NATIONAL CLINICAL GUIDELINES

THE DIAGNOSIS & MANAGEMENT OF URINARY TRACT INFECTIONS IN CHILDREN

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المبادئ الإرشادية السريرية لدولة قطر
NATIONAL CLINICAL GUIDELINES FOR QATAR

وزارة الصحـــــة العامـــــة
Ministry of Public Health
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Version History

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1.0	Final	19th October 2019	Guidelines Team	Final version for publication.

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Abbreviations

The abbreviations used in this guideline are as follows:

ABU	Asymptomatic bacteriuria
DMSA	Dimercaptosuccinic acid
ESBL	Extended spectrum beta-lactamase bacteria
IV	Intravenous route of administration
KUB	Radiography of the kidneys, ureters and bladder
MOPH	Ministry of Public Health of Qatar
PUJ	Pelvic-ureteric junction
SPA	Suprapubic aspiration
UTI	Urinary tract infection
VCUG	Voiding cystourethrogram
VUR	Vesicoureteric reflux

View Pathway

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1 Information about this Guideline

1.1 Objective and Purpose of the Guideline

The purpose of this guideline is to define the appropriate diagnosis and management of urinary tract infections in children. The objective is to improve the appropriate diagnosis, management and referral of patients presenting to provider organisations in Qatar. It is intended that the guideline will be used primarily by physicians in primary care and outpatient settings.

1.2 Scope of the Guideline

Aspects of care covered within this guideline, include:

- Clinical presentation, investigation, diagnosis and management of urinary tract infections (UTI) in children and adolescents aged up to 18 years of age, including:
    - Interpretation of urine dipstick, urine microscopy and urine culture results.
    - Diagnostic imaging strategies by age group.
    - Empirical antibiotic prescribing recommendations by age group.

Patient groups not covered in this guideline:

- Management of UTI in pregnant adolescents aged <18 years

1.3 Editorial Approach

This guideline document has been developed and issued by the Ministry of Public Health of Qatar (MOPH), through a process which aligns with international best practice in guideline development and localisation. The guideline will be reviewed on a regular basis and updated to incorporate comments and feedback from stakeholders across Qatar.

The editorial methodology, used to develop this guideline, has involved the following critical steps:

- Extensive literature search for well-reputed published evidence relating to the topic.
- Critical appraisal of the literature.
- Development of a draft summary guideline.
- Review of the summary guideline with a Guideline Development Group, comprised of practising healthcare professionals, subject matter experts and patient representatives, from across Qatar.
- Independent review of the guideline by the National Clinical Guidelines & Pathways Committee, appointed by the MOPH, from amongst stakeholder organisations across Qatar.

Whilst the MOPH has sponsored the development of the guideline, the MOPH has not influenced the specific recommendations made within it.

1.4 Sources of Evidence

The professional literature has been systematically queried using specially developed, customised, and tested search strings. Search strategies are developed to allow efficient yet comprehensive analysis of relevant publications for a given topic and to maximise retrieval of articles with certain desired characteristics pertinent to a guideline.

For each guideline, all retrieved publications have been individually reviewed by a member of the Editorial Team and assessed in terms of quality, utility, and relevance. Preference is given to publications that:

1. Are designed with rigorous scientific methodology.
2. Are published in higher-quality journals.
3. Address an aspect of specific importance to the guideline in question.

Further information about the literature search and appraisal process is included in the appendix.

1.5 Evidence Grading and Recommendations

Recommendations made within this guideline are supported by evidence from the medical literature and where possible the most authoritative sources have been used in the development of this guideline. In order to provide insight into the evidence basis for each recommendation, the following evidence hierarchy has been used to grade the level of authoritativeness of the evidence used, where recommendations have been made within this guideline.

Where the recommendations of international guidelines have been adopted, the evidence grading is assigned to the underlying evidence used by the international guideline. Where more than one source has been cited, the evidence grading relates to the highest level of evidence cited:

- **Level 1 (L1):**
  - Meta-analyses.
  - Randomised controlled trials with meta-analysis.
  - Randomised controlled trials.
  - Systematic reviews.

- **Level 2 (L2):**
  - Observational studies, examples include:
    - Cohort studies with statistical adjustment for potential confounders.
    - Cohort studies without adjustment.
    - Case series with historical or literature controls.
    - Uncontrolled case series.
  - Statements in published articles or textbooks.

- **Level 3 (L3):**
  - Expert opinion.
  - Unpublished data, examples include:
    - Large database analyses.
    - Written protocols or outcomes reports from large practices.

In order to give additional insight into the reasoning underlying certain recommendations and the strength of recommendation, the following recommendation grading has been used, where recommendations are made:

- **Recommendation Grade A (RGA):** Evidence demonstrates at least moderate certainty of a net benefit from the recommendation.
- **Recommendation Grade B (RGB):** Evidence is insufficient, conflicting, or poor and demonstrates an incomplete assessment of net benefit vs harm; additional research is recommended.
- **Recommendation Grade C (RGC):** Evidence demonstrates potential harm that outweighs benefit; additional research is recommended.
- **Recommendation of the GDG (R-GDG):** Recommended best practice on the basis of the clinical experience of the Guideline Development Group members.

1.6 Guideline Development Group Members

The following table lists members of the Guideline Development Group (GDG) nominated by their respective organisations and the National Clinical Guidelines & Pathways Committee. The GDG members have reviewed and provided their feedback and approval of the guideline document. Each member has completed a declaration of conflicts of interest, which has been reviewed and retained by the MOPH.

Guideline Development Group Members		
Name	**Title**	**Organisation**
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[1] Mr Ahmed Babiker attended the MOPH in his capacity as a Clinical Pharmacist and advisor on the availability of medications in Qatar.

1.7 National Clinical Guidelines & Pathways Committee Members

The following table lists members of the National Clinical Guidelines & Pathways Committee (NCGPC), appointed by the MOPH. The NCGPC members have reviewed and provided their feedback and approval of the guideline document. Each member has completed a declaration of conflicts of interest, which has been reviewed and retained by the MOPH.

National Clinical Guidelines & Pathways Committee (NCGPC) Members		
Name	**Title**	**Organisation**
Ms Huda Amer Al-Katheeri	Chair of the NCGPC, Director of Strategic Planning & Performance Department	Ministry of Public Health
Shk Dr Mohammed Hamad J. Al Thani	Co-Chair of the NCGPC, Director of Public Health	Ministry of Public Health
Prof Anthony Akobeng	Chair Clinical Practice Guidelines Committee	Sidra Medicine
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Dr Chris Kenny	Executive Director Clinical and Service Development, Office of the Chief Medical Officer	Hamad Medical Corporation
Dr Egon Toft	VP and Dean of College of Medicine	College of Medicine, Qatar University

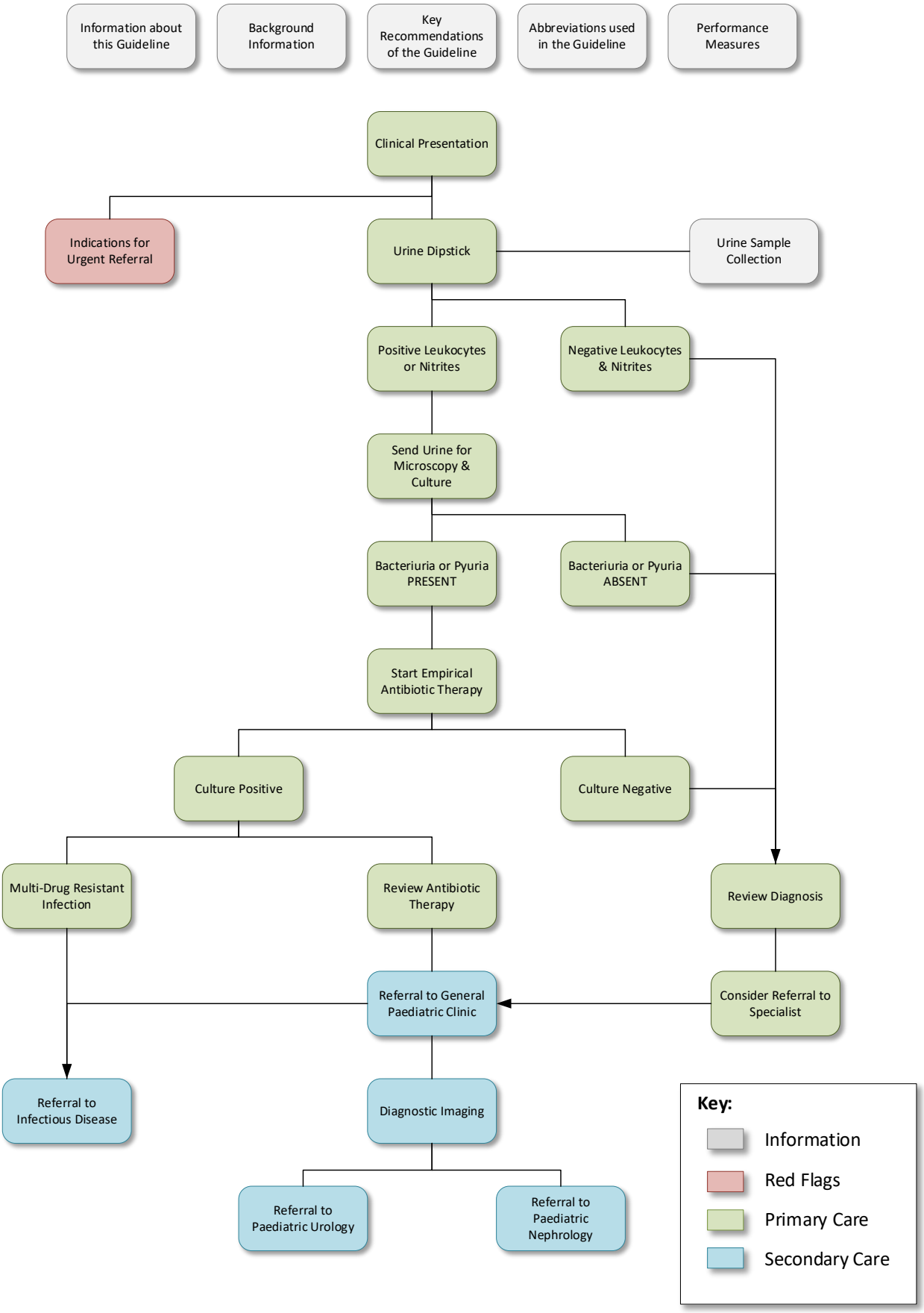
1.8 Responsibilities of Healthcare Professionals

This guideline has been issued by the MOPH to define how care should be provided in Qatar. It is based upon a comprehensive assessment of the evidence as well as its applicability to the national context of Qatar. Healthcare professionals are expected to take this guidance into account when exercising their clinical judgement in the care of patients presenting to them.

The guidance does not override individual professional responsibility to take decisions which are appropriate to the circumstances of the patient concerned. Such decisions should be made in consultation with the patient, their guardians, or caregivers and should consider the individual risks and benefits of any intervention that is contemplated in the patient's care.

2 Diagnosis & Management Pathway

Click on a box below to see the relevant page of the Pathway.



3 Key Recommendations of the Guideline

The key recommendations of this guideline are:

Clinical Presentation (*Section 5*):

- Presenting symptoms and signs may be non-specific in younger children[1,2].
- Infants with a fever (>39°C) for >48 hours and without another source for infection are highly likely to have a UTI[3,4].
- UTI should not be excluded on the absence of pyuria[4,5], especially in infants <2 months of age or if the patient is immunocompromised[4] [**L2, RGC**].
- See *Section 5.3* for clinical features of a an Atypical UTI.

Investigation (*Section 6*):

- A urine sample should be collected and tested within 24 hours of presentation[1,6] [**L1, RGA**] in:
    - All infants and children presenting with unexplained fever(Rectal temperature ≥38°C)[1,4,6].
        - If infection is localised in an alternative site, urine sample testing is not required, but should be considered if the patient remains unwell.
    - Infants and children with symptoms and signs suggestive of a UTI[1,6].
- If the infant is less than 3 months of age, a urine sample should be collected within 1-2 hours of presentation [**R-GDG**].
- Collection of bag urine samples is NOT recommended due to a frequent false-positive results[3,7].
- Such samples should not be sent for culture[7].
- **In a patient with a high risk of serious illness, initiation of treatment should not be delayed if a urine sample is unobtainable**[1,6] [**L1**].
- See *Section 6.2* for interpretation of urine dipstick testing results.
- Urine samples for microscopy and culture, should be collected prior to antibiotic treatment to prevent false negative results[4].
- Collected urine should be examined within 2 hours of collection [**R-GDG**]. Otherwise, it should be refrigerated or preserved with boric acid immediately[1,6].
- See *Section 6.3* for interpretation of microscopy and culture results.

Diagnostic Imaging (*Section 6.4*):

- See *Section 6.4.1* for diagnostic imaging strategies by age group.
- VCUG should be performed at least 3 weeks after resolution of the acute infection [**R-GDG**].
- DMSA scan should be performed 4-6 months after resolution of the acute infection [**R-GDG**].

General Principles of Management (Section 7):

- Paediatric patients ≥3 months to 3 years of age, with non-specific symptoms and low risk of serious illness can be observed without antibiotic therapy, until results of microscopy become available [**R-GDG**].
- Urine microscopy should be ordered as STAT investigation and should therefore be available within 1 hour of the sample being sent to the laboratory [**R-GDG**].
- When initiating treatment:
    - Select a first-choice empirical antibiotic[8].
    - If there is no improvement after 48 hours, reassess the diagnosis [**R-GDG**].
    - Review the culture result if available[4,6,8].
    - Consider changing the antibiotic to an alternative[2,8] [**L1, RGA**].
- Oral administration of antibiotics is preferred in non-toxic children with no known structural urological abnormality[4,6,9].
- If oral administration is not possible, consider IV antibiotics[8,10].

- If IV administration is not possible, consider intramuscular treatment[1,10].
- If IV antibiotics are used, consider stepping down to oral antibiotics where possible, after 48 hours and the patient is aged ≥3months[8,10].
- Monitor antibiotic drug levels as necessary[7] [**L1, RGA**].
- **If any multi-drug resistant infective organism is suspected, seek advice from Infectious Disease and Infection Control measures should be observed** [**R-GDG**].
- Quinolones should not be used routinely in paediatric patients but may be justified if the organism is resistant to other oral antibiotics[4].

Management of Acute Infection (*Section 8*):

- See *Section 8* for empirical antibiotic prescribing recommendations in patients of different age groups.

Long-Term Management (*Section 9*):

- Asymptomatic bacteriuria (ABU) should not be further investigated or treated with antibiotics in paediatric patients[2,3,6,11,12] [**L1, RGB**]. (See *Sections 4.1* and *6.3.2* for the definition of ABU).
- Antimicrobial therapy for ABU may be considered in renal transplant recipients and children undergoing urological procedures[11] [**L2**].
- Medical management of recurrent UTI should be used if behavioural and personal hygiene measures alone are not effective or not appropriate. In such cases, consultation with a paediatric specialist is required[13].
- Antibiotic prophylaxis is not recommended in infants and children following the first UTI[1,3,6,7,14] [**L1, RGB**].
- However, prophylaxis may be considered in paediatric patients:
    - With recurrent UTI[1,3,15]
    - With existing structural abnormality of the urinary tract[3,4,7,9], including:
        - VUR Grades III-V.
        - Obstructive uropathy, e.g. posterior urethral valves.
- See *Section 9.2* for recommendations on antibiotic prophylaxis in recurrent UTI.
- Urine of asymptomatic patients who have had an episode of UTI, should not be re-tested for infection after treatment[1,6].

Referral Criteria (*Section 10*):

- See *Section 10* for referral criteria for:
    - Urgent admission to hospital.
    - General Paediatric Outpatient Clinic.
    - Paediatric Nephrology Clinic.
    - Paediatric Urology Clinic.

4 Background Information

4.1 Definitions and Classification

A urinary tract infection (UTI) is defined as an infection of the urinary system and the presence of bacteria in the urine causing an inflammatory response[1,16].

- **Lower UTI (cystitis)**[1]:
  - Evidence of a UTI confined to the lower urinary tract giving rise to inflammation of the bladder.

- **Upper UTI (pyelonephritis)**[1]:
  - Evidence of a UTI leading to the inflammation of the kidneys.

- **Uncomplicated UTI**[16]:
  - Infection in an otherwise healthy individual, with no functional or structural abnormality of the urinary tract.

- **Complicated UTI**[16]:
  - An infection associated with a structural or functional abnormality of the urinary tract.
  - A complicated UTI can be categorised as follows:
    - **Anatomical abnormalities,** including:
      - Hydronephrosis, hydroureteronephrosis (including vesico-ureteral reflux (VUR)), cystocele, diverticulum, fistula.
    - **Urinary tract obstruction**, including:
      - Bladder outlet obstruction, ureteral stricture, pelvic-ureteric junction (PUJ) stenosis. (posterior urethral valves, severe phimosis, severe urethral stenosis or stricture)
    - **Voiding dysfunction**, including:
      - Anatomical or functional neurogenic bladder.
    - **Iatrogenic factors**, including:
      - Indwelling catheter, nosocomial infection, surgery.
    - **Other factors**, including:
      - Urolithiasis, immunocompromise.

- **Atypical UTI**[7]:
  - UTI with a microorganism other than *E. coli* and *K. pneumoniae*.
  - UTI in an infant less than 3 months of age.
  - See *Section 5.3* below.

- **Recurrent UTI**[17]:
  - Recurrent urinary tract infection (UTI) is defined as repeated UTIs with a frequency of ≥2 UTIs in the last 6 months or ≥3 or more UTIs in the last 12 months.

- **Asymptomatic bacteriuria** (ABU)[11]**:**
  - Positive urine cultures in an asymptomatic patient.

4.2 Infective Organisms

Most UTIs are caused by Gram-negative bacteria. *Escherichia coli* is the most common infective organism (75-90%)[2,18] followed by *Klebsiella pneumoniae*.

Other less common pathogens of UTI include [2,19–21]:

- Other *Klebsiella* species.
- *Proteus* species.
- *Enterobacter* species.
- *Citrobacter* species.
- *Enterococcus* species.
- *Pseudomonas* species.
- *Staphylococcus saprophyticus*.
- Nontyphoidal *Salmonella.*
- *Candida albicans*.
- *Ureaplasma* species.
- *Chlamydia* species.
- Adenoviruses.

4.3 Risk Factors

Risk factors for UTI in children include[1,6]:

- History suggesting previous UTI or a confirmed previous UTI.
- Constipation.
- Antenatally-diagnosed renal abnormality.
- Poor urine flow.
- Recurrent fever of uncertain origin.
- Family history of VUR or renal disease.
- Dysfunctional voiding (dribbling or straining).
- Enlarged bladder.
- Evidence of spinal lesion.

4.4 Complications

An untreated UTI may lead to the following complications (particularly in the first 2 years of age)[9,18,22]:

- Urosepsis.
- Renal scarring, resulting in:
    - Hypertension.
    - Proteinuria.
    - Renal insufficiency.

5 Clinical Presentation

The investigation and diagnosis of UTI is substantially based upon the presence of the corresponding symptoms and signs, given below for different age groups. Be aware that presenting symptoms and signs may be non-specific in younger children[1,2].

5.1 Infants <3 Months of Age

Presenting symptoms and signs of a UTI in infants <3 months of age, include[6,7,18]:

- Abnormal temperature.
- Vomiting.
- Lethargy.
- Irritability.
- Poor feeding.
- Jaundice.
- Failure to thrive.
- Haematuria.
- Offensive urine.

NB:

- Infants with a fever (>39°C) for >48 hours and without another source for infection are highly likely to have a UTI[3,4].
- UTI should not be excluded on the absence of pyuria[4,5], especially in infants <2 months of age or if the patient is immunocompromised[4] [**L2, RGC**].

5.2 Infants and Children ≥3 Months of Age

Presenting symptoms and signs of a UTI in infants and children ≥3 months of age, include[6,7,18]:

- Fever.
- Vomiting.
- Lethargy.
- Irritability.
- Abdominal pain.
- Loin tenderness.
- Poor feeding or loss of appetite.
- Haematuria or cloudy urine.
- Offensive urine.
- Failure to thrive.

Older toilet-trained children may additionally present with the following symptoms and signs[6,18]:

- Frequency.
- Urgency.
- Dysuria.
- Changes to continence.

5.3 Clinical Features of an Atypical UTI

An atypical UTI should be considered if any of the following features are present[1,7]:

- An infant < 3 months of age.
- Serious illness in a child of any age.
- Septicaemia.
- Poor urine flow secondary to an abnormality of the urinary tract.
- Abdominal or bladder mass.
- Raised creatinine concentration.
- Failure to respond to treatment with suitable antibiotics within 48 hours.

6 Investigation

6.1 Urine Sample Collection

A urine sample should be collected and tested within 24 hours of presentation[1,6] [**L1, RGA**] in:

- All infants and children presenting with unexplained fever (Rectal temperature ≥38 °C)[1,4,6].
    - If infection is localised in an alternative site, urine sample testing is not required, but should be considered if the patient remains unwell.
- Infants and children with symptoms and signs suggestive of a UTI[1,6].

NB:

- If the infant is less than 3 months of age, a urine sample should be collected within 1-2 hours of presentation [**R-GDG**].

The following methods can be attempted for the urine collection[1,6]:

- Midstream clean-catch sample (preferable):
    - Decontaminate the genitalia, prior to collection, using normal saline or tap water.
    - Apply gauze soaked in sterile saline to the suprapubic area to stimulate infants ages 1 to 12 months to provide a clean catch urine sample[23].
- Catheter samples or suprapubic aspiration (SPA):
    - Only if non-invasive methods are not possible.
    - The presence of urine in the bladder should be confirmed with ultrasound prior to SPA.

NB:

- Catheter samples and SPA cannot be obtained at health centers, in such cases the child should be referred to the Paediatric Emergency Center or to the general paediatric to rule out the infection [**R-GDG**].
- Collection of bag urine samples is NOT recommended due to a frequent false-positive results[3,7].
- Such samples should not be sent for culture[7].
- **In a patient with a high risk of serious illness, initiation of treatment should not be delayed if a urine sample is unobtainable**[1,6] [**L1**].

6.2 Urine Dipstick Testing

In immunocompetent patients ≥3 months of age with a suspected UTI[4,6,7], use the table below to determine appropriate management.

Leukocyte Esterase	Nitrites	Action
Positive	Positive	• Send the urine sample for microscopy & culture. • Start antibiotic therapy.
Negative	Negative	• Do not send the urine sample for microscopy & culture. • Do not start antibiotic therapy. • Review the differential diagnosis.
Negative	Positive	• Send the urine sample for microscopy & culture. • Only start antibiotic therapy, if there is good clinical evidence of a UTI.
Positive	Negative	• Send the urine sample for microscopy & culture. • Only start antibiotic therapy, if there is good clinical evidence of a UTI. • Review the differential diagnosis.

Table 6.2: Interpretation of urine dipstick results[4,6,7].

In immunocompromised patients with suspected UTI [**R-GDG**]:

- Send the urine sample for microscopy and culture irrespective of the urine dipstick result.
- Start antibiotic therapy.

In infants <3 months of age with a suspected UTI:

- Manage as per the sepsis pathway (See *MOPH National Guideline on Sepsis (2019)*).

6.3 Urine Microscopy and Culture

Urine samples for microscopy and culture, should be collected prior to antibiotic treatment to prevent false negative results [4]. Collected urine should be examined within 2 hours of collection [**R-GDG**]. Otherwise, it should be refrigerated or preserved with boric acid immediately[1,6].

6.3.1 Interpretation of Microscopy Results

Interpretation of microscopy results in a symptomatic patient, should be based on the guidance given in the table below:

	Pyuria positive	Pyuria negative
Bacteriuria positive	The infant or child should be regarded as having UTI.	
Bacteriuria negative	Antibiotic therapy should be started if clinically indicated.	The infant or child should be regarded as NOT having UTI.

Table 6.3.1: Guidance on the interpretation of microscopy results[1,6].

6.3.2 Interpretation of Culture Results

Interpretation of culture results in a symptomatic patient, should be based on the guidance given in the table below[3,6,7,11,24]:

Specimen Source	Definite UTI (cfu/ml)	Possible UTI (cfu/ml)
Clean-Catch	>100,000	>50,000
Catheterised Sample	>50,000	>10,000
Suprapubic Aspiration	Any growth is regarded as significant	

Table 6.3.2: Interpretation of Culture Results[3,6,7,11,243,6,7,11,24].

NB:

- Clinicians should use clinical criteria for their decisions in cases where urine testing does not support the findings[6].
- ABU should be diagnosed, if urinary symptoms are absent but the same pathogen is detected in 2 consecutive urine samples[11].

6.4 Diagnostic Imaging

Imaging of the urinary tract is not routinely indicated but may be justified in specific circumstances see *Section 6.4.1* below [1,6,11].

Antibiotic prophylaxis during diagnostic imaging is not routinely recommended[4] [**L1, RGB**], but is indicated when performing a voiding cystourethrogram (VCUG) in children <2 years of age. For antibiotic prophylaxis in VCUG, give a treatment dose of antibiotics for 3 days, with the VCUG performed on day 2[1,3,6] [**L1, RGA**].

6.4.1 Imaging Strategies

Infants and children <2 years of age [**R-GDG**]:

- Perform a KUB ultrasound in all patients.
- VCUG should be performed if:
    - Atypical UTI, recurrent UTI or abnormality on ultrasound.
    - Poor growth or hypertension.
- DMSA scan should be performed if:
    - Atypical UTI, recurrent UTI or abnormality on ultrasound or VCUG.

Children ≥2 years of age [**R-GDG**]:

- Perform a KUB ultrasound if:
    - Atypical UTI or recurrent UTI.
- DMSA scan should be performed if:
    - Atypical UTI, recurrent UTI or abnormality on ultrasound.
- VCUG should be performed if:
    - Abnormality on DMSA.
    - Voiding dysfunction.

NB:

- VCUG should be performed at least 3 weeks after resolution of the acute infection [**R-GDG**].
- DMSA scan should be performed 4-6 months after resolution of the acute infection [**R-GDG**].

7 General Principles of Management

Paediatric patients ≥3 months to 3 years of age, with non-specific symptoms and low risk of serious illness can be observed without antibiotic therapy, until results of microscopy become available[1] [**L1, RGA**]. Urine microscopy should be ordered as STAT investigation and should therefore be available within 1 hour of the sample being sent to the laboratory [**R-GDG**].

When initiating treatment:

- Select a first-choice empirical antibiotic[8].
- If there is no improvement after 48 hours, reassess the diagnosis [**R-GDG**].
- Review the culture result if available[4,6,8].
- Consider changing the antibiotic to an alternative[2,8] [**L1, RGA**].
- Repeat the urine culture[7] [**L1, RGA**].

When culture results are available, the causative microorganism and antibiotic sensitivity results should be evaluated to formulate a targeted therapeutic regimen[4,6,8] [**L1, RGA**].

Route of administration:

- Oral administration of antibiotics is preferred in non-toxic children with no known structural urological abnormality[4,6,9].
- If oral administration is not possible, consider IV antibiotics[8,10].
- If intravenous (IV) administration is not possible, consider intramuscular treatment[1,10].
- If IV antibiotics are used, consider stepping down to oral antibiotics where possible, after 48 hours and the patient is aged ≥3months[8,10].
- Monitor antibiotic drug levels as necessary[7] [**L1, RGA**].

Duration of antibiotic therapy depends upon the microorganism identified on culture and the clinical course of the patient[7] [**L1**].

7.1 Multi-Drug Resistant Bacteria

Community multidrug resistant bacteria (e.g. extended spectrum beta-lactamase (ESBL) *E.coli* and carbapenamase-producing organisms) are increasingly prevalent worldwide[25,26].

Risk factors for increased antimicrobial resistance include[25,27,28]:

- Injudicious use of antibiotics.
- Hospitalisation for more than 7 days in the last 6 months.
- Presence of indwelling catheters [**R-GDG**].
- Overseas antibiotic treatment [**R-GDG**].

NB:

- **If any multi-drug resistant infective organism is suspected, seek advice from Infectious Disease and Infection Control measures should be observed** [**R-GDG**].
- Quinolones should not be used routinely in paediatric patients but may be justified if the organism is resistant to other oral antibiotics[4].

8 Management of Acute Infection

The antimicrobial prescribing recommendations outlined below were made with reference to the latest antibiogram data from HMC and PHCC which were available to GDG members representing those organisations.

8.1 Children Under 3 Months of Age

Infants <1 month of age [**R-GDG**]:

- Prescribe cefotaxime and ampicillin.

Infants 1-3 months of age [**R-GDG**]:

- Prescribe ceftriaxone and ampicillin.

NB:

- Treatment should be continued for at least 10 days [**R-GDG**].
- Ampicillin and gentamicin should also be considered if the initial urinalysis confirms UTI as the source of sepsis[7] [**L1, RGA**].

8.2 Children at 3 Months to 2 Years of Age

8.2.1 Oral Antibiotics

Empirical oral antibiotics for up to 3 days, until culture results are known [**R-GDG**]:

- Co-amoxiclav; or
- Third-generation cephalosporin (e.g. cefixime).

NB:

- Continue treatment with oral antibiotics for at least 10 days in total [3,4,7,10] or as clinically indicated.
- Reassess treatment when culture results are available[4,6,8].

8.2.2 IV Antibiotics

Empirical IV antibiotics for up to 3 days, until culture results are known [**R-GDG**]:

- Gentamicin; or
- Co-amoxiclav; or
- Ceftriaxone.

NB:

- Convert treatment to oral antibiotics if improving after 48 hours and complete a 10-day course of antibiotics in total [**R-GDG**].
- Reassess treatment when culture results are available[4,6,8].
- Renal function should be monitored if treatment with aminoglycosides (gentamycin or amikacin) continues for more than 48 hours[4] [**L1, RGA**].
- Discuss with Infectious Disease if no improvement after 48 hours [**R-GDG**].

8.3 Children Over 2 Years of Age

8.3.1 Cystitis

Empirical oral antibiotic treatment [**R-GDG**]:

- Nitrofurantoin; or
- Co-trimoxazole; or
- Co-amoxiclav.

NB:

- Continue treatment for 5-7 days or as clinically indicated[4,8] [**L1, RGA**].
- Reassess treatment when culture results are available[4,6,8].

8.3.2 Pyelonephritis

8.3.2.1 Oral Antibiotics

Empirical oral antibiotics for up to 3 days, until culture results are known [**R-GDG**]:

- Co-amoxiclav; or
- Third-generation cephalosporin (e.g. cefixime).

NB:

- Continue treatment with oral antibiotics for at least 10 days in total[3,4,7,10] or as clinically indicated.
- Reassess treatment when culture results are available[4,6,8].

8.3.2.2 IV Antibiotics

Empirical IV antibiotics for up to 3 days, until culture results are known [**R-GDG**]:

- Gentamicin; or
- Co-amoxiclav; or
- Ceftriaxone.

NB:

- Convert treatment to oral antibiotics if improving after 48 hours and complete a 10-day course of antibiotics in total [**R-GDG**].
- Reassess treatment when culture results are available[4,6,8].
- Renal function should be monitored if treatment with aminoglycosides (gentamycin or amikacin) continues for more than 48 hours[4] [**L1, RGA**].
- Discuss with Infectious Disease if no improvement after 48 hours [**R-GDG**].

9 Long-Term Management

9.1 Asymptomatic Bacteriuria

Asymptomatic bacteriuria (ABU) should not be further investigated or treated with antibiotics in paediatric patients[2,3,6,11,12] [**L1, RGB**]. Advise children and their parents on improving hygiene and bowel habits as well as on proper hydration[2].

Antimicrobial therapy for ABU may be considered in renal transplant recipients and children undergoing urological procedures [11] [**L2**].

9.2 Recurrent UTI

Medical management of recurrent UTI should be used if behavioural and personal hygiene measures alone are not effective or not appropriate. In such cases, consultation with a paediatric specialist is required[13].

Antibiotic prophylaxis is not recommended in infants and children following the first UTI[1,3,6,7,14] [**L1, RGB**].

However, prophylaxis may be considered in paediatric patients:

- With recurrent UTI[1,3,15]
- With existing structural abnormality of the urinary tract[3,4,7,9], including:
    - VUR Grades III-V.
    - Obstructive uropathy, e.g. posterior urethral valves.

9.2.1 Antibiotic Prophylaxis in Recurrent UTI

Infants <3 months of age [**R-GDG**]:

- Amoxicillin; or
- Cefalexin.

Infants and children aged ≥3 months[12–14]:

- Nitrofurantoin; or
- Trimethoprim; or
- Cephalosporin (e.g., cephalexin).

NB:

- In an infant or child who is receiving prophylactic antibiotic and develops a UTI, use a different antibiotic for treatment, rather than a higher dose of the same prophylactic[6].

9.2.2 Alternative Therapies

Note:

- Cranberry products are not recommended as a measure to prevent UTI in paediatric patients[2,3,13] [**L1, RGB**].
- Evidence is insufficient to recommend probiotics[29], vitamin A[30], zinc supplementation[31], nasturtium and horseradish, methenamine hippurate and UroVaxom[3] [**L1, RGB**].

View Pathway

9.3 Follow-Up

Urine of asymptomatic patients who have had an episode of UTI, should not be re-tested for infection after treatment[1,6].

Regular monitoring and appropriate management should be provided to infants and children with[1,2,6,9,18]:

- Bilateral renal abnormalities.
- Impaired kidney function.
- Raised blood pressure.
- Proteinuria.
- Renal scarring.

10 Referral Criteria

Most infants and children >3 months with UTI can be safely managed as outpatients[7]. All paediatric patients with acute pyelonephritis should be referred to hospital[1,6,10].

10.1 Urgent Referral for Admission

Refer the following patients to hospital for admission [**R-GDG**]:

- Infants <3 months with a possible UTI.
- Infants and children with a high risk of a serious illness.
- Infants and children who do not respond to outpatient therapy.
- Patients with lack of adequate outpatient follow-up (e.g., no telephone, live far from hospital).
- Consider referral for infants and children ≥3 months with acute pyelonephritis, especially if they:
    - Are significantly dehydrated or unable to take oral fluids and medicines; or
    - Have a higher risk of developing complications (e.g., have diabetes, immunosuppression or abnormality of the genitourinary tract).
- Infants and children with atypical UTI.

10.2 Referral to a General Paediatric Outpatient Clinic

Refer the following patients to a General Paediatric Outpatient Clinic[1,6,7]:

- Infants and children < 2 years of age with a first UTI
- Infants and children of any age with recurrent UTI.
- Infants and children of any age with abnormal imaging results.
- Infants and children with multi-drug resistant UTI.

10.3 Referral to Paediatric Nephrology Clinic:

Refer the following patients to a Paediatric Nephrology clinic[7]:

- VUR (Grades III or above) or obstructive uropathy.
- Renal abnormalities.
- Impaired kidney function.
- Elevated blood pressure.
- Children of any age with a UTI who have history of poor growth.

10.4 Referral to Paediatric Urology Clinic

Refer to a Paediatric Urology clinic, children of any age with[7]:

- UTI with obstructive uropathy.
- VUR Grade III or above.
- Any VUR with a scar.
- UTI with a stone.
- Voiding dysfunction after treating UTI.

11 Key Considerations for Patient Preferences

Patient preferences refer to patient perspectives, beliefs, expectations, and goals for health and life, and to the steps employed by individuals in assessing the potential benefits, harms, costs, and limitations of the management options in relation to one another. Patients may have preferences when it comes to defining their problems, identifying the range of management options and selecting or ranking the outcomes used to compare these options.

It is important for healthcare professionals to develop an understanding of the patient as an individual and the unique way in which each person experiences a condition and its impact on their life.

The following recommendations are therefore made for physicians and other healthcare professionals regarding general principles of patient care in Qatar:

- **Respect Patients:** Treat patients with respect, kindness, dignity, courtesy and honesty. Ensure that the environment is conducive to discussion and that the patient's privacy is respected, particularly when discussing sensitive, personal issues. Ask the patient how they wish to be addressed and ensure that their choice is respected and used.

- **Maintain Confidentiality:** Respect the patient's right to confidentiality and avoid disclosing or sharing patients' information without their informed consent. In this context, students and anyone not directly involved in the delivery of care should first be introduced to the patient before starting consultations or meetings, and let the patient decide if they want them to stay.

- **Clarify Third-Party Involvement:** Clarify with the patient at the first point of contact whether and how they like their partner, family members or carers to be involved in key decisions about their care or management and review this regularly. If the patient agrees, share information with their partner, family members or carers.

- **Obtain Informed Consent:** Obtain and document informed consent from patients, in accordance with MOPH policy and guidance.

- **Encourage Shared Decision Making:** Ensure that patients are involved in decision making about their own care, or their dependent's care, and that factors that could impact the patient's participation in their own consultation and care including physical or learning disabilities, sight, speech or hearing impairments and problems with understanding, reading or speaking English are addressed.

- **Disclose Medical Errors:** Disclose errors when they occur and show empathy to patients.

- **Ensure Effective Communication:** Explore ways to improve communication including using pictures, symbols or involving an interpreter or family members. Avoid using medical jargon. Use words the patient will understand and confirm understanding by asking questions.

- **Ensure Continuity of Care:** Provide clear and timely sharing of patient information between healthcare professionals especially at the point of any transitions in care.

12 Performance Measures

A list of performance measures is given in the table below. Healthcare organisations are encouraged to monitor service performance using the indicator definitions below.

Number	Numerator	Denominator
UTIC01	The number of people in the denominator who have a urine sample tested within 24 hours.	The number of patients aged <18 years presenting with unexplained fever of 38°C or higher.
UTIC02	The number in the denominator investigated with a urine culture.	The number of patients aged <18 years with a recorded diagnosis of UTI and a record of either positive leukocytes or nitrites on urine dipstick testing.
UTIC03	The number in the denominator treated with antibiotics.	The number of patients aged <18 years with a recorded diagnosis of asymptomatic bacteriuria.
UTIC04	The number in the denominator treated with IV antibiotics.	The number of patients aged <18 years with a recorded diagnosis of UTI.
UTIC05	The number in the denominator who received appropriate empirical antibiotics.	The number of patients aged <18 years with a recorded diagnosis of UTI.

Table 12.1: Performance measures.

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Appendix: Detailed Description of the Literature Search

A systematic search for existing literature on UTI in children was performed in the period June 17th - 24th, 2019.

The search for clinical practice guidelines on UTI in children diagnosis and/or management was performed in the *PubMed* database and websites of relevant organisations and societies including the *World Health Organization (WHO), Canadian Paediatric Society, MOPH Qatar* and other. The present guideline is primarily based on UK NICE and Canadian guidelines and is supplemented with other relevant studies.

Peer-reviewed scientific publications were found in PubMed and via *Google Scholar* Internet search engine. Non-peer reviewed studies were identified in *bioRxiv*. Books were checked in *PubMed*. Information published on medical websites, and drug prescribing information sheets were found via Google search engine.

The included publications were identified using the following term combination "urinary AND tract AND infection AND children". All hits published since January 1st, 2017 were reviewed.

Figure A.1 below demonstrates graphically the results of the search and application of exclusion criteria.

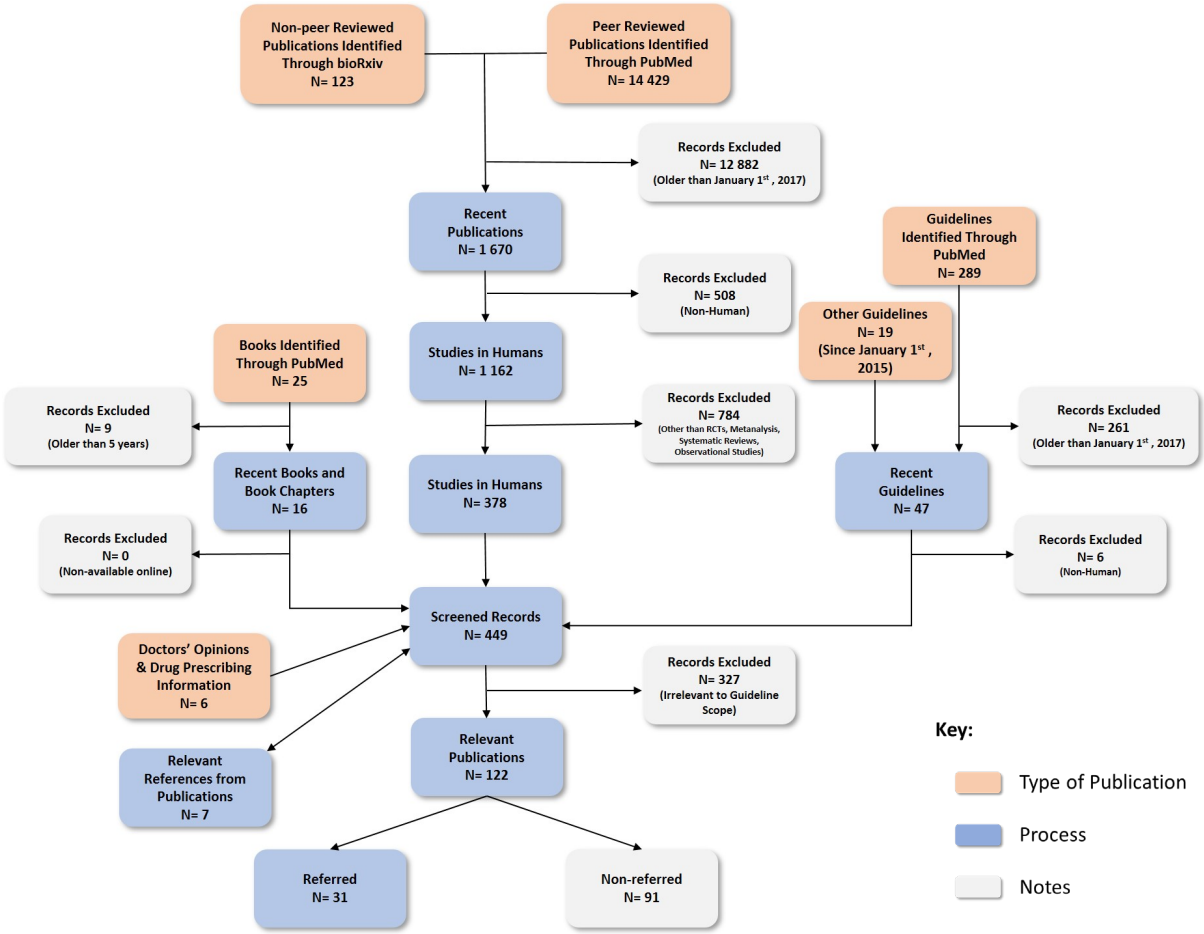

Fig A.1: Literature search results and application of exclusion criteria.

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