

South Australian Paediatric Clinical Practice Guidelines

Urinary Tract Infection in Children

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Note:

This guideline provides advice of a general nature. This statewide guideline has been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. The guideline is based on a review of published evidence and expert opinion.

Information in this statewide guideline is current at the time of publication.

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Health practitioners in the South Australian public health sector are expected to review specific details of each patient and professionally assess the applicability of the relevant guideline to that clinical situation.

If for good clinical reasons, a decision is made to depart from the guideline, the responsible clinician must document in the patient's medical record, the decision made, by whom, and detailed reasons for the departure from the guideline.

This statewide guideline does not address all the elements of clinical practice and assumes that the individual clinicians are responsible for discussing care with consumers in an environment that is culturally appropriate and which enables respectful confidential discussion. This includes:

- The use of interpreter services where necessary,
- Advising consumers of their choice and ensuring informed consent is obtained,
- Providing care within scope of practice, meeting all legislative requirements and maintaining standards of professional conduct, and
- Documenting all care in accordance with mandatory and local requirements

Explanation of the aboriginal artwork:

The aboriginal artwork used symbolises the connection to country and the circle shape shows the strong relationships amongst families and the aboriginal culture. The horse shoe shape design shown in front of the generic statement symbolises a woman and those enclosing a smaller horse shoe shape depicts a pregnant woman. The smaller horse shoe shape in this instance represents the unborn child. The artwork shown before the specific statements within the document symbolises a footprint and demonstrates the need to move forward together in unison.



Cultural safety enhances clinical safety.

To secure the best health outcomes, clinicians must provide a culturally safe health care experience for Aboriginal children, young people and their families. Aboriginal children are born into strong kinship structures where roles and responsibilities are integral and woven into the social fabric of Aboriginal societies.

Australian Aboriginal culture is the oldest living culture in the world, yet Aboriginal people currently experience the poorest health outcomes when compared to non-Aboriginal Australians.

It remains a national disgrace that Australia has one of the highest youth suicide rates in the world. The over representation of Aboriginal children and young people in out of home care and juvenile detention and justice system is intolerable.

The cumulative effects of forced removal of Aboriginal children, poverty, exposure to violence, historical and transgenerational trauma, the ongoing effects of past and present systemic racism, culturally unsafe and discriminatory health services are all major contributors to the disparities in Aboriginal health outcomes.

Clinicians can secure positive long term health and wellbeing outcomes by making well informed clinical decisions based on cultural considerations.

The term 'Aboriginal' is used to refer to people who identify as Aboriginal, Torres Strait Islanders, or both Aboriginal and Torres Strait Islander. This is done because the people indigenous to South Australia are Aboriginal and we respect that many Aboriginal people prefer the term 'Aboriginal'. We also acknowledge and respect that many Aboriginal South Australians prefer to be known by their specific language group(s).



Urinary Tract Infection (UTI) in Children

Purpose and Scope of PCPG

The Urinary Tract Infection (UTI) in Children Paediatric Clinical Practice Guideline (PCPG) main focus is on the management of bacterial UTI and is primarily aimed at medical staff working in any of the primary care, local, regional, general or tertiary hospitals. It may however assist the care provided by other clinicians such as nurses.

The information is current at the time of publication and provides a minimum standard for the assessment (including investigations) and management of UTI in children; it does not replace or remove clinical judgement or the professional care and duty necessary for each specific case.

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Urinary Tract Infection (UTI) in Children

Important points

- > Urinary tract infections (UTIs) in childhood are common and can be potentially serious in the first few years of life.
- > An estimated 2% of boys and 8% of girls will experience a UTI by seven years of age.
- > The diagnosis of UTI should be considered in infants and young children with non-specific symptoms and in all febrile infants and young children especially those without focus.
- > Children and infants who are seriously unwell require IV antibiotics.
- > Infants under 3 months with suspected UTI should be considered for admission and IV antibiotics, even if not seriously unwell.
- > Urine samples should be collected prior to starting antibiotics unless the child is **seriously** unwell and requires **immediate** IV therapy.
- > Microscopy of uncontaminated urine which shows pyuria +/- bacteriuria followed by culture is the gold standard in diagnosis of UTI.
- > Admitted children with UTI who presented severely unwell or with atypical UTI should have a renal ultrasound prior to discharge to exclude renal tract obstruction or abnormality.
- > Children with recurrent or atypical UTI require further investigation of their renal tract.
- > Post-treatment urine culture to confirm resolution of infection for asymptomatic children is not routinely indicated.

Abbreviations

CCU	Clean catch urine specimen
CFU	Colony forming unit
CRP	C reactive protein
CSU	Catheter specimen of urine
DMSA	Dimercaptosuccinic acid
EUC	Electrolytes, urea and creatinine
<i>E coli</i>	<i>Escherichia coli</i>
FBC	Full blood count
IV	Intravenous
MCU	Micturating cystourethrogram
MSU	Mid-stream urine specimen
PCR	Polymerase chain reaction
SPA	Suprapubic aspirate
STI	Sexually transmitted infection
UTI	Urinary tract infection
UTIs	Urinary tract infections
VUR	Vesicoureteric reflux

Urinary Tract Infection (UTI) in Children

Definition

Urinary tract infection (UTI) refers to infection in the bladder (cystitis), or kidneys and ureters (pyelonephritis). UTI in children is commonly acute pyelonephritis; it is difficult to distinguish pyelonephritis from cystitis, particularly in infants.

In older children, if the child has bacteriuria and localising symptoms (such as dysuria, frequency, urgency or lower abdominal discomfort), and does not have fever (38°C or higher) or loin pain or tenderness, treat as acute cystitis. If the child has bacteriuria and either fever (38°C or higher) or loin pain or tenderness, treat as acute pyelonephritis.

Pyelonephritis is considered non-severe if the child does not have systemic features (e.g. tachycardia, nausea, vomiting), or sepsis or septic shock. Pyelonephritis is considered severe in the presence of these features.

Pyuria and/or bacteriuria is the presence of white cells and/or bacteria in the urine with or without urinary tract infection ([see Interpretations of results](#)).

Atypical UTI includes any of the following:

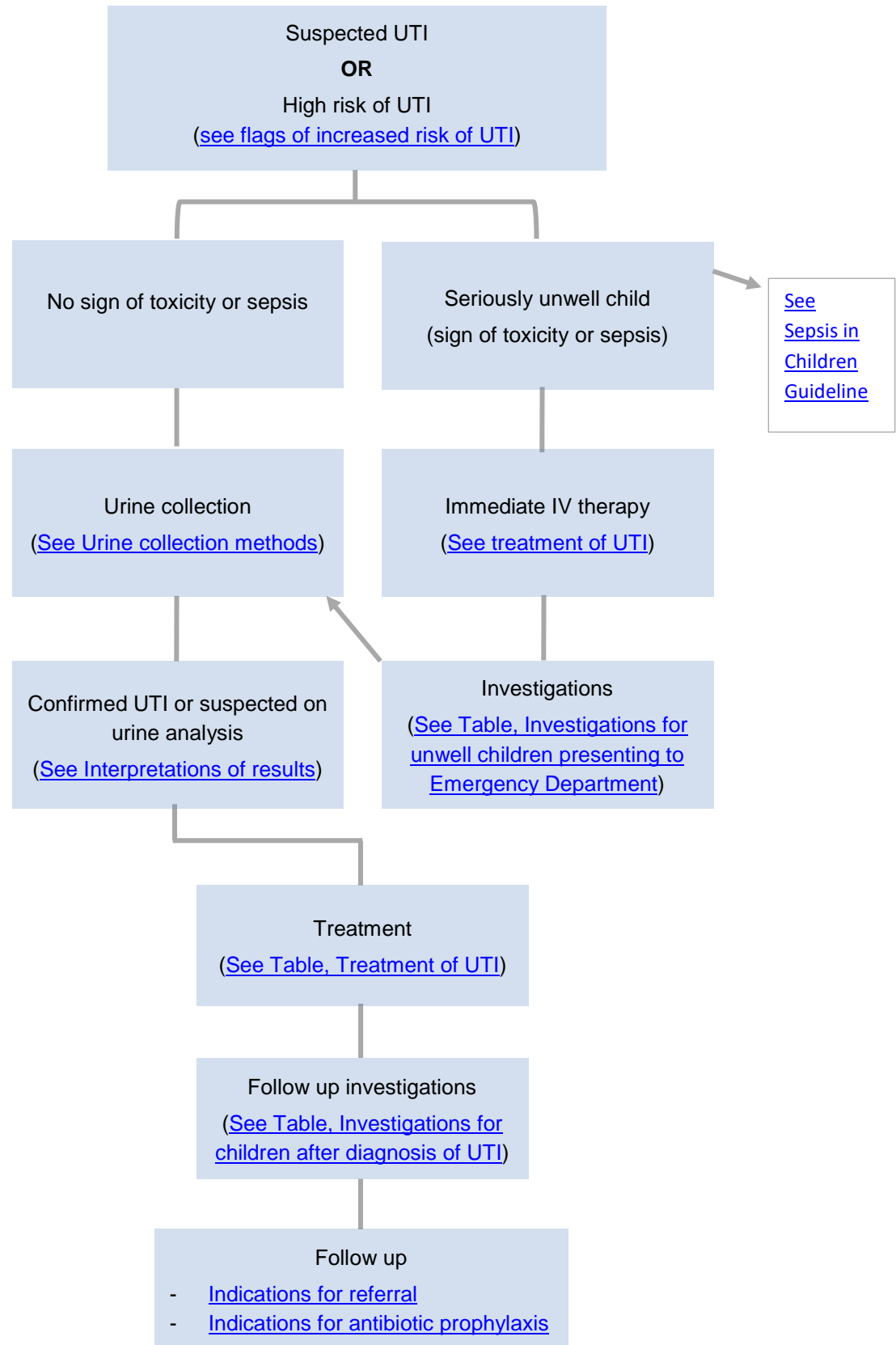
- > Aged less than 3 months
- > Any seriously ill child or septicaemia
- > History of poor urine flow or history of abnormal urinary tract on antenatal ultrasound
- > Abdominal or bladder mass palpable
- > Raised creatinine
- > Failure to respond to suitable antibiotics within 48 hours
- > Infection with uncommon organisms, i.e. non *E. coli* organisms.

Recurrent UTI is defined as children who have either:

- > Two or more UTIs with acute pyelonephritis, or
- > One episode of acute pyelonephritis and one or more UTI with cystitis, or
- > Three or more UTIs with cystitis.

Urinary Tract Infection (UTI) in Children

Flowchart



Urinary Tract Infection (UTI) in Children

Summary of Practice Recommendations

Assessment

Diagnosing a UTI in young children can be challenging as symptoms can be non-specific. The clinical features on history are variable and age-dependent:

Symptoms that might be present on presentation		
< 3 months	3 months – 3 years	≥ 3 years
Fever Vomiting Lethargy Irritability Poor feeding Failure to thrive Jaundice Haematuria Offensive urine	Fever Abdominal pain Loin tenderness Vomiting Poor feeding Lethargy Irritability Haematuria Offensive urine Failure to thrive	Urinary frequency Dysuria Dysfunctional voiding Changes to continence Abdominal pain Loin tenderness Fever Malaise Vomiting Haematuria Offensive urine Cloudy urine

History should also include specific **flags of increased risk of UTI** such as:

- > Congenital genitourinary tract malformations (i.e. ask about antenatal ultrasound)
- > Spina bifida or other causes of neurogenic bladder
- > Phimosis or labial adhesion
- > Bladder or bowel dysfunction
- > Previous history of recurrent UTIs
- > Abnormal urine stream/ flow i.e. dribbling or straining (might suggest obstruction)
- > Surgical alterations to urinary tract.

Examination

- > No physical sign is pathognomonic for a UTI
- > Examination may be normal (except fever)
- > Assess for sepsis (refer to the 'Sepsis' guideline under *Paediatric Clinical Guidelines* available at <https://extapps2.sahealth.sa.gov.au/PracticeGuidelines/>)
- > Lower abdominal or loin tenderness may be present
- > Non-specific findings include dehydration and lethargy
- > Abdominal examination may identify a palpable mass
- > Examine external genitalia to identify a genitourinary abnormality predisposing to UTI
- > Lower limb neurological examination should be considered if impaired bladder emptying
- > Don't forget to check blood pressure.

Urinary Tract Infection (UTI) in Children

- > Refer to the 'Sepsis' guideline under *Paediatric Clinical Guidelines* available at <https://extapps2.sahealth.sa.gov.au/PracticeGuidelines/> for a child presenting with toxic features including tachypnoea, increased work of breathing, grunt, weak cry, marked/persistent tachycardia, moderate to severe dehydration.
- > Refer to the 'Fever' guideline under *Paediatric Clinical Guidelines* available at <https://extapps2.sahealth.sa.gov.au/PracticeGuidelines/> for the assessment of children with a fever $\geq 38^{\circ}\text{C}$ without localising signs. In general, the younger the infant or child is, the lower the threshold for urine screening.

Diagnosis of UTI

Microscopy of **uncontaminated** urine which shows pyuria +/- bacteriuria followed by culture is the gold standard in diagnosis of UTI.

Urine collection methods

Collection method	Utility	Notes
Supra-pubic bladder aspiration (SPA)	<ul style="list-style-type: none"> • age < 6 months and toxic • phimosis or labial adhesion 	<ul style="list-style-type: none"> • invasive • gold standard as lowest contamination rate • success rate varies (23 - 90%) depending on operator, use of ultrasound and the presence of at least 20mL of urine • ultrasound significantly increases success rate
Urethral catheterisation (CSU) "in-out catheter"	<ul style="list-style-type: none"> • age > 6 months and toxic • age < 6 months and toxic with failed SPA • where CCU/MSU not possible/failed 	<ul style="list-style-type: none"> • invasive • low contamination rate • highest success rate • risk of iatrogenic infection
Clean catch specimen (CCU)	<ul style="list-style-type: none"> • non-urgent collection and unable to void on request <p>(A randomised controlled trial showed suprapubic stimulation hastened non-invasive urine collection (CCU) from infants)</p>	<ul style="list-style-type: none"> • non-invasive • high false positive rate if poor collection technique
Midstream urine (MSU)	<ul style="list-style-type: none"> • non-urgent collection and able to void on request 	<ul style="list-style-type: none"> • preferred method for toilet-trained children who can void on request
Bag specimens / cotton wool balls specimens	<ul style="list-style-type: none"> • not recommended, however UTI can be excluded in children based on negative urinalysis 	<ul style="list-style-type: none"> • high contamination rate so not recommended for UTI diagnosis



Urinary Tract Infection (UTI) in Children

Investigations for unwell children presenting to Emergency Department

Birth to 6 weeks	6 weeks to 3 months	> 3 months	Toilet trained children
FBC, CRP, EUC, Blood Culture	FBC, CRP, EUC, Blood Culture.	FBC, CRP, EUC, Blood Culture and sterile site PCR if clinically indicated	FBC, CRP, EUC, Blood Culture and sterile site PCR if clinically indicated
Sterile site PCR	Sterile site PCR		
Urine (SPA)	Urine (SPA or in – out catheter)	Urine (in– out catheter or clean catch, consider SPA if ≤ 6 months)	Clean catch or mid-stream urine
Lumbar puncture	Lumbar puncture if toxic signs present	Consider LP if clinically indicated	In – out catheter if unwell and delay in obtaining a clean catch urine

Other inpatient investigations

Consider imaging (kidney and bladder ultrasound) for the following children:

- No response to 48 hours of appropriate antibiotic therapy
- Severely unwell/septic
- Renal impairment
- Boys ≤ 3 months to exclude obstruction (i.e. posterior urethral valves)
- Upper renal tract features
- Recurrent urinary tract infections (to identify/exclude a structural abnormality) if they did not have previous ultrasound.

Consider sexually transmitted infection (STI) screening including Gonorrhoea and Chlamydia PCR testing on urine where appropriate.

Interpretations of results

Urinalysis analysis result	Implications	Management	Further testing
Leucocyte esterase positive and Nitrite positive	Consistent with UTI	Commence antibiotics	Send urine for MCS
Leucocyte esterase positive and Nitrite negative	Treat as UTI if clinically indicated	Consider antibiotics	Send urine for MCS and consider infection outside the urinary tract
Leucocyte esterase negative and Nitrite positive	Treat as UTI if clinically indicated	Consider antibiotics	Send for MCS
Leucocyte esterase negative and Nitrite negative	Do not treat as UTI	Antibiotics for UTI should not be started	Unlikely to be a UTI, consider other causes of illness. MCS is usually still sent in non-toilet trained children.

Urinary Tract Infection (UTI) in Children

Urine dipstick

Dipstick analysis is less reliable in neonates and infants with the risk of falsely negative testing. It is recommended to send urine sample for culture for neonates and infants even if urine analysis is negative.

Not all urinary organisms produce nitrites, so the absence of nitrites does not exclude UTI. Urine must be present in the bladder for enough time for the reaction to occur – non-toilet trained children may have a false negative due to more frequent bladder emptying.

Leucocytes may come from other anatomically related areas, e.g. appendicitis. Pyuria (leucocytes) can occur with other febrile illnesses, so pyuria alone on dipstick/microscopy does not confirm UTI.

Pyuria (with no epithelial cells) and bacteria seen on microscopy are suggestive of UTI, but a positive culture is required to confirm the diagnosis.

Epithelial cells (squames) suggest skin contamination and a poorly collected sample; consider recollection if clinically indicated.

The presence of blood or protein on dipstick testing is not a reliable marker of UTI.

Urine culture

- Growth of a single organism at $> 10^8$ CFU/litre ($> 10^5$ CFU/ml) from any collection method suggests infection.
- Growth of a single organism at lower counts of 10^{6-8} CFU/litre ($> 10^{3-5}$ CFU/ml) from catheter urine suggests infection, and from clean catch or MSU may indicate early infection.
- Growth of any amount from SPA suggests infection.

Urinary Tract Infection (UTI) in Children

Treatment of UTI

Birth* to 3 months of age	Over 3 months of age		
Most infants under 3 months should be admitted for initial IV antibiotics	Well	Unwell but not toxic. Tolerating oral intake.	Unwell and not tolerating oral intake/vomiting/ toxic/sepsis
IV antibiotics: Gentamicin & Amoxicillin If Gentamicin is contraindicated use Cefotaxime as monotherapy *For neonates, including those less than 44 weeks corrected age, refer to the specific antibiotic guideline on the South Australian Neonatal Medication Guidelines for appropriate dosing. DO NOT use the antibiotic doses listed in this table for this patient group.	Discharge on empiric oral antibiotics: **Cefalexin OR Amoxicillin-Clavulanate OR **Nitrofurantoin (ONLY FOR CYSTITIS) OR Trimethoprim OR Trimethoprim + Sulfamethoxazole with GP follow up in 48 hours. **For paediatric antibiotic therapy, refer to the WCHN Paediatric Antibacterial Quick Reference Card (Appendix 1.)	Consider one dose of IM Gentamicin or Ceftriaxone. Discharge home on oral antibiotics: **Cefalexin OR Amoxicillin-Clavulanate OR **Nitrofurantoin (ONLY FOR CYSTITIS) OR Trimethoprim OR Trimethoprim + Sulfamethoxazole with GP follow up in 48 hours.	Urine samples should be collected prior to starting antibiotics unless the child is seriously unwell and requires immediate IV therapy. IV antibiotics: Gentamicin & Amoxicillin. Use Ceftriaxone as monotherapy if Gentamicin is contraindicated. Modify antibiotics depending on culture sensitivity. Switch to oral therapy once the child is clinically stable and can tolerate oral therapy. GP and Paediatric follow up.
Duration of antibiotic treatment (IV or oral)	Total duration of 3 days for cystitis depend on clinical response. Total duration of 7 - 10 days for pyelonephritis depend on clinical response.		
Resistant bacteria	Consult Infectious Disease if ESBL-producing bacteria/multidrug resistant bacteria or if longer duration of treatment is required or in children hypersensitive or allergic to penicillin.		
Empirical therapy for severe pyelonephritis or UTI sepsis or children with UTI unable to tolerate oral intake	Gentamicin <ul style="list-style-type: none"> • Term infants and children (1 month to 10 years of age): <ul style="list-style-type: none"> ○ 7.5 mg/kg intravenously once daily. Use ideal body weight. ○ Initial maximum dose 320 mg • 10 to 18 years of age: <ul style="list-style-type: none"> ○ 6 to 7 mg/kg intravenously once daily. Use ideal body weight. ○ Initial maximum dose 560 mg Plus Amoxicillin or Ampicillin 50 mg/kg up to 2 g intravenously, 6-hourly.		
If Gentamicin contraindicated	Cefotaxime 50 mg/kg up to 1 g intravenously, 8-hourly (up to 2 g intravenously 8-hourly for children with sepsis or requiring intensive care support) OR, Ceftriaxone (child 1 month or older) 50 mg/kg up to 1 g intravenously, daily (Use 50 mg/kg up to 1 g, 12-hourly for children with sepsis or requiring intensive care support).		

Urinary Tract Infection (UTI) in Children

If penicillin allergy	Use Gentamicin as monotherapy and consult with Infectious Diseases .
Oral antibiotic for treatment of acute cystitis and pyelonephritis in children tolerating oral therapy Choice of oral antibiotic is guided by urine culture sensitivity	Cefalexin 12.5 mg/kg up to 500 mg orally, 6-hourly. OR Amoxicillin + Clavulanate orally, Infant younger than 2 months: 15+3.75 mg/kg, 8-hourly. Child 2 months or older: 22.5+3.2 mg/kg up to 875+125 mg, 12-hourly. OR Trimethoprim + sulfamethoxazole (child 1 month or older) 4+20 mg/kg up to 160+800 mg orally, 12-hourly. OR (if a suitable trimethoprim formulation is available) Trimethoprim 4 mg/kg up to 160 mg orally, 12-hourly, OR **Nitrofurantoin (ONLY FOR CYSTITIS) (child older than 1 month) 0.75mg – 1.75mg/kg up to 100mg orally, 6 hourly (consult with Infectious Diseases if risk of adverse effects)
If culture and susceptibility testing indicate the pathogen is resistant to empirical oral therapy	Do not modify therapy if symptoms are improving.
If resistance to all the above drugs is confirmed, provided the pathogen is susceptible, suitable alternatives are: *Consult with Infectious Diseases	Norfloxacin 10 mg/kg up to 400 mg orally, 12-hourly (if a suitable norfloxacin formulation is available), OR Ciprofloxacin 12.5 mg/kg up to 500 mg orally, 12-hourly (if a suitable ciprofloxacin formulation is available).
<i>Pseudomonas aeruginosa</i>	Infection with <i>Pseudomonas aeruginosa</i> can be associated with coexisting urological abnormalities. Treat children who have UTI caused by <i>P. aeruginosa</i> with Norfloxacin or Ciprofloxacin as above; however, a longer treatment duration is often required —seek Infectious Disease advice.
Asymptomatic bacteriuria	Do not routinely screen for or treat asymptomatic bacteriuria in infants or children, except in some patients undergoing elective urological procedures.
In children with indwelling urinary catheter	In catheterised children, collect a specimen and contact the treating team. Catheters should only be removed on specialist advice. Bacterial colonisation of long-term catheters is common, and these children are often asymptomatic despite pyuria and bacteriuria. Empiric and/or prophylactic antibiotics should be decided on a case by case basis, ideally after discussion with the child's Paediatrician and where relevant, Infectious Disease physician or Surgical team. Improper use of antibiotics in this cohort may encourage the development of antibiotic resistance.
Post-treatment	Performance of post-treatment urine culture to confirm resolution of UTI for asymptomatic children is not routinely indicated.



Urinary Tract Infection (UTI) in Children

Antibiotic prophylaxis

Do not routinely give antibiotic prophylaxis to infants or children following the first episode of urinary tract infection (UTI).

Antibiotic prophylaxis is not routinely used for cases of vesicoureteric reflux (VUR).

Antibiotic prophylaxis for UTI in children increases the risk of infection with multidrug-resistant bacteria.

Indications to consider antibiotic for UTI prophylaxis:

1. Recurrent UTI, or
2. Vesicoureteric reflux grades III to V, or
3. If recommended by the child's nephrologist or urologist for other indications
4. Short duration of prophylaxis prior to MCU.

Antibiotic prophylaxis

Cefalexin 12.5 mg/kg up to 250 mg orally, at night, **OR**

Trimethoprim + sulfamethoxazole (child 1 month or older) 2+10 mg/kg up to 80+400 mg orally, at night, **OR**

Trimethoprim 2 mg/kg up to 150 mg orally, at night (if a suitable trimethoprim formulation is available), **OR**

Nitrofurantoin (child 1 month or older) 1 mg/kg up to 50 mg orally, at night (if a suitable Nitrofurantoin formulation is available). Risk of adverse effects with long-term use – consult with Infectious Diseases.

Review the need for prophylaxis every 6 months

Investigations for children after diagnosis of UTI

Further investigation is dependent on type of UTI – typical vs. atypical, single episode vs. recurrent episodes.

Children with atypical or recurrent UTIs require imaging of their renal tract.

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Summary of post UTI renal tract imaging

[^]Seek specialist advice first before arranging MCU or DMSA

[#]See consideration for referral p. 14

Age < 6 months

Test	Ultrasound during episode	Ultrasound 6 weeks later	[^] DMSA - 4 to 6 months after the infection resolved	[^] MCU
Typical UTI	No	Yes	No	Consider if ultrasound abnormal
[#] Atypical or recurrent UTI	Yes	No	Yes	Yes - delay at least 2 weeks after the infection resolved

Age 6 months to 3 years

Test	Ultrasound during episode	Ultrasound 6 weeks later	[^] DMSA - 4 to 6 months after the infection resolved (large radiation exposure)
Typical UTI	No	No	No
[#] Atypical UTI	Yes	No	Yes
[#] Recurrent UTI	No	Yes	Yes

MCU is not routinely indicated for this age group for either atypical or recurrent UTI but it may need to be considered if an atypical infection, abnormal ultrasound or family history of VUR (consider procedure sedation).

Age > 3 years

Test	Ultrasound during episode	Ultrasound 6 weeks later	[^] DMSA - 4 to 6 months after the infection resolved (large radiation exposure)
Typical UTI	No	No	No
[#] Atypical UTI	Yes	No	No
[#] Recurrent UTI	No	Yes	Yes

MCU is not routinely recommended for this age group for either atypical or recurrent UTI (consider procedure sedation).

Urinary Tract Infection (UTI) in Children

Criteria for transfer

Any child requiring care beyond the level of comfort of the treating hospital. Decision of transfer is to be discussed and accepted by the receiving team at the receiving hospital.

Criteria for discharge

1. Clinically stable
2. Tolerating oral intake/oral antibiotic

Plan for discharge

1. Parent/carer to organise follow up with GP
2. Provide discharge letter to parent/carer and to GP
3. Organise referral to **general paediatric clinic** for children presenting with atypical or recurrent UTI
4. Consider referral to Paediatric Urologist or Nephrologist if indicated

Indications for consideration of referral to Paediatric urology clinic

1. Urgent referral if there is evidence or suspicion of renal tract obstruction
2. High grade vesicoureteric reflux
3. Recurrent and atypical UTI
4. Structural urological abnormality
5. Suspected neurogenic bladder

Indications for consideration of referral to Paediatric renal clinic

1. Renal scarring
2. Hypertension
3. Persistent deranged renal function



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Appendices

APPENDIX 1 – EXCERPT FROM THE WCHN PAEDIATRIC EMPIRIC ANTIMICROBIAL QUICK REFERENCE

Urinary Tract Infection		
RENAL	<u>Cystitis:</u> <u>/ Non severe</u> <u>Pyelonephritis:</u> (>1 month)	Options include: <i>cefalexin</i> 12.5mg/kg/dose up to 500mg oral 6-hourly OR <i>nitrofurantoin</i> (ONLY FOR CYSTITIS) 0.75-1.75mg/kg (max 100mg) oral 6-hourly OR <i>amoxicillin-clavulanate</i> 22.5mg/kg/dose (amoxicillin) up to 875mg oral 12-hourly. Duration for cystitis 3 days, for non-severe pyelonephritis 7-10 days
	<u>Severe</u> <u>Pyelonephritis:</u>	<i>amoxicillin</i> 50mg/kg up to 2g IV 6-hourly PLUS <i>gentamicin</i> 7.5mg/kg/dose IV once daily (7mg/kg/dose for pt. > 10 yrs.) (total IV+oral duration 7-10 days)

