-analysis. Pediatrics 104: 1117-1118.</p>
<p><b>STUDY DESIGN &amp; NHMRC LEVELS OF EVIDENCE</b></p>	<p>Level I – Systematic Review</p>
<p><b>DESCRIPTION:</b> Patient (subjects), Interventions, Comparisons, Outcomes, Inclusion &amp; Exclusion Criteria</p>	<p><b>Patients (Subjects):</b> Children ≤ 12 years of age.  <b>Diagnostic Tests:</b> Urine dipsticks (leukocyte esterase and/or nitrite), gram stain and microscopic analysis  <b>Comparisons:</b> Urine culture  <b>Outcomes:</b> True-positive rate (TPR) and false-positive rate (FPR) as measures of sensitivity and specificity.  <b>Inclusion criteria:</b> Primary data, use of one of more of the identified rapid diagnostic tests, use of urine culture as the reference standard, independent comparison with urine culture and one of the screening tests, definition of positive screening tests provided, only paediatric patients included or evaluable separately, and both gold standard and screening test performed on all patients.  <b>Exclusion criteria:</b> Languages other than English, same data published in another included report</p>
<p><b>VALIDITY:</b> Methodology, rigour, selection, analysis</p>	<p><b>Focused question:</b> No question identified.  <b>Search strategy:</b> MEDLINE was searched for the years 1966 to 1998 for articles published in English, concerning the rapid diagnosis of urinary tract infection (UTI) in children.  The search strategy used was:  ((urine [mh] or urinalysis [mh] or pyuria [mh] or reagent strips [mh] or bacteriuria [mh])  and ((urinary tract infections [mh] or pyelonephritis [mh]) not schistosomiasis [mh])  and (english [la])  and (infant, newborn [mh] or infant [mh] or child, preschool [mh] or child [mh])  <b>Assessed validity:</b> Titles and abstracts retrieved by search were reviewed by both authors and discrepancies resolved by discussion and consensus. Authors state articles were reviewed for “any possible methodological concerns (eg, non-consecutive patient enrolment or nonblinded assessment)”.  <b>Consistent results:</b> Most of the tests showed substantial heterogeneity among both TPR and FPR – authors state that differences in the gold standard and definition of UTI used by different studies explain some, but not all of the observed heterogeneity.  <b>Appropriate analysis of results:</b> Separate comparisons of the TPR and FPR for all studies were performed using the Pearson chi-squared test. Pooled results from studies were also analysed in subgroups according to the definition of UTI used and then according to the age of the patients included: all ages or only patients &lt;2 years of age. TPR and FPR for each study were plotted on receiver-operator characteristic plots. Likelihood ratios (LR) and a range of other statistics were calculated.</p>
<p><b>RESULTS:</b> Generally favourable or unfavourable, specific outcomes of interest, estimate of experimental effect and precision if appropriate</p>	<p>26 studies met all inclusion criteria.</p> <p>There was substantial heterogeneity in both TPR and FPR, some of which was explained by the use of different definitions of UTI.</p> <p>There was no significant difference in the sensitivity of results for Gram stain and dipstick tests between age groups, but the TPR of the presence of ≥10 white blood cells/mm<sup>3</sup> was significantly higher in the studies including only children &lt;2 years of age.</p>

	<p>The test with the best combination of sensitivity and specificity was Gram stain (Positive likelihood ratio (LR) 18.5, negative LR 0.07). Urine dipsticks performed nearly as well; the presence of both LE and nitrites had a positive LR of 12.6, whereas the absence of both LE and nitrite had a negative LR of 0.13.</p> <p>Only two studies were found that examined the combination of Gram stain and cell count on uncentrifuged urine, referred to as enhanced urinalysis.</p>
<p><b>AUTHORS COMMENTS:</b> Limitations, implications for practice and research</p>	<p>The authors concluded that the urine dipstick test and Gram stain perform similarly in detecting UTI in children, with high sensitivity and a low FPR. They state that enhanced urinalysis may offer a better combination of test performance characteristics but has not yet been well studied. All these tests have better sensitivity and specificity than the presence of pyuria in either centrifuged or uncentrifuged specimen.</p>
<p><b>OUR COMMENTS:</b> Opportunity for bias, weakness and strength</p>	<p><b>Potential for bias:</b> Differing definitions of UTI used in appraised articles presents opportunities for introduction of bias.</p> <p><b>Strengths:</b> A broad search and sensitive statistical analysis was undertaken.</p> <p><b>Weaknesses:</b> Analysis of methodological quality of included articles is not described.</p>

<p><b>Evidence Summary Clinical Guideline</b></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Dipstick urinalysis for screening of childhood urinary tract infection</p> </div>	<p style="text-align: center;"><b>Guideline 1</b></p> <p>American Academy of Pediatrics. Committee on Quality Improvement. Subcommittee on Urinary Tract Infection (1999). Practice Parameter: The Diagnosis, Treatment, and Evaluation of the Initial Urinary Tract Infection in Febrile Infants and Young Children. Pediatrics 103: 843 – 852.</p>
<p><b>GUIDELINE DEVELOPMENT SOCIETY/ GROUP</b></p>	<p>American Academy of Pediatrics. Committee on Quality Improvement. Subcommittee on Urinary Tract Infection</p>
<p><b>CLINICAL APPLICABILITY</b></p>	<p><b>Objectives:</b> To formulate recommendations for health care professionals about the diagnosis, treatment, and evaluation of an initial urinary tract infection (UTI) in febrile infants and young children (ages 2 months to 2 years).</p> <p><b>Guideline topic:</b> Diagnosis, Treatment, and Evaluation of the Initial Urinary Tract Infection in Febrile Infants and Young Children</p> <p><b>Patient population:</b> Febrile infants and young children (ages 2 months to 2 years). Neonates and infants younger than 2 months were excluded, as were children older than 2 years.</p> <p><b>Health provider population:</b> Clinicians who treat infants and young children in a variety of clinical settings (e.g., office, emergency department, hospital). (USA)</p>
<p><b>VALIDITY</b></p>	<p><b>How consensus was reached:</b> Not described</p> <p><b>Identification of evidence:</b> The Subcommittee identified the population at highest risk of incurring renal damage from UTI - infants and young children with UTI and fever. A comprehensive bibliography on UTI in infants and young children was compiled.</p> <p><b>Evaluation of evidence:</b> Literature was abstracted in a formal manner, and evidence tables were constructed. Decision analysis and cost-effectiveness analyses were performed to assess various strategies for diagnosis, treatment, and evaluation.</p> <p><b>Links made between recommendations and evidence:</b> Recommendations made and indication given of the strength of evidence supporting the recommendation. (Strong, good, fair or opinion/consensus)</p> <p><b>Costs and benefits:</b> Cost-effectiveness analyses were performed using the methods of Rice and associates (reference given).</p>
<p><b>MULTIDISCIPLINARY PROCESS</b></p>	<p><b>Conflicts of interest:</b> Not identified</p> <p><b>Funding:</b> Not described</p> <p><b>Guideline development group:</b> The American Academy of Pediatrics (AAP) Committee on Quality Improvement selected a Subcommittee composed of pediatricians with expertise in the fields of epidemiology and informatics, infectious diseases, nephrology, pediatric practice, radiology, and urology to draft the parameter. The Subcommittee, the AAP Committee on Quality Improvement, a review panel of office-based practitioners, and other groups within and outside the AAP reviewed and revised the parameter.</p>
<p><b>CLINICAL FLEXIBILITY</b></p>	<p><b>Exceptions/ flexibility:</b> "The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate."</p> <p><b>Patient preferences considered:</b> Not applicable.</p> <p><b>Ethical issues:</b> None identified.</p>
<p><b>CLARITY</b></p>	<p><b>Clearly worded:</b> Yes</p> <p><b>Presentation:</b> Text and tables, as well as diagnostic algorithm Available online at <a href="http://www.aap.org/policy/ac9830.htm">http://www.aap.org/policy/ac9830.htm</a></p>

	<b>Ease of use:</b> Good – however definitive direction as to appropriate screening protocols are not given
<b>RELIABILITY/ REPRODUCABILITY</b>	<p><b>Independent review:</b> The document was reviewed by the appropriate committees and sections of the American Academy of Pediatrics (AAP), including the Committee on Infectious Diseases, the Committee on Medical Liability, and the Committee on Practice and Ambulatory Medicine; the Sections on Infectious Diseases, Nephrology, Radiology, and Urology; and the Chapter Review Group, a focus group of office-based pediatricians representing each AAP District. Comments also were solicited and received from the American Academy of Family Physicians, the American College of Emergency Physicians, and the American Urological Association.</p> <p><b>Pilot/ pre-testing:</b> Not described.</p> <p><b>Process of development documented:</b> Not described.</p>
<b>SCHEDULED REVIEW</b>	<p><b>Date of issue:</b> April, 1999</p> <p><b>Expiry date/ scheduled review:</b> Not identified.</p>
<b>APPLICATION</b>	<p><b>Guidelines for dissemination and implementation:</b> Not described.</p> <p><b>Guidelines for evaluation:</b> Not provided.</p>
<b>RELEVANT RECOMMENDATIONS &amp; CORRESPONDING LEVELS OF EVIDENCE:</b>	<p>The Clinical Guideline includes 11 recommendations – only those relevant to this appraisal are reported here.</p> <p><b>Recommendation 1:</b> The presence of UTI should be considered in infants and young children 2 months to 2 years of age with unexplained fever (strength of evidence: strong).</p> <p><b>Recommendation 2:</b> In infants and young children 2 months to 2 years of age with unexplained fever, the degree of toxicity, dehydration, and ability to retain oral intake must be carefully assessed (strength of evidence: strong).</p> <p><b>Recommendation 3:</b> If an infant or young child 2 months to 2 years of age with unexplained fever is assessed as being sufficiently ill to warrant immediate antimicrobial therapy, a urine specimen should be obtained by SPA or transurethral bladder catheterization; the diagnosis of UTI cannot be established by a culture of urine collected in a bag (strength of evidence: good).</p> <p><b>Recommendation 4:</b> If an infant or young child 2 months to 2 years of age with unexplained fever is assessed as not being so ill as to require immediate antimicrobial therapy, there are two options (strength of evidence: good). Option 1: Obtain and culture a urine specimen collected by SPA or transurethral bladder catheterization. Option 2: Obtain a urine specimen by the most convenient means and perform a urinalysis. If the urinalysis suggests a UTI, obtain and culture a urine specimen collected by SPA or transurethral bladder catheterization; if urinalysis does not suggest a UTI, it is reasonable to follow the clinical course without initiating antimicrobial therapy, recognizing that a negative urinalysis does not rule out a UTI.</p> <p>Of the components of urinalysis, the three most useful in the evaluation of possible UTI are leukocyte esterase test, nitrite test, and microscopy. A positive result on a leukocyte esterase test seems to be as sensitive as the identification of WBCs microscopically, but the sensitivity of either test is so low that the risk of missing UTI by either test alone is unacceptably high (Table 1). The nitrite test has a very high specificity and positive predictive value when urine specimens are processed promptly after collection. Using either a positive leukocyte esterase or nitrite test improves sensitivity at the expense of specificity; that is, there are many false-positive results. The wide range of reported test characteristics for microscopy indicates the difficulty in ensuring quality performance; the best results are achieved with skilled technicians processing fresh urine specimens.</p> <p>The urinalysis cannot substitute for a urine culture to document the</p>

	<p>presence of UTI, but the urinalysis can be valuable in selecting individuals for prompt initiation of treatment while waiting for the results of the urine culture. Any of the following are suggestive (although not diagnostic) of UTI: positive result of a leukocyte esterase or nitrite test, more than 5 white blood cells per high-power field of a properly spun specimen, or bacteria present on an unspun Gram-stained specimen.</p> <p>In circumcised boys, whose low a priori rate of UTI (0.2% to 0.4%) does not routinely justify an invasive, potentially traumatic procedure, a normal urinalysis reduces the likelihood of UTI as the cause of the fever still further, to the order of 0.1%.</p> <p><b>Recommendation 5:</b> Diagnosis of UTI requires a culture of the urine (strength of evidence: strong). The standard test for the diagnosis of UTI is a quantitative urine culture; no element of the urinalysis or combination of elements is as sensitive and specific</p>
<p><b>OUR COMMENTS:</b></p>	<p><b>Strengths:</b> A broad range of literature was reviewed in the formulation of this guideline. Many reviewers and expert bodies were also consulted.</p> <p><b>Weaknesses:</b> Descriptions of the levels of evidence and the ways in which recommendations were assigned to them are not given.</p> <p>The methodology by which recommendations were drawn from the literature is not described. Neither is the way in which studies were included or excluded in the analysis that resulted in the creation of this guideline.</p> <p>A date for next review is not given.</p>

<b>Evidence Summary Diagnosis</b>  <div style="border: 1px solid black; padding: 5px; width: fit-content;">Dipstick urinalysis for screening of childhood urinary tract infection</div>	<b>Study 1</b>  Armengol CE, Hendley JOT & Schlager TA (2001). Should we abandon standard microscopy when screening for urinary tract infections in young children? The Pediatric Infectious Disease Journal 20: 1176-1177.	<b>Study 2</b>  Bachur R & Harper MB (2001). Reliability of the Urinalysis for Predicting Urinary Tract Infections in Young Febrile Children. Archives of Pediatrics & Adolescent Medicine 155: 60-65.
<b>STUDY DESIGN</b>	Retrospective analysis of medical records.	Retrospective analysis of medical records.
<b>DESCRIPTION:</b> Patients (subjects), Diagnostic Test, Comparison, Outcomes	<b>Patients (subjects):</b> 260 children <4 years of age seen as outpatients in the General Paediatric Clinic or Emergency Department at the University of Virginia Health Sciences Center, 30 of whom were culture positive for UTI. <b>Diagnostic test:</b> Microscopy and leukocyte esterase (LE) and nitrite dipstick analysis <b>Comparison:</b> Urine culture <b>Outcome:</b> Specificity and sensitivity	<b>Patients (subjects):</b> 37450 patients younger than 2 years with fever ( $\geq 38^{\circ}\text{C}$ ) seen in the Emergency Department, Children's Hospital, Boston, during a period of 65 months <b>Diagnostic test:</b> Dipstick analysis, followed by microscopy only if the dipstick indicated the presence of leukocyte esterase, nitrite, blood or protein. <b>Comparison:</b> Urine culture <b>Outcome:</b> Specificity and sensitivity
<b>VALIDITY:</b> Methodology, rigour, selection	<b>Reference test (Gold standard):</b> Urine culture <b>Patient spectrum:</b> Appropriate <b>All patients tested with reference test:</b> Yes <b>Blinding of assessors:</b> Not described.	<b>Reference test (Gold standard):</b> Urine culture <b>Patient spectrum:</b> Good. <b>All patients tested with reference test:</b> No <b>Blinding of assessors:</b> Not described.
<b>RESULTS:</b> Generally favourable or unfavourable, specific outcomes of interest, estimate of experimental effect and precision if appropriate	Dipstick analysis was 98% specific but only 70% sensitive. Microscopy was slightly more sensitive but at the expense of a marked loss in specificity. Combining dipstick analysis with microscopy further increased sensitivity at the expense of reducing specificity to 64%.	The overall sensitivity for dipstick analysis alone was 79% (95%CI 76 - 82%), microscopy alone was 82%(79 -84%) and combined dipstick and microscopy (UA) was 92% (91 - 92%). These figures were consistent across age subgroups among febrile infants younger than 2 years old.
<b>AUTHOR(S) CONCLUSIONS:</b> Limitations, implications for practice and research	Authors suggest that the data reported provides compelling evidence that the standard microscopy available in the ambulatory setting is an inaccurate laboratory test for evaluating urine in infants and young children with possible UTI. They also note that microscopy provides no advantage over dipstick analysis. They suggest foregoing microscopy in favour of dipstick analysis when evaluating febrile infants and young children for UTI.	Authors note that most clinicians agree that very young, febrile infants require a proper urine culture for diagnosis, and those patients with abnormal UA results require a urine culture. However whether older febrile infants "require" a screening or a urine culture regardless of the UA result (especially if empirical antibiotic therapy is being considered) is controversial.  Authors suggest that in the absence of empiric antibiotic therapy,

		<p>if the prevalence of UTI is less than 2% in a given population, the risk of missing a UTI as a result of a false negative urinalysis result is "acceptable".</p>
<p><b>OUR COMMENTS:</b> Opportunities for bias, weakness and strength</p>	<p><b>Potential for bias:</b> Use of medical records and other retrospective data introduces potential bias.  <b>Weakness/es:</b> Other studies frequently group patients into &lt;2 years and &gt; 2 years, and several have found differences between these categories. This study has not examined this possibility. Blinding of persons undertaking analysis not described. CI values not provided.  <b>Strength/s:</b> All patients tested with reference test.</p>	<p><b>Potential for bias:</b> Use of medical records and other retrospective data introduces potential bias. Bias is also introduced as not all patients had a UA or urine culture obtained and retrospective data does not allow analysis of reasons for this. Estimates of prevalence are likely to be minimums.  <b>Weakness/es:</b> Blinding of persons undertaking analysis not described.  <b>Strength/s:</b> Large sample size.</p>

<b>Evidence Summary Diagnosis</b>  <div style="border: 1px solid black; padding: 5px; width: fit-content;">Dipstick urinalysis for screening of childhood urinary tract infection</div>	<b>Study 3</b>  Craver RD & Abermanis JG (1997). Dipstick only urinalysis screen for the pediatric emergency room. Pediatric Nephrology 11: 331-333.	<b>Study 4</b>  Doley A & Nelligan M (2003). Is a negative dipstick urinalysis good enough to exclude urinary tract infection in paediatric emergency department patients? Emergency Medicine 15: 77-80.
<b>STUDY DESIGN</b>	Diagnostic cross sectional study	Retrospective analysis of medical records.
<b>DESCRIPTION:</b> Patients (subjects), Diagnostic Test, Comparison, Outcomes	<b>Patients (subjects):</b> 236 children aged 3 weeks to 21 years examined during a 9 week period in the New Orleans Children's Hospital emergency room. 73 patients were below 2 years of age. <b>Diagnostic test:</b> LE and nitrite dipstick and microscopic analysis <b>Comparison:</b> Urine culture <b>Outcome:</b> Specificity and sensitivity	<b>Patients (subjects):</b> Records of 6618 paediatric presentations over an eight month period at the Department of Emergency Medicine, Flinders Medical Centre, Adelaide. After exclusions, 2482 case note reviews remained. Of these 720 cases had a printed urinalysis and 375 also had a full urine culture result. Analysis was carried out on these 375 cases, divided into two age categories, up to 2 years of age and 2-10 years. <b>Diagnostic test:</b> LE and nitrite dipstick and microscopic analysis <b>Comparison:</b> Urine culture <b>Outcome:</b> Specificity and sensitivity
<b>VALIDITY:</b> Methodology, rigour, selection	<b>Reference test (Gold standard):</b> Urine culture <b>Patient spectrum:</b> Good <b>All patients tested with reference test:</b> Yes. <b>Blinding of assessors:</b> Not described.	<b>Reference test (Gold standard):</b> Urine culture. <b>Patient spectrum:</b> Not well detailed. <b>All patients tested with reference test:</b> Yes. <b>Blinding of assessors:</b> Not described.
<b>RESULTS:</b> Generally favourable or unfavourable, specific outcomes of interest, estimate of experimental effect and precision if appropriate	Twenty-four positive urine cultures were identified (19 girls, 4 boys[sic]). One of these was in a child less than 2 years old.  Dipstick analysis sensitivity was either 92%(95%CI 81 – 100%) or 88%(74-100%) depending on whether trace blood levels were considered a positive result or not, respectively. Likewise, dipstick specificity was either 62%(56-69%) or 75%(70-81%).  Microscopic analysis resulted in sensitivity of 71%(53-89%) and specificity of 74%(68-80%).	For cases aged 0-2 years, dipstick urinalysis for UTI had a sensitivity of 87.5% (95% CI 74.3 – 100%) and a specificity of 39.7% (31.5-47.9%).  For cases aged 2-10 years, dipstick urinalysis had a sensitivity of 100% (100 – 100%) and a specificity of 39.2% (32.4-46%).  In the 0-2 age group a failure to diagnose rate of over 5% was seen.

<p><b>AUTHOR(S) CONCLUSIONS:</b> Limitations, implications for practice and research</p>	<p>From these results, authors suggest optimum screening for UTI in children in the emergency room is by dipstick only, with negative LE, negative nitrite and trace blood or less as a negative results.</p> <p>Because of the number of false positive results, the dipstick urinalysis cannot eliminate the need for confirmatory urine cultures. Thus positive dipstick urinalysis should be confirmed by urine culture.</p> <p>Screening for children under 2 years of age is being further investigated.</p>	<p>Authors state that in children of less than 2 years of age for whom there is any concern about the possibility of UTI, a urine specimen should be collected for microscopy and culture.</p> <p>For older children, a negative dipstick urinalysis is adequate to exclude a UTI unless there is a high clinical suspicion.</p>
<p><b>OUR COMMENTS:</b> Opportunities for bias, weakness and strength</p>	<p><b>Potential for bias:</b> <b>Weakness/es:</b> Very small number of cases in the under 2 years old age group. Small number of male cases. <b>Strength/s:</b> Use of prospective study design eliminates some opportunity for introduction of bias. All patients tested with reference test.</p>	<p><b>Potential for bias:</b> Use of medical records and other retrospective data introduces potential bias. Specificity data are very low compared with other similar studies. This may reflect the presence of other un-addressed confounding variables. <b>Weakness/es:</b> Reasons for exclusions not well described. Results not well described. Gender details of cases not provided. <b>Strength/s:</b> All patients tested with reference test.</p>

<p><b>Evidence Summary Diagnosis</b></p> <p>Dipstick urinalysis for screening of childhood urinary tract infection</p>	<p><b>Study 5</b></p> <p>Sharief N, Hameed M &amp; Petts D (1998). Use of rapid dipstick tests to exclude urinary tract infection in children. British Journal of Biomedical Science 55: 242-246.</p>
<p><b>STUDY DESIGN</b></p>	<p>Diagnostic cross sectional study</p>
<p><b>DESCRIPTION:</b> Patients (subjects), Diagnostic Test, Comparison, Outcomes</p>	<p><b>Patients (subjects):</b> 325 children admitted to a general paediatric ward in whom UTI was a possibility on clinical grounds. 229 males, 146 females, age range: 2 days – 16 years, mean 39.5 months, 124 patients were less than one year old. None of the children had urinary tract symptoms.</p> <p><b>Diagnostic test:</b> Nitrite and leukocyte dipstick urinalysis</p> <p><b>Comparison:</b> Urine culture</p> <p><b>Outcome:</b> Specificity and sensitivity</p>
<p><b>VALIDITY:</b> Methodology, rigour, selection</p>	<p><b>Reference test (Gold standard):</b> Urine culture</p> <p><b>Patient spectrum:</b> Good.</p> <p><b>All patients tested with reference test:</b> Yes.</p> <p><b>Blinding of assessors:</b> Laboratory assessment for UTI was carried out blind to dipstick analysis results.</p>
<p><b>RESULTS:</b> Generally favourable or unfavourable, specific outcomes of interest, estimate of experimental effect and precision if appropriate</p>	<p>Sensitivity data for the whole age range for nitrite alone, leukocyte esterase (LE) alone and nitrite and LE combined were 54.6%, 100% and 54.6% respectively. The sensitivity of nitrite analysis was skewed by very low (20%) sensitivity in children less than one year old.</p> <p>Specificity data for the whole age range for nitrite alone, leukocyte esterase (LE) alone and nitrite and LE combined were 96.8%, 78.1% and 98.7% respectively. Looking at children less than one year old only, the specificity results were 98.3%, 73.1% and 98.7%.</p>

<p><b>AUTHOR(S) CONCLUSIONS:</b> Limitations, implications for practice and research</p>	<p>In the absence of strong clinical indications it is not necessary to submit a urine for microbiological examination when the LE and nitrite tests are both negative.</p>
<p><b>OUR COMMENTS:</b> Opportunities for bias, weakness and strength</p>	<p><b>Potential for bias:</b> Very low sensitivity of nitrite urinalysis is not reflected in other literature. Population studied had low (5.2%) incidence of UTI.  <b>Weakness/es:</b> Confidence intervals not provided. Results for all children discussed together rather than in 0-2 and older than 2 years age groups as in other literature. Specimens were not tested for the presence of antibiotics.  <b>Strength/s:</b> Use of prospective study design eliminates some opportunity for introduction of bias. Good descriptions of methodology and results.</p>

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**CURRENT OR RECENTLY COMPLETED RESEARCH  
(UNPUBLISHED)**

"A systematic review of tests for the diagnosis and evaluation of urinary tract infection in children under five years." Contact Professor Jos Kleijnen, NHS Centre for Reviews & Dissemination, University of York, email [jk13@york.ac.uk](mailto:jk13@york.ac.uk), end date 31/10/2003.

"Does negative mean negative?" – in young children less than two years of age, would the significance of a negative predictive value following urinalysis prevent the need to culture the urine sample? Contact Sara Johnson, Starlight Uni, Homerton University Hospital NHS Trust, email [sara.johnson@homerton.nhs.uk](mailto:sara.johnson@homerton.nhs.uk), end date 31/03/2002.

## APPENDIX 1

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## APPENDIX 2

### Search strategy

	<b>Search terms for MEDLINE, CINAHL, EBM- Reviews, PREMEDLINE, Current Contents</b>
1	urinary tract infection
2	dipstick\$
3	dip slide\$
4	reagent strip\$
5	child\$
6	urinalysis
7	1 and 2 and 5
8	limit 7 to english language
9	1 and 3 and 5
10	limit 9 to english language
11	1 and 4 and 5
12	limit 11 to english language
13	2 and 5 and 6
14	limit 13 to english language
15	3 and 5 and 6
16	limit 15 to english language
17	4 and 5 and 6
18	limit 17 to english language

Similar terms, appropriately translated, were used to search the other databases and resources.