Diagnosis of UTI
Quick Reference Guide for Primary Care

URINARY SYMPTOMS IN ADULT WOMEN <65 DO NOT CULTURE ROUTINELY<sup>1-5</sup>
In sexually active young men and women with urinary symptoms consider *Chlamydia trachomatis*<sup>3</sup>

Severe<sup>3C</sup> or ≥ 3 symptoms of UTI<sup>4B+</sup>
- Dysuria
- Frequency
- Suprapubic tenderness
- Urgency
- Polyuria
- Haematuria

AND

NO vaginal discharge or irritation<sup>2,5C</sup>
90% culture positive
Give empirical antibiotic treatment

Mild or ≤ 2 symptoms of UTI (as above)
Obtain urine specimen
Urine NOT cloudy 97% NPV<sup>7,9B-</sup>
Consider other diagnosis

UREINE CLOUDY
Perform urine dipstick test with nitrite
When reading test WAIT for the time recommended by the manufacturer

Positive nitrite, and leucocytes and blood 92% PPV<sup>4B+</sup>
or positive nitrite alone<sup>4B+</sup>
Probable UTI
Treat with first line agents on local or HPA Guidance

Negative nitrite
Positive leucocyte<sup>12</sup>
UTI or other diagnosis equally likely
Review time of specimen (*morning is most reliable*)
Treat if severe symptoms or consider delayed antibiotic prescription and send urine for culture

Negative nitrite, leucocytes and blood 76% NPV<sup>4B+</sup>or negative nitrite and leucocyte positive blood<sup>2,5C</sup>or protein<sup>12</sup>
Laboratory microscopy for red cells is less sensitive than dipstick
UTI Unlikely
Consider other diagnosis
Reassure and give advice on management of symptoms

URINE CULTURE IN WOMEN AND MEN > 65 YEARS
- Do not send urine for culture in asymptomatic elderly with positive dipsticks
- Only send urine for culture if 2 or more signs of infection, especially dysuria, fever > 38 °C or new incontinence.<sup>4,5C</sup>
- Do not treat asymptomatic bacteriuria in the elderly as it is very common.<sup>1B+</sup>
- Treating does not reduce mortality or prevent symptomatic episodes, but increases side effects & antibiotic resistance.<sup>2,3B+</sup>

URINE CULTURE IN WOMEN AND MEN WITH CATHETERS
- Do not treat asymptomatic bacteriuria in those with indwelling catheters, as bacteriuria is very common and antibiotics increase side effects and antibiotic resistance.<sup>1B+</sup>
- Treatment does not reduce mortality or prevent symptomatic episodes, but increase side effects & antibiotic resistance.<sup>2,3B+</sup>
- Only send urine for culture in catheterised<sup>1B</sup> if features of systemic infection.<sup>1,5,6C</sup> However, always:
  - Exclude other sources of infection.<sup>4C</sup>
  - Check that the catheter drains correctly and is not blocked.
  - Consider need for continued catheterisation.
  - If the catheter has been in place for more than 7 days, consider changing it before/when starting antibiotic treatment.<sup>1,6C, 8B+</sup>
- Do not give antibiotic prophylaxis for catheter changes unless history of symptomatic UTIs due to catheter change.

WHEN ELSE SHOULD I SEND A URINE FOR CULTURE?
- Pregnancy: If symptomatic, for investigation of possible UTI.<sup>1B+</sup>
  In all at 1st antenatal visit - as asymptomatic bacteriuria is associated with pyelonephritis & premature delivery.<sup>1,2B+</sup>
- Suspected pyelonephritis<sup>3C</sup> (loin pain and fever).
- Suspected UTI in men.<sup>1,4C</sup>
- Failed antibiotic treatment or persistent symptoms.<sup>5A+, 6B-</sup>
  *E. coli* with *Extended-spectrum Beta-lactamase enzymes* are increasing in the community.
  ESBLs are multi-resistant but usually remain sensitive to nitrofurantoin or fosfomycin.<sup>5,7B+, 9A+</sup>
- Recurrent UTI, abnormalities of genitourinary tract, renal impairment — more likely to have a resistant strain.

Produced 2002: Latest update April 2011
For review April 2014

Endorsed by:

Royal College of General Practitioners
**Refrigerate specimens to prevent bacterial overgrowth** or use specimen pots with boric acid (fill to the line). In women: the specimen should be mid-stream. Cleansing with water and holding the labia apart are not essential. Cleansing with antiseptic leads to false negatives.

- In men: the specimen should be mid-stream.
- People with catheters: using aseptic technique, drain a few mL of urine, then collect a sample from catheter sampling port.

**HOW DO I INTERPRET A CULTURE RESULT?**

<table>
<thead>
<tr>
<th>White blood cells</th>
<th>White cells ≥ 10³/mL are considered to represent inflammation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epithelial cells/sterile pyuria</td>
<td>In sterile pyuria consider Chlamydia trachomatis (especially if 16-24 years), other vaginal infections, other non-culturable organisms, including TB or renal pathology.</td>
</tr>
<tr>
<td>Red cells</td>
<td>Presence indicates perineal contamination, which reduces significance of culture.</td>
</tr>
</tbody>
</table>

**Sterile pyuria**

- May be present in UTI, patients with persistent haematuria post UTI should be referred.
- Lab microscopy for red cells is less accurate than dipstick due to red cell lysis in transport.

**IS A FOLLOW-UP URINE SAMPLE NEEDED?**

Follow-up urine samples are not usually indicated, except when treating asymptomatic bacteriuria in pregnancy.

**CHILDREN**

<table>
<thead>
<tr>
<th>Child &lt; 3 months with suspected UTI: Failure-to-thrive &amp;/or fever &amp;/or vomiting &amp;/or irritability</th>
<th>All children aged 3 months to 3 years of age with specific or non-specific urinary symptoms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send urine for culture and sensitivities AND Refer urgently for assessment.</td>
<td>Send urine for culture and sensitivities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Children aged 3 years and older with specific or non-specific urinary symptoms</th>
<th>Assess with leucocyte &amp; nitrite urine dipstick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive leucocytes AND nitrite</td>
<td>Probable UTI</td>
</tr>
<tr>
<td>Probable UTI</td>
<td>Treat as UTI and send urine for culture</td>
</tr>
</tbody>
</table>

**Child over 3 yrs with other risk:**

- Systemic illness or suspected pyelonephritis
- Require immediate transfer to hospital
- Recurrent UTI
- No response to treatment within 24-48 hrs

**SAMPLING IN WOMEN AND MEN**

- Single organism ≥ 10³ colony forming units (CFU)/mL indicates UTI.
- Or ≥ 10⁴ mixed growth with one predominant organism (Escherichia coli or Staphylococcus saprophyticus) ≥ 10³ CFU/mL.
- Do not treat asymptomatic bacteriuria in the elderly as it does not reduce mortality or prevent symptomatic episodes.

**INTERPRETATION OF CULTURE RESULTS:**

- Single organism ≥ 10³ colony forming units (CFU)/mL indicates UTI. In supra-pubic aspirates any growth is significant.
- All children need clinical assessment for risk factors: If risk factors or non-E coli UTI, renal imaging needed (NICE page 12).
- White blood cells: In children pyuria may be absent or, in contrast, present due to fever without UTI.
Local adaptation:
- We would discourage major changes to the guidance but the Word format allows minor changes to suit local service delivery and sampling protocols.
- To create ownership agreement on the guidance locally, dissemination should be taken forward in close collaboration between primary care clinicians, laboratories and secondary care providers.

Grading of guidance recommendations

In the development of this guidance a full Medline search for recent articles since the last review in 2008 was undertaken, other searches were undertaken at the discretion of the experts and development team. The guidance has been reviewed by members of CKS, The BIA, BSAC, RCGP and The Department of Health Antimicrobial Resistance and Health Care Associated Infections Advisory Group. It is in line with CKS, SIGN & NICE.

The strength of each recommendation is qualified by a letter in parenthesis.

<table>
<thead>
<tr>
<th>Study design</th>
<th>Recommendation grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good recent systematic review of studies</td>
<td>A+</td>
</tr>
<tr>
<td>One or more rigorous studies, not combined</td>
<td>A-</td>
</tr>
<tr>
<td>One or more prospective studies</td>
<td>B+</td>
</tr>
<tr>
<td>One or more retrospective studies</td>
<td>B-</td>
</tr>
<tr>
<td>Formal combination of expert opinion</td>
<td>C</td>
</tr>
<tr>
<td>Informal opinion, other information</td>
<td>D</td>
</tr>
</tbody>
</table>

We welcome, in fact encourage, opinions on the advice given and future topics we should cover. We would be most appreciative if you could email any evidence or references that support your requests for change so that we may consider them at our annual review. Comments should be submitted to Dr Cliodna McNulty, Head, PHE Primary Care Unit, Microbiology Laboratory, Gloucestershire Royal Hospital, Great Western Road, Gloucester GL1 3NN. Email: Katherine.Butler@phe.gov.uk

REFERENCES

**Adult women — acute uncomplicated UTI**

- Affects up to 15% of women each year. 1
- **Routine urine culture is unnecessary.** 2,3C
- Use symptoms, urine appearance and dipstick tests to diagnose UTI to reduce antibiotic use & laboratory investigations 1,4B+ as 50% of women with symptoms of UTI have negative culture. 2,3C
- The presence of **vaginal discharge** reduces the likelihood of UTI to about 20% 5 - consider STIs and vulvovaginitis.


2. SIGN. Management of suspected bacterial urinary tract infection in adults: a national clinical guideline. **Scottish Intercollegiate Guidelines Network. 2006** [http://www.sign.ac.uk/guidelines/fulltext/88/index.html](http://www.sign.ac.uk/guidelines/fulltext/88/index.html) (Accessed 2nd March 2011). *Diagnosis in women; expert consensus is that it is reasonable to start empirical antibiotics in women with symptoms of UTI without urine dipstick or urine culture. Expert consensus is that in women with symptoms of vaginal itch or discharge, alternative diagnoses to UTI should be explored. Based on evidence from poor quality RCTs, the SIGN guideline group recommended that dipstick tests should only be used to diagnose bacteriuria in women with limited symptoms and signs (no more than two symptoms).*


4. Little P, Turner S, Rumsby K., Warner G, Moore M, Lowes JA, Smith H, Hawke C, Turner D, Leydon GM, Arscott A, Mullee M. Dipsticks and diagnostic algorithms in urinary tract infection: development and validation, randomised trial, economic analysis, observational cohort and qualitative study. Health Technology Assessment 2009;13(19):1-96. *Predictive rules validation study; in women with uncomplicated UTI, the negative predictive value when nitrite, leucocytes, and blood are ALL negative was 76%. The positive predictive value for having nitrite and EITHER blood or leucocytes was 92%. When clinical variables were examined, the positive predictive value was 82% for women with all three of cloudy urine, dysuria, and nocturia. The negative predictive value was 67% for none of these three features. When individual clinical features were considered alone, cloudy urine or dysuria were predictive of UTI, but nocturia or smelly urine were not.*

5. Bent S, Nallamothu BK, Simel DL, Stephan DF, Saint S. Does this woman have an acute uncomplicated urinary tract infection? JAMA 2002;297:2701-10. *A systematic review of diagnostic studies found that the presence of vaginal discharge or vaginal irritation substantially reduces the probability of UTI, to around 20%.*
1. SIGN. Management of suspected bacterial urinary tract infection in adults: a national clinical guideline. *Scottish Intercollegiate Guidelines Network* 2006. http://www.sign.ac.uk/guidelines/fulltext/88/index.html (Accessed 2nd March 2011). Asymptomatic bacteriuria in the elderly: elderly women and men with should not receive antibiotic treatment for asymptomatic bacteriuria. There is evidence that mortality and the number of symptomatic episodes are not reduced, but for every three people given antibiotics, one will experience adverse effects (such as rash or GI symptoms), NNH = 3.

2. Abrutyn E, Mossey J, Berlin JA, Boscia J, Levison M, Pitsakis P, Kaye D. Does asymptomatic bacteriuria predict mortality and does antimicrobial treatment reduce mortality in elderly ambulatory women? *Ann Int Med* 1994:827-33. This cohort study found that asymptomatic bacteriuria occurs in 25% of women >65years and 10% of men >65years. However, it was not a risk factor for mortality in elderly women without catheters. Those with asymptomatic bacteriuria were subsequently randomized to treatment or no treatment. There was no difference in the risk of mortality between the treated and untreated groups.

3. Rodgers M, Nixon J, Hempel S, Aho, T. Kelly J, Neal D, Duffy S, Ritchie G, Kleijnen J and Westwood M. Diagnostic tests and algorithms used in the investigation of haematuria: systematic reviews and economic evaluation. *Health Technology Assessment* 2006:10: no 18. http://www.hta.ac.uk/project/1363.asp (Accessed 2nd March 2011) This systematic review found that it was not possible to define the most effective diagnostic strategy for the investigation of microscopic and macroscopic haematuria in adults as insufficient data were currently available. The detection of microhaematuria was not found to be a useful test to either rule in or rule out the presence of a significant underlying pathology such as urinary calculi or bladder cancer. An algorithm was therefore developed by expert consensus (see the Appendices of the systematic review) to guide further investigations.

4. Bulloch B, Bausher JC, Pomerantz WJ, Connors JM, Mahabee-Gittens M, Dowd MD. Can urine clarity exclude the diagnosis of urinary tract infection? *Pediatrics* 2000;106:60-63. This was a prospective cohort of 159 children (aged from 4 weeks to 19 years) presenting to an emergency department with possible UTI. Catheterized or midstream clean-catch urine specimens were collected for culture. The finding of clear urine on visual inspection had a negative predictive value of 97.3%.

5. Flanagan PG, Davies EA, Rooney PG, Stout RW. Evaluation of four screening tests for bacteriuria in elderly people. *Lancet* 1989;1:1117-19. This was a prospective cohort of urine sample from 418 elderly people admitted to hospital for any reason. A clear urine sample had a negative predictive value of 91.2%.

6. Phillips G, Fleming LW, Khan I and Stewart WK. Urine transparency as an index of absence of infection. *British Journal of Urology* 1992;70:191-95. This was a prospective cohort of urine samples from 363 adults attending a nephrology clinic over a 6-month period. A clear urine sample had a negative predictive value of 97%.

7. Czerwinski AW, Wilkerson RG, Merrill JA, Braden B et al. Further evaluation of the Griess test to detect significant bacteriuria. *Part II* Am J Obstet Gynaecol 1971;110:677-81. Nitrite is produced by the action of bacterial nitrate reductase in urine. As contact time between bacteria and urine is needed, morning specimens are most reliable. Early morning urine gives more accurate nitrite results, as bacteria must be in contact with the urine for sufficient time to allow reduction of nitrates to nitrates.

8. Bulloch B, Bausher JC, Pomerantz WJ, Connors JM, Mahabee-Gittens M, Dowd MD. Can urine clarity exclude the diagnosis of urinary tract infection? *Pediatrics* 2000;106:60-63. This was a prospective cohort of 159 children (aged from 4 weeks to 19 years) presenting to an emergency department with possible UTI. Catheterized or midstream clean-catch urine specimens were collected for culture. The finding of clear urine on visual inspection had a negative predictive value of 97.3%.


10. European Urinalysis Guidelines. Eds. Kouri T, Flogazzi G, Gant V, Hallender H. Hofmann W, Guder WG Scand J Clin Lab Invest 2000;60:1-96. Very extensive guidelines (aimed at laboratory staff) for interpretation of urine culture and microscopy. Reasons for false positive and negative results: see page 34. Other causes of leucocytes in urine: Leucocyte esterase detects intact and lysed leucocytes produced in inflammation. Neutrophils are found in UTI and also glomerulonephritis, interstitial nephritis and aseptic cystitis. The appearance of lymphocytes in urine is associated with chronic inflammatory conditions, viral diseases and renal transplant rejection. Macrophages are also suggested to reflect inflammatory activity of renal disease. Other causes of haematuria: haematuria remains a major sign of urinary tract and renal disease. It may also reflect a general bleeding tendency, or be caused by strenuous exercise or menstruation. Other causes of proteinuria: protein is found in UTI and also in bladder or prostatic disease, and in vaginal discharge. Intermittent proteinuria may be due to fever, exercise, epileptic seizure, congestive heart failure, or be orthostatic (occurs in the upright position only). Persistent proteinuria can be due to rhabdomyolysis, acute haemolysis, IGA nephropathy, drug-induced nephropathy.
3. Nicolle LE, Mayhew WJ and Bryan L. Prospective randomized comparison of therapy and no therapy for asymptomatic bacteriuria in institutionalized elderly women. *The American Journal of Medicine* 1987;83:27-33. There was no difference in morbidity or mortality in those randomised to antibiotics or no antibiotics (50 participants). However, antibiotic treatment was associated with an increased risk of adverse effects.


5. Loeb M, Bentley DW, Bradley S, Crossley K, Garibaldi R, Gantz N, McGeer A, Muder RR, Mylotte J, Nicolle LE, Nurse B, Paton S, Simor AE, Smith P, Strausbaugh L. Development of minimum criteria for the initiation of antibiotics in residents of long-term care facilities: results of a consensus conference. *Infection control and hospital epidemiology* 2001;22:120-124. *Elderly people: expert consensus is that the minimum criteria for initiating antibiotics for bacteriuria include acute dysuria alone or fever and at least one of the following: new or worsening urgency, frequency, suprapubic pain, new costovertebral angle tenderness, or urinary incontinence. People with an indwelling catheter: expert consensus is that the minimum criteria for initiating antibiotics for bacteriuria include the presence of at least one of the following: fever, new costovertebral tenderness, rigors, or new onset delirium.*

6. Tenke P, Kovacs B, Bjerkandl Johansen TE, Matsumoto T, Tambyah PA, and Naber KG. European and Asian guidelines on management and prevention of catheter-association urinary tract infections. *International Journal of Antimicrobial Agents* 2008;31S:S68-S78 *When to send samples for culture: a sample is only needed if the person is symptomatic. Asymptomatic bacteriuria is common, but should not generally be treated because bacteriuria will either not be eradicated or will return rapidly, and antibiotic treatment will contribute to antibiotic resistance and cause adverse effects. Antibiotic treatment is recommended only in symptomatic infection. Systemic antibiotics should be used for catheterised patients who are febrile and appear to be ill. Catheter change before treating symptomatic infection: owing to the likelihood of bacteria sequestered in a biofilm on the catheter surface, expert opinion is that it may be reasonable to replace or remove the catheter (if the indwelling catheter has been in place for more than 7 days) before the therapy of symptomatic catheter-associated bacteriuria.*

7. Tambyah PA, Maki DG. The relationship between pyuria and infection in patients with indwelling urinary catheters: a prospective study of 761 patients. *Archives of Internal Medicine.* 2000;160:673-77. Pyuria is common in catheterised patients and it has no predictive value in this population. Dipstick testing should not, therefore, be used to diagnose UTI in catheterised patients.

8. Raz R, Schiller D, Nicolle LE. Chronic indwelling catheter replacement before antimicrobial therapy for symptomatic urinary tract infection. *Journal of Urology.* 2000;164:1254-58. *This small (n = 54) randomized, open trial found that urine culture 72 hours after starting antibiotic treatment was more likely to be negative in people whose indwelling catheters were changed at the start of treatment (89%; 24 of 27) compared with those whose catheters were not changed (30%; 8 of 27), p = 0.001.*


**Laboratory testing for culture and sensitivity**

1. SIGN. Management of suspected bacterial urinary tract infection in adults: a national clinical guideline. *Scottish Intercollegiate Guidelines Network.* 2006 [http://www.sign.ac.uk/guidelines/fulltext/88/index.html](http://www.sign.ac.uk/guidelines/fulltext/88/index.html) (Accessed 2nd March 2011). *Screening for bacteriuria during pregnancy: there is evidence from a systematic review that dipstick testing is not sufficiently sensitive to be used as a screening test in pregnancy. Expert consensus is that urine culture should be performed routinely at the first antenatal visit. Women with bacteriuria should have a second urine culture. If bacteriuria is confirmed by the second culture, give antibiotics and repeat urine culture at each antenatal visit until delivery. Women who do not have bacteriuria in the first trimester should not have repeat urine cultures unless symptomatic. Diagnosis in men: a urine sample is recommended because UTI in men is generally regarded as complicated (it results from anatomic or functional abnormality) and there are no studies on the predictive values of dipstick testing in men.*


5. Costello C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients; systematic review and meta-analysis. British Medical Journal 2010; 340: c2096. This systematic review found that individuals prescribed an antibiotic in primary care for a respiratory or urinary infection develop bacterial resistance to that antibiotic. The effect is greatest in the month immediately after treatment, but may persist for up to 12 months. In five studies of urinary tract bacteria (14,348 participants), the pooled odds ratio for bacterial resistance was 2.5 (95% CI 2.1 to 2.9) within 2 months of antibiotic treatment, and 1.33 (1.2 to 1.5) within 12 months of treatment.

6. Vellinga A, Cormican M, Hanahoe B, Murphy AW. Predictive value of antimicrobial susceptibility from previous urinary tract infection in the treatment of re-infection. British Journal of General Practice 2010;60:511-513. Analysis of susceptibility results from 3,413 patients who provided at least two E. coli positive urine samples over the study period found that if resistance to ampicillin, trimethoprim, or ciprofloxacin was detected, a recurrent UTI within 3 months of this sample is likely to be associated with an organism that is still resistant. However, if resistance to nitrofurantoin was detected, a recurrent UTI within 3 months has only a 1 in 5 chance of being a resistant organism. If the organism was susceptible to nitrofurantoin, ciprofloxacin, or trimethoprim, then a recurrent UTI within 12 months is likely to still be susceptible.

7. Naber KG, Schito G, Botto H, Palou J, Mazzei T. Surveillance study in Europe and Brazil on clinical aspects and Antimicrobial Resistance epidemiology in Females with Cystitis (ARESC): implications for empiric therapy. European Urology 2008;54:1164-1175. In all countries, susceptibility rate to E. coli above 90% (p < 0.0001) was found only for fosfomycin, mecillinam, and nitrofurantoin.


9. Falagas ME, Vouloumanou EK, Togias AG, Karadima M, Kapaskelis AM, Rafailidis PI, Athanasiou S. Fosfomycin versus other antibiotics for the treatment of cystitis: a meta-analysis of randomized controlled trials. J. Antimicrob. Chemother. 2010; 65 (9):1862-1877. doi: 10.1093/jac/dkq237. In this meta-analysis including 27 trials, 848 women received fosfomycin and 754 comparative agents. Efficacy of fosfomycin was similar to all the comparator agents including fluoroquinolones and trimethoprim. 5 of the 27 trials included 502 pregnant women in which side effects for fosfomycin were lower than for non-pregnant women. RR0.35 CI 0.12-0.97.

Sampling technique in men and women

1. HPA. Investigation of Urine. Health Protection Agency. National Standard Method BSOP 41. 2009 http://www.hpa-standardmethods.org.uk/documents/bsop/pdf/bsop41.pdf (Accessed 2nd March 2011) Midstream urines are recommended for routine use. Delays and storage at room temperature allow organisms to multiply, which may generate false positive results. Where delays in processing are unavoidable, refrigeration is recommended. Use of a boric acid preservative may also be useful. Boric acid preservative holds the bacterial population steady for 48-96 hours. Toxicity to some organisms has been reported, but this often reflects under filling of the container.


3. Lifshitz E and Kramer L. Outpatient urine culture: does collection technique matter? Archives of Internal Medicine 2000;150: 2537-40. This randomized study of 242 women who presented with symptoms suggestive of UTI found that there was no difference in contamination rates between samples obtained with no technique (not mid-stream and no cleansing; 29% contaminated; n = 77), samples obtained midstream with perineal cleansing and spreading of the labia (32% contaminated, n = 84), and samples obtained midstream with perineal cleansing and a vaginal tampon in place (31% contaminated, n = 81).

4. Baerheim A, Digraines A, Hunsakaar S. Evaluation of urine sampling technique: bacterial contamination of samples from women students. Br J Gen Pract 1992;42:241-243. This prospective study obtained a series of urine samples (a new sample was obtained each day for 8 days, using a different set of instructions each day) from 111 healthy young women. There was no statistically significant difference in contamination rates between the following techniques: no precautions (31%), midstream sample (23.9%), midstream sample with perineal cleansing (20.4%), midstream and holding labia apart (21.1%). However, holding the labia apart as the sole technique was associated with a lower contamination rate (13%) in this study.

5. Leisure MA, Dudley SM, Donowitz LG. Does a clean-catch sample reduce bacterial contamination? New England Journal of Medicine 1993;328:289-90. A midstream urine specimen and a midstream urine specimen with prior cleansing were obtained during consecutive urinations in a series of 105 asymptomatic female health care workers. Sixty four percent of samples obtained by each method were found to be contaminated.
6. Roberts AP, Robinson IE, Beard KW. Some of the factors affecting bacterial colony counts in urinary infection. BMJ 1967;1:400-3. Suprapubic specimens and midstream samples taking using perineal cleansing with chlorhexidine were both taken from a series of 20 women presenting with suspected UTI. The colony count was reduced in 12 of the midstream plus chlorhexidine cleaning samples compared with the suprapubic sample from the same woman.


Interpretation of culture result in adults

1. European Urinalysis Guidelines. Eds. Kouri T, Flogazzi G, Gant V, Hallender H, Hofmann W, Guder WG Scand J Clin Lab Invest 2000;60:1-96. Laboratory decision-limits for significant bacteriuria; see section 7.2.3, page 29. The cut-offs for symptomatic urinary tract infection caused by primary pathogens (E. coli and S. saprophyticus) are set by the European Confederation of Laboratory Medicine at ≥ 10⁵ CFU/mL in mid-stream urine specimens. For secondary pathogens (such as Enterobacter species, Enterococcus species, Klebsiella species, P. mirabilis, P. aeruginosa etc) cuts off are set as ≥ 10⁶ CFU/mL for women and ≥ 10⁵ CFU/mL for men.

Evaluating urine culture findings has long been dominated by Kass’s criteria for significant bacteriuria. Kass found that 95% of women with pyelonephritis had ≥ 10⁵ CFU/L (≥ 10⁵ CFU/mL) or one bacterial species in a clean-catch mid-stream urine, and that such a finding in two consecutive mid-stream urine specimens in asymptomatic women would, with 95% probability, give the same result in a third mid-stream urine specimen (Kass EH. Trans Assoc Am Phys 1956; 69: 56-63; Kass EH. In: Quinn Biology of pyelonephritis. Boston: Little & Brown; 1960. p. 399-412.). Kass also showed that <10⁵ CFU/L indicated contamination during sample collection, whereas bacterial concentration in the interval of 10⁵ - <10⁶ CFU/L was difficult to interpret. Despite the fact that the criteria were developed for acute pyelonephritis and asymptomatic bacteriuria in women, they began to be used generally, even for symptomatic lower urinary tract infection.

Stamm et al examined 187 sexually active young women with dysuria and urinary urgency (Stamm WE et al. N Engl J Med 1982; 307: 462-8). Cultures of mid-stream urine samples were compared to urine cultures obtained through suprapubic aspiration or urethral catheterisation. Enterobacteriaceae were isolated from bladder urine in 98 (52%) women. S. saprophyticus, S. aureus and enterococci were cultured in 26 (14%). The women who had ‘coliform’ bacteria in bladder urine were further analysed regarding the number of CFU/L. If 10⁵ CFU/L mid-stream urine was used as a cut-off for ‘significant’ bacteriuria, the sensitivity was 51% and the negative predictive value was 65%. If, on the other hand, a cut-off of 10⁶ CFU/L mid-stream urine was used, the sensitivity was 95% with a negative predictive value of 94%, whereas specificity declined from 99% to 85%. Thus, low cut-off of ‘coliform’ bacteria in mid-stream urine more accurately predicted bladder infection in symptomatic women than in asymptomatic. Many additional studies support the observation that low bacterial concentrations of E. coli in particular have diagnostic relevance, even in mixed flora. Findings of E. coli have been interpreted as the first phase in urethritis in an ascending infection.

2. HPA. Investigation of Urine. Health Protection Agency. National Standard Method BSOP 41. 2009 http://www.hpa-standardmethods.org.uk/documents/bsonp/pdf/bsop41.pdf (Accessed 2nd March 2011). White blood cells; significant pyuria is defined by the HPA as ≥ 10³ WBC/mL, although higher numbers are often found in healthy, asymptomatic women. A level of ≥ 10³ WBC/mL has been suggested to be more appropriate for discriminating infection. Sterile pyuria (i.e. pyuria in the presence of no growth on routine culture media) may be the result of many factors including genital tract infection, infection with C. trachomatis, infection with a fastidious organism, prior treatment with an antibiotic, renal calculi, bladder neoplasm, catheterisation, renal tuberculosis, or lysis of WBC in alkaline urine (as occurs in infections with Proteus species).

3. Joint consensus statement on the initial assessment of haematuria. Renal Association & British Association of Urological Surgeons. July 2008, http://www.renal.org/Librarys/Other_guidelines/haematuria_RA-BAUS_consensus_guideline_2008.sflb.ashx This joint working party agreed that urine testing for haematuria should only be performed for identifiable clinical reasons; there is currently no evidence to support opportunistic screening of the general population. Urine dipstick of a fresh voided urine sample, containing no preservative, is considered a sensitive means of detecting the presence of haematuria. Significant haematuria is considered to be 1+ or greater. Trace haematuria should be considered negative. Routine microscopy for confirmation of dipstick haematuria is not necessary. Significant haematuria is diagnosed if there is any single episode of visible haematuria; any single episode of symptomatic non-visible haematuria (in absence of UTI or other transient causes); persistent (2 out of 3 dipsticks positive) asymptomatic non-visible haematuria (in absence of UTI or other transient causes). Haematuria in association with UTI is not uncommon. Following treatment of UTI, a dipstick should be repeated to confirm the post-treatment absence of haematuria. Other causes of transient haematuria include exercise induced haematuria, rarely myoglobinuria and menstruation.

Refer to urology: All patients with visible haematuria (any age). All patients with s-NVH (any age). All patients with a-NVH aged ≥ 40 yrs.

Children

1. NICE. Urinary tract infection in children. Diagnosis, treatment and long-term management. Clinical guideline 54. 2007 http://guidance.nice.org.uk/CG54 (Accessed 2nd March 2011). Urine culture: evidence from systematic reviews is that urgent microscopy and culture is the preferred method of diagnosis in children aged 3 months to 3 years of age. However, antibiotics should be started while awaiting results of MSU in children with specific urinary symptoms. In those without specific urinary symptoms, use positive nitrite on dipstick testing to start empirical antibiotics. Evidence from systematic reviews is that, in children over the age of 3 years dipstick testing is as useful as culture. MSU is only needed in this age group if UTI is
recurrent, or the child has a high or intermediate risk of serious illness, or if only one of nitrite or leucocyte esterase is positive. Children under 3 months of age: expert opinion is that children under 3 months of age with suspected UTI should be referred urgently for assessment.


Sampling technique in children

1. Rees JC, Vernon S, Pedler SJ, Coulthard MG. Collection of urine from washed-up potties. *Lancet* 1996;348:197. *This study tested four methods of cleaning the potty to reduce faecal contamination of the sample. Washing potties using washing up liquid with hot water at 60°C before taking a urine specimen was the most effective method of reducing faecal contamination. Cleaning potties with Dettol or bleach were less successful.*

2. NICE. Urinary tract infection in children. Diagnosis, treatment and long-term management. Clinical guideline 54. 2007 *http://guidance.nice.org.uk/CG54* (Accessed 2nd March 2011). This guideline reviews all the evidence around sample collection in children, and suggests that clean catch and supra-pubic aspirate provide the most diagnostically accurate samples.

3. Lynster LCT, Nayar DM, Pedler SJ, Coulthard MG. Home collection of urine for culture from infants by three methods. Survey of parents’ preferences and bacterial contamination rates. *BMJ* 2000;320:1312-3. *In this series of 44 infants, parents collected three urine samples using a urine pad, bag, and clean-catch method (in a randomized order). Urine contamination levels were similar between pads (16%) and bags (18%) but lower with clean catch (2%). Parents disliked the clean-catch method (requiring nursing the infant with a bottle ready until they wee, which is both time consuming and messy). Parents found pads and bags easy to use, and preferred them to clean catch. The pad was considered comfortable. However, the bag was distressing, particularly on removal, often leaking and leaving red marks.*

4. Rao S, Bhatt J, Houghton C, Macfarlane P. An improved urine pad collection method: a randomised clinical trial. *Arch Dis Child* 2004;89:773-775. *Febrile children under the age of two were randomized to either the same urine collection pad kept in the nappy until urine was passed, or to urine collection pads to be changed every 30 minutes until a urine was passed. From 80 children enrolled, a satisfactory sample was obtained from 68 of them (12 samples were unusable because of faecal soiling). Heavy mixed growth (indicating contamination) occurred in 3% of the replaced urine collection pad group (1 of 31) compared with 29% (10 of 35) in the single urine collection pad group, *p = 0.008.*

Interpretation of culture result children

1. European Urinalysis Guidelines. Eds. Kouri T, Flogazzi G, Gant V, Hallender H, Hofmann W, Guder WG *Scand J Clin Lab Invest* 2000;60:1-96. *Laboratory decision-limits for significant bacteriuria: see section 7.2.3, page 29. The cut-offs for symptomatic urinary tract infection caused by primary pathogens (E. coli and *S. saprophyticus*) are set by the European Confederation of Laboratory Medicine at ≥ 10⁴ CFU/mL in mid-stream urine specimens. For secondary pathogens (such as Enterobacter species, Enterococcus species, Klebsiella species, *P mirabilis*, *P aeruginosa* etc) cuts off are set as ≥ 10¹ CFU/mL for women and ≥ 10² CFU/mL for men.*

2. HPA. Investigation of Urine. *Health Protection Agency. National Standard Method BSOP 41. 2009* *http://www.hpa-standardmethods.org.uk/documents/bsop/pdf/bsop41.pdf* (Accessed 2nd March 2011). *White blood cells: significant pyuria is defined by the HPA as ≥ 10⁴ WBC/mL, although higher numbers are often found in healthy, asymptomatic women. A level of ≥ 10⁴ WBC/mL has been suggested to be more appropriate for discriminating infection. Sterile pyuria (i.e. pyuria in the presence of no growth on routine culture media) may be the result of many factors including genital tract infection, infection with *C. trachomatis*, infection with a fastidious organism, prior treatment with an antibiotic, renal calculi, bladder neoplasm, catheaterisation, renal tuberculosiis, or lysis of WBC in alkaline urine (as occurs in infections with Proteus species).*


Other general reading on laboratory diagnosis of UTI


Treatment advice can be found on our website: *http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1194947333801* (Accessed 20th February 2012)