NATIONAL CLINICAL GUIDELINES

THE DIAGNOSIS & MANAGEMENT OF LOWER URINARY TRACT INFECTION IN ADULT WOMEN

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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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2.2	Final	15th June 2020	Guidelines Team	Updated version for publication.

Citation

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Abbreviations

The abbreviations used in this guideline are as follows:

AIDS	Acquired Immunodeficiency Syndrome
eGFR	Estimated Glomerular Filtration Rate
ESBL	Extended Spectrum Beta-Lactamase
G6PD	Glucose-6-Phosphate Dehydrogenase
HIV	Human Immunodeficiency Virus
HMC	Hamad Medical Corporation
IV	Intravenous
MOPH	Ministry of Public Health of Qatar
MRSA	Methicillin-Resistant *Staphylococcus aureus*
MSU	Mid-Stream Urine
SIRS	Systemic Inflammatory Response Syndrome
STD	Sexually Transmitted Disease
USC	Urgent Suspected Cancer
UTI	Urinary Tract Infection

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 acute lower urinary tract infections in adult women. The objective is to reduce inappropriate antibiotic prescribing and referral of patients, as well as reduce the incidence of complications of acute lower urinary tract infections. It is intended that the guideline will be used primarily by physicians in primary care and outpatient settings.

1.2 Scope of the Guideline

This guideline covers the following aspects of care:

- Assessment and management of lower urinary tract infections (UTIs) in adult women.
- Recurring infections and relapses.
- Special considerations for pregnant women, patients aged over 65 years and catheterised patients.

Aspects of care not covered in this guideline are:

- Diagnosis and management of UTIs in children younger than age 18 years.
- Management of upper UTIs.
- Management of complicated UTIs.

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 published in the English language 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 clinical editor 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 (i.e. journals that are read and cited most often within their field).
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 at least moderate net benefit.
- **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 Clinical Governance Group. The GDG members have reviewed and provided feedback on the draft guideline relating to the topic. 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**
Dr Fadwa Mohd. Al Ali	Senior Consultant Nephrology	Hamad Medical Corporation
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Sis Manal Al Yafei	Lead Specialist Nurse	Qatar Petroleum
Prof Wedad Askar	Consultant Obstetrics & Gynaecology	Family Medical Clinic
Dr Ahmed M. Hussein Babiker	Head of Registration Section & Clinical Pharmacist	Dept of Pharmacy and Drug Control, MOPH[1]
Dr Ghada Barbara	Consultant Obstetrics & Gynaecology	American Hospital
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Dr Eva Thomas	Chief Microbiologist	Sidra Medicine

[1] Dr 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 Abi Khalil Charbel	Associate Professor of Medicine Consultant Cardiology	Weill Cornell Medicine-Qatar
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Dr Ghassan Youseph Hommos	Consultant Endocrinology	Al Emadi Hospital
Dr Chris Kenny	Executive Director Clinical and Service Development, Office of the Chief Medical Officer	Hamad Medical Corporation
Dr Egon Toft	VP and Dean	College of Medicine, Qatar University

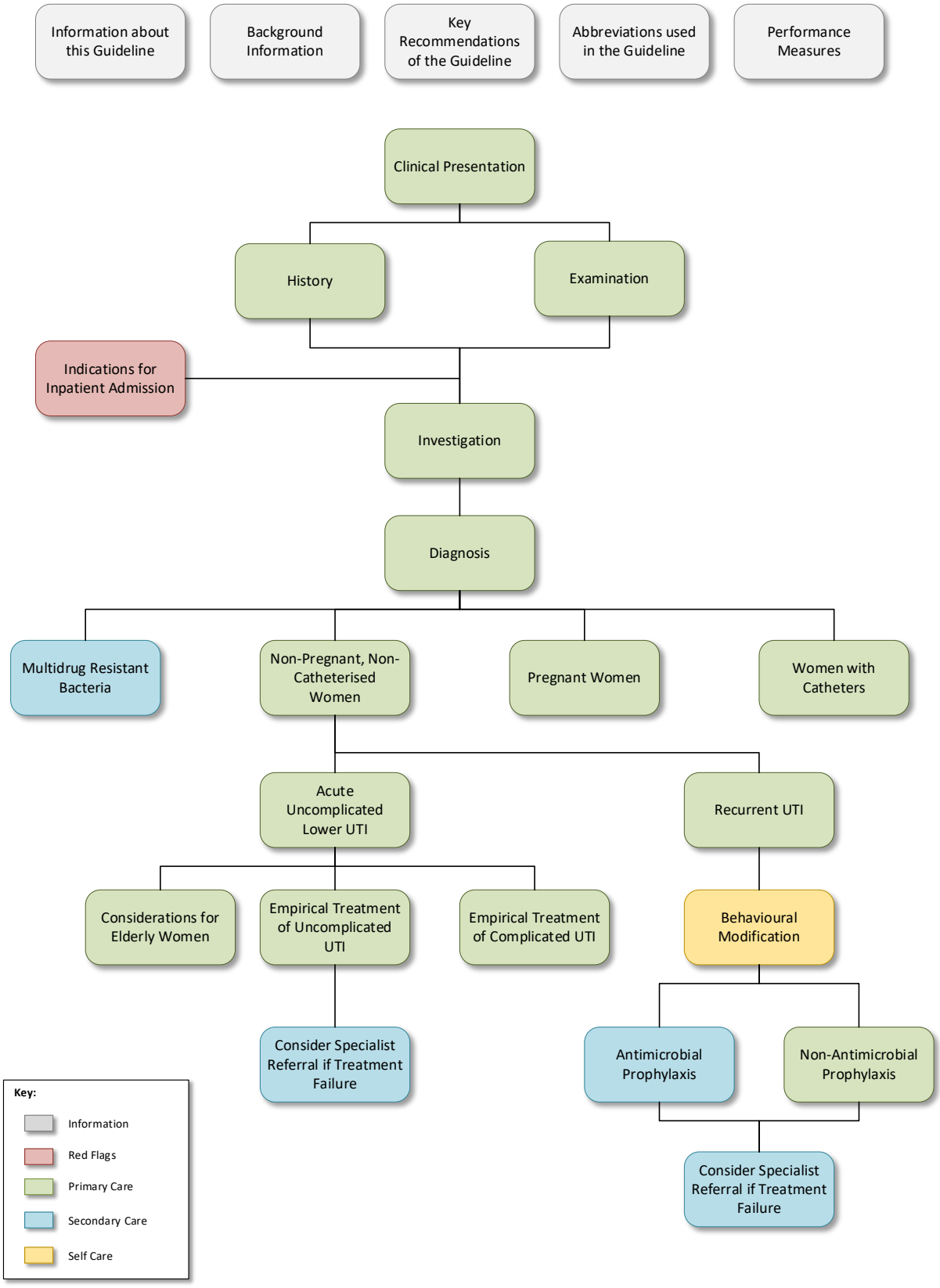
1.8 Responsibilities of Healthcare Professionals

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 carers and should consider the individual risks and benefits of any intervention that is contemplated in the patient's care.

2 Lower UTI in Women - Pathway

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



View Pathway

3 Key Recommendations of the Guideline

The key recommendations of this guideline are:

Definitions:

- See *Section 4.1* for the definitions of a UTI.

Diagnosis of uncomplicated UTI in women aged <65 years:

- In women aged less than 65 years of age, routine dipstick or urine culture are not necessary for the diagnosis of lower UTI, if ≥3 of the classical features (see *Section 5*) are present and both vaginal discharge and irritation are absent [1,2][**L2**].
- Routine dipstick or urine culture are not therefore necessary, in this patient group, if symptoms and signs are strongly indicative of a lower UTI [1,2][**L2, RGA**].
- Use results from dipstick tests to guide treatment decisions in otherwise healthy women aged less than 65 years of age who present with ≤2 of the classical features of UTI, as listed in *Section 5* [3][2][**L1, RGA**].

Urine microscopy and culture should be performed in the following cases [1,4–6] [**L1, RGA**]:

- Lower UTI symptoms that do not resolve on empirical treatment with antibiotics.
- Lower UTI symptoms do not improve or recur 2-4 weeks after completion of a course of antibiotics.
- Pregnant women (see *Section 11*).
- Elderly women or those who present with atypical symptoms.
- Women with suspected or known functional or structural genitourinary abnormalities.
- Suspected upper UTI, sepsis or pyelonephritis.
- Recurrent UTI (two episodes in past 6 months or 3 episodes in past 12 months).
- Hospitalisation for more than 7 days in last 6 months.
- If a patient is transferred from or admitted in a facility that is known to have high rates of multi-drug resistant organisms [**R-GDG**].
- If prescribing antibiotic for a patient with a urinary catheter.

Empirical treatment of acute uncomplicated lower UTI in non-pregnant women:

- The recommended first-line empirical treatment of an acute uncomplicated UTI in non-pregnant women, of any age, [7,8] [**R-GDG**]**:**
  - Fosfomycin 3 grams once[9]; or
  - Septrin (trimethoprim and sulfamethoxazole), one double-strength tablet twice daily for 3 days; or
  - Nitrofurantoin 100 mg every 6 hours for 5 days.
  - Fluoroquinolones **should not** be used routinely for an acute uncomplicated lower UTI in adult non-pregnant women [7,10,11] [**L1, R-GDG**].

Asymptomatic bacteriuria in non-pregnant and pregnant women:

- Asymptomatic bacteriuria does not require treatment in non-pregnant women of any age [1,3,4,6,12,13] [**L1, RGA**].
- Screening for asymptomatic bacteriuria in pregnancy should be undertaken during the first trimester, and again at 28 weeks, using MSU sampling [**R-GDG**].
- Treatment of asymptomatic bacteriuria is necessary in pregnant women [3,14,15] [**L1, RGA**].
- Treatment and prophylaxis of asymptomatic bacteriuria are recommended immediately before performing high-risk urological procedures [16][**L2, RGA**].

Patients with catheters:

- Antimicrobial prophylaxis is not effective at preventing catheter-associated UTI in patients with a catheter [3,13] [**L1, RGB**].
- Do not treat asymptomatic bacteriuria in those with catheters as bacteriuria is expected, and antibiotics increase side effects and antibiotic resistance [3,8][**L1, RGA**].

Follow-up testing:

- Routine post-treatment urine dipstick testing or urine culture are not indicated in asymptomatic women [1,3,12,14] [**L1, RGA**].

4 Background Information

4.1 Definitions

A urinary tract infection (UTI) is defined as an infection of the urinary system causing an inflammatory response [14].

- **Lower UTI** [3]:
  - Evidence of a UTI with symptoms suggestive of cystitis.

- **Upper UTI** [3] :
  - Evidence of a UTI with symptoms suggestive of pyelonephritis.

- **Recurrent UTI** [1,3,17]:
  - 2 or more UTIs diagnosed in a 6-month period; or
  - 3 or more UTIs diagnosed in a 12-month period.
  - May be further sub-classified as:
    - **Unresolved infection** suggested by the following:
      - Sub-therapeutic antibiotic level.
      - Poor compliance to treatment.
      - Malabsorption of antibiotic treatment.
      - Infection with pathogen resistant to the prescribed antibiotic.
    - **Bacterial persistence** [14,18]:
      - The same bacteria are cultured in the urine 2 weeks after initiating treatment
      - May be due to a nidus for persistent infection in the urinary tract.
    - **Reinfection** [14,18]:
      - A new infection with a different organism acquired from peri-urethral, perineal or rectal flora after initial treatment cessation.

- **Uncomplicated UTI** [14]:
  - Infection in an otherwise healthy individual, with no functional or structural abnormality of the urinary tract.

- **Complicated UTI** [14]:
  - An infection associated with a structural or functional abnormality of the urinary tract.
  - Host factors, which classify a UTI as complicated, include:
    - **Anatomical abnormality** (e.g., cystocele, diverticulum, fistula).
    - **Iatrogenic factors** (e.g., indwelling catheter, nosocomial infection, surgery).
    - **Voiding dysfunction** (e.g. vesicoureteric reflux, neurological disease, pelvic floor dysfunction, high post-void residual, incontinence).
    - **Urinary tract obstruction** (e.g., bladder outlet obstruction, ureteral stricture, ureteropelvic junction obstruction).
    - **Other factors** (e.g., pregnancy, urolithiasis, diabetes, or other immunosuppression).

4.2 Infective Organisms

Escherichia coli (*E.coli*) is the infective organism in the majority (70-95% [4,10,12]) of uncomplicated UTIs in women under 50 years of age [2,14,19].

Other less common pathogens of UTI may include [2,10,12,14,19]:

- *Staphylococcus saprophyticus.*
- *Klebsiella pneumoniae*.
- *Proteus mirabilis.*
- Group B *Streptococcus.*
- *Enterococcus* spp.

4.3 Natural History

Asymptomatic bacteriuria occurs in 1-5% of healthy pre-menopausal women [1] and 4%–7% of pregnant women [10]. It corresponds to a commensal colonisation and increases in prevalence with increasing age and is more common in patients with diabetes mellitus[1]. Studies have shown that asymptomatic bacteriuria may protect against superinfecting symptomatic UTI[1] or may lead to a progression to symptomatic UTI, including pyelonephritis, during pregnancy [10]. Therefore, treatment should only be prescribed when specific host factors are present[1] (see *Section 10*).

Data from trials suggests that women with uncomplicated UTIs have a favourable prognosis with low rates of developing complications[3,20]. A simple, uncomplicated lower UTI may however progress to involve the upper urinary tract and lead to renal complications and sepsis. Treatment is therefore aimed at providing antibiotics to symptomatic women with lower or upper UTI and those susceptible to recurrent UTI, or at risk of complications [3,19,21].

4.4 Complications

Whilst a proportion of uncomplicated lower UTIs may resolve without treatment, the principal complication of a lower UTI is ascending infection involving the upper urinary tract [1]. An untreated lower UTI may therefore ultimately lead to the following complications [1,22–24]:

- Recurrent lower UTI.
- Acute pyelitis
- Acute pyelonephritis.
- Renal or perinephric abscess.
- Emphysematous pyelonephritis.
- Septicaemia.
- Preeclampsia.

2-9% of pregnant women are bacteriuric in the first trimester. 10-30% of women with bacteriuria will develop an upper UTI in the second and third trimester [1]. Upper UTI in pregnancy is associated with pre-term premature rupture of the membranes, pre-term labour, and low-birth weight babies.

4.5 Risk Factors for Lower UTI

Almost half of all women will experience at least one episode of UTI during their lifetime [18]. Nearly 1 in 3 women will have had at least one episode of UTI by the age of 24 years [18].

Risk factors in women include [1,23]:

- Young and premenopausal women:
  - Sexual intercourse.
  - Use of spermicide.
  - A new sexual partner.
  - A mother with a history of UTI.
  - History of a UTI in childhood.
- Postmenopausal and elderly women:
  - History of UTI before menopause.
  - Urinary incontinence.
  - Atrophic vaginitis due to oestrogen deficiency.
  - Cystocele.
  - Urinary catheterisation.
- Medical risk factors:
  - Poorly controlled diabetes mellitus.
  - Relevant immunosuppression.
  - Connective tissue diseases.
  - Deterioration in elderly institutionalised women.
- Nephropathic disease risk factors:
  - Renal insufficiency.
  - Polycystic kidney disease.
- Urological risk factors:
  - Ureteral obstruction i.e., stone, stricture.
  - Urinary catheterisation.
  - Controlled neurogenic bladder dysfunction.
  - Urological instrumentation or surgery.
  - Modifiable related risk factors i.e., use of diaphragms.

5 Clinical Presentation

The investigation or diagnosis of lower UTI is based upon the presence of the classical features of a lower UTI. The following symptoms may accompany a UTI [3,7,10]:

- Fever >38°C or rigors without alternative cause.
- Urgency, frequency, dysuria.
- Haematuria.
- Suprapubic pain or tenderness.
- Costovertebral pain or tenderness.
- New onset mental status changes with:
    - Leucocytosis (>10,000 cells/mm^3).
    - Hypotension (<90mmHg systolic).
    - 2 or more SIRS (Systemic Inflammatory Response Syndrome) criteria.

Symptoms suggestive of a UTI in patients with a catheter, include [10,16,25]:

- Fever.
- Rigors.
- Flank or suprapubic discomfort.
- Change in voiding patterns.
- Nausea, vomiting or malaise.
- New onset or worsening of baseline confusion.

Note:

- In older adults, symptoms of UTI may be unspecific (e.g., delirium and loss of diabetic control) or less clear [5,12].
- Hypothermia (<36°C) may also indicate infection [26].
- Spasticity or autonomic dysreflexia may be present in patients with a spinal cord injury [7].

6 History

Important aspects to elicit in the patient's history, include [17,19,21,23]:

- Nature, duration, and severity of symptoms.
- History of previous UTIs and use of antibiotics.
- Comorbidities which increase the risk of immunosuppression (e.g., diabetes, corticosteroid use, HIV/AIDS).
- Sexual history to exclude sexually transmitted disease (STD).
- Genito-urinary symptoms suggestive of STD:
    - Dyspareunia.
    - Itch.
    - Discharge (urethral or vaginal).
    - Pelvic pain.
    - History of unprotected sexual contact.
- Factors that increase the risk of UTI (see *Section 4.5*).

7 Examination

General examination is recommended in all patients and should be extended according to symptoms and signs [**R-GDG**]:

- Perform pelvic examination in women presenting with recurrent UTI [12].
- Consider pelvic examination if symptoms of vaginal itch or discharge are reported [3].

At a minimum, examination should look for the following [1,14,17,19,21]:

- Features supporting a diagnosis of lower UTI [1,3].
- Suprapubic tenderness.
- Features indicative of an upper UTI [3]:
    - Costovertebral angle tenderness.
    - Systemic features of sepsis (e.g., rigors, sweats, pallor, and tachycardia).
    - High temperature (>38°C).
    - Symptoms of lower UTI may be absent.

8 Investigation

8.1 Screening for Asymptomatic Bacteriuria

Screening for asymptomatic bacteriuria:

- Is not recommended in **non-pregnant** women but may be justified in select circumstances[7,12] [**L1, RGB**].
- Should be undertaken during the first trimester and again at 28 weeks as part of routine antenatal care in Qatar using MSU sampling [**R-GDG**].

Perform a urine microscopy and culture:

- When the patient is symptomatic [1,3] [**L1, RGA**].
- On specimens collected prior to initiating treatment [12,27][**L1, RGA**].
- Prior to performing a high risk urological procedure [16] [**L2, RGA**].

8.2 Urine Dipstick Testing

Perform dipstick tests to guide treatment decisions in otherwise healthy women aged less than 65 years of age who present with ≤2 of the classical features of UTI, listed in *Section 5* [3][**L1, RGA**].

Dipstick test is not necessary, in adult woman aged less than 65 years, if ≥3 of the classical features are present and if symptoms and signs are strongly indicative of a lower UTI [1,2] [**L2, RGA**].

Do not use dipstick test to diagnose UTI in elderly patients[26], patients with catheters [13] and in pregnant women [3] [**L1, RGA**].

8.3 Urine Microscopy and Culture

Urine culture should NOT be performed:

- If none of UTI symptoms (see *Section 5*) are present [7].
- If there is an alternative cause for the symptom [7].

- If ≥3 of the classical features are present in adult woman aged less than 65 years and if symptoms and signs are strongly indicative of a lower UTI [1,2].
- For uncomplicated lower UTI in the absence of additional risk factors, in women aged less than 65 years [1]
- For patients with catheters [3]:
    - Send urine for culture, if there are features of systemic infection to determine the infecting organism and susceptibility to antibiotics.

Urine microscopy and culture should be performed in the following cases [1,4–6] [**L1, RGA**]:

- Lower UTI symptoms that do not resolve on empirical treatment with antibiotics.
- Lower UTI symptoms do not improve or recur 2-4 weeks after completion of a course of antibiotics.
- Pregnant women (see *Section 11*).
- Elderly women or those who present with atypical symptoms.
- Women with suspected or known functional or structural genitourinary abnormalities.
- Suspected upper UTI, sepsis or pyelonephritis.
- Recurrent UTI (2 episodes in past 6 months or 3 episodes in past 12 months).
- Hospitalisation for more than 7 days in last 6 months.
- If a patient is transferred from or admitted in a facility that is known to have high rates of multi-drug resistant organisms [**R-GDG**].
- If prescribing antibiotic for a patient with a urinary catheter.

8.4 Mid-Stream Urine Testing

For pregnant women with lower UTI take an mid-stream urine (MSU) sample for culture, before empirical antibiotic treatment is initiated [1,3,28].

8.5 Imaging Studies

Further imaging studies may also be necessary in some women, but are not routinely indicated [1,3,10,12,14,17][**L1**].

Cystoscopy and imaging of the upper urinary tract should be performed for women with persistent haematuria or persistent growth of bacteria aside from *E. coli* [29].

9 Diagnosis

Dysuria is central in the diagnosis of UTI. Although it is a highly specific symptom for both young and elderly women, it should occur in conjunction with the laboratory detection of a pathogen from the urine (typically *E. coli*) [12].

There is no bacterial count that can be taken as an absolute 'gold standard' for the diagnosis of UTI [3]. The following colony count for MSU sample may help to distinguish bacteriuria from contamination [3,12,16,30] [**L1**]:

- Asymptomatic patients: threshold 10^5 CFU/mL.
- Symptomatic patients: threshold 10^2 CFU/mL (sensitivity 95%, specificity 85%).

False-positive culture results are common and may result from antibiotic treatment given prior to sampling [1,3] or contamination of a sample collected via mid-stream or urethral catheter [1].

A diagnosis of a lower UTI can be made with high probability in an adult young woman (< 65 years), if ≥3 of the classical features (*Section 5*) are present and both vaginal discharge and irritation are absent [1,2][**L2**].

The classical features of UTI (*Section 5*) cannot be consistently relied upon when making a diagnosis of UTI in a catheterised patient [3][**L1**].

As elderly patients often present with atypical symptoms (see notes in *Section 5*), diagnosis should be based on full clinical assessment of signs and symptoms, rather than laboratory testing alone [3].

9.1 Differential Diagnosis

To diagnose a lower UTI, exclude irritation, vaginal and urethral causes of urinary symptoms, which include[5,10]:

- Vaginal discharge (75-80% of patients do not have UTI).
- Urethritis (inflammation post sexual intercourse, irritants).
- STD (e.g., chlamydia and gonorrhoea).
- Genitourinary syndrome of menopause (vulvovaginal atrophy).

Check for signs and symptoms of pyelonephritis, systemic infection, and sepsis [5].

Bladder and gynaecological cancers are important differential diagnoses to be considered in patients with haematuria or persistent UTI symptoms (in the absence of a UTI), especially in elderly patients or those with a history of heavy smoking [31,32].

10 Management of Lower UTI in Non-Pregnant Women

10.1 General Principles of Management

In the absence of UTI symptoms (see *Section 5*), patients with a positive urine culture and/or pyuria should **not** be treated with antibiotics [7] [**L1, RGA**].

All antibiotic treatment recommendations outlined below have been made by the Guideline Development Group on the basis of the latest available antibiogram data for Qatar[8][**L3**].

If antibiotic treatment is required, follow a two-step approach [7,15][**L1, RGA**]:

- Empiric antibiotic choice:
  - Take into consideration recent previous culture results, prior antibiotic use, antibiotic allergies, and severity of the illness.
- Final antibiotic choice:
  - Based on antibiotic susceptibilities of the pathogen.
  - Takes into consideration antibiotic allergies of the patient.

Should first-line empirical antibiotic treatment be ineffective, undertake the following [1,3,14]:

- Check compliance with the treatment and continue to relieve symptoms with analgesia.
- Take a urine sample for culture to guide a change of antibiotic.
- If the patient does not respond to two courses of appropriate treatment, and compliance has been determined, refer for assessment and investigations.

Paracetamol or ibuprofen (if preferred and suitable) are recommended for pain relief [15,26][**L1, RGA**].

10.2 Acute Lower UTI

In general, women with an acute uncomplicated lower UTI should be managed in an outpatient or primary care setting [**R-GDG**]. See *Section 13.1* for the indications for inpatient admission.

10.2.1 Empirical Antimicrobial Treatment of Uncomplicated Lower UTI

Antibiotic treatment targeting *E. coli* is indicated in women diagnosed with an acute lower UTI [1,3,4,14,28,30]. Treat non-pregnant adult women up to the age of 65 years with symptoms of acute lower UTI with the following [7,8] [**R-GDG**]**:**

- Fosfomycin 3 grams once[9]; or
- Septrin (trimethoprim and sulfamethoxazole), one double-strength tablet twice daily for 3 days; or
- Nitrofurantoin 100 mg every 6 hours for 5 days.

If considering prescribing nitrofurantoin, review the following [3,28,33]:

- Nitrofurantoin is contraindicated in patients with G6PD deficiency [34].
- Take care when prescribing to elderly patients who may be at increased risk of toxicity.
- Do not use to treat patients with an estimated glomerular filtration rate (eGFR) of less than 45mL/min/1.73m^2 [33]. Seek specialist advice from Infectious Disease.
- Advise the patient not to take alkalinising agents, such as potassium citrate.

NB: Fluoroquinolones (e.g. ofloxacin, ciprofloxacin, levofloxacin and norfloxacin) are highly efficacious in a 3-day regimen but tend to increase bacterial resistance [7,16]. On the basis of other guidelines [7,10,11], local antibiogram data[8], and current levels of antimicrobial resistance in Qatar, it is recommended that **fluoroquinolones should not be used routinely** for an acute uncomplicated lower UTI in adult non-pregnant women [**R-GDG**].

NB: Co-trimoxazole is not recommended for empirical treatment of uncomplicated lower UTI, as recent antibiogram data shows *E.coli* and *Proteus* spp. are >20% resistant in Qatar [8][**R-GDG**].

10.2.2 Empirical Antimicrobial Treatment of Complicated Lower UTI

Consider the following empirical antibiotic treatment [7]:

- Oral nitrofurantoin (100 mg twice daily) for 7 days (may be extended up to 10-14 days).
- Oral or intravenous (IV) beta-lactams or aztreonam for cephalosporin allergic patients.
- Fluoroquinolones should not be used as first- or second-line therapy, unless there is no alternative. Duration of treatment is 5-7 days [11].

10.2.3 Considerations for Elderly Women

Narrow spectrum antibiotic therapy may be initiated prior to culture and sensitivity in accordance to kidney function and general medical status [27]. Recommended empirical antibiotic treatment for symptomatic bacteriuria:

- Consider using the following treatments whilst awaiting culture results [**R-GDG**]:
    - Oral cephalosporin for 3 days; or
    - Oral co-amoxiclav for 3 days.
- If allergic to beta-lactams, consider using a fluoroquinolone.

If symptoms do not improve within 48 hours of appropriate antibiotic therapy initiation, consider an alternate diagnosis, e.g. [27]:

- Gynaecological causes (e.g., vaginitis).
- Urolithiasis.

Note:

- Overuse of antimicrobials in elderly people admitted to long-term care facilities is a recognised problem that promotes antimicrobial resistance in the community [3].
- Older people are vulnerable to *Clostridium difficile* infection [26].
- In post-menopausal women, recurrent symptoms may be associated with vaginal atrophy [26].

10.3 Recurrent Lower UTI

Management of recurrent UTI is divided into the following aspects and should be attempted in the following order [1]:

1. Behavioural modification and avoidance of risk factors (see *Section 10.4.1*).
2. Non-antimicrobial prophylaxis (see *Section 10.4.2*).
3. Antimicrobial prophylaxis (see *Section 10.4.3*).

Consider referral to a urologist in women if antimicrobial prophylaxis is being considered, or when the diagnosis is uncertain [1,3,14,17][**L3**].

10.3.1 Behavioural Modification and Avoidance of Risk Factors

Sexual intercourse is the risk factor most frequently associated with recurrent UTI in young otherwise healthy, non-pregnant women [1]. For recurrent UTI associated with intercourse, consider providing advice on the following:

- If a diaphragm and spermicide are used, consider using an alternative contraceptive method [19,29].
- Using lubricant if symptoms are associated with mild trauma [19].
- Voiding shortly before and after intercourse [19].
- Increasing water intake [35].

10.3.2 Non-Antimicrobial Prophylaxis

Vaginal Oestrogen

In peri- and post-menopausal women with recurrent uncomplicated UTI, vaginal oestrogen is recommended to reduce the risk of future UTIs [1,12,16,29,36]. It may cause vaginal irritation [1][**L1, RGA**]. Do not offer oral oestrogens [16,36] [**L1, RGB**].

Cranberry Products

The evidence on the use of cranberry products is insufficient to recommend it for routine use [37] but cranberry prophylaxis can safely be suggested as complementary therapy to patients to reduce recurrent urinary tract infections [12,16,29] [**L1, RGB**].

Advise over-the-counter use of cranberry tablets/capsules instead of cranberry fruit or juice, due to the high concentration of cranberry extract in the capsules [3].

Alternative Therapies

Consider acupuncture as an alternative method to prevent recurrent UTIs in women who are unresponsive to or intolerant of antibiotic prophylaxis [29,37] [**L1, RGB**].

Consider intravesical hyaluronic acid and chondroitin sulphate as alternatives to antibiotics for recurrent urinary tract infections [38][**L1, RGB**].

Other potential approaches require more trials before recommending them [**L2, RGB**]:

- Vitamin D [39].
- D-mannose [37].
- Probiotics [40].
- Herbal medicines [41,42].
- Vaginal application of lactobacilli [16].
- Electrofulguration [43].

10.3.3 Antimicrobial Prophylaxis

Due to the risks of antimicrobial resistance, consider antimicrobial prophylaxis only if the above behavioural and non-antimicrobial measures have failed [2,36]. Antimicrobial prophylaxis may be provided as a post-coital stat dose, intermittent courses for self-administration, or as a continuous prophylaxis [1,12,29].

Post-Coital Antibiotics

A single dose of post-coital antibiotics should be considered only after counselling and behaviour modification has been attempted and when non-antimicrobial measures have been unsuccessful [3,29,36]. Based on local antibiogram data in Qatar, the recommended post-coital antibiotic regime is [8][**L3, R-GDG**]:

- Oral nitrofurantoin, single stat dose (to be taken within 2 hours after intercourse).
- Advise the patient to see their primary care physician if symptoms develop despite the use of the prophylactic antibiotics [19].

Standby Antibiotics (Self-Start Antibiotics)

Standby antibiotics are a short course of antibiotics, used by the patient if symptoms develop [3]. Acute self-treatment should be restricted to compliant and motivated patients with clearly documented recurrent UTI [29].

Based on local antibiogram data in Qatar, the recommended antibiotic regime is [8][**L3, R-GDG**]:

- Oral nitrofurantoin for 5 days [12].
- If nitrofurantoin is not available or contraindicated, use:
    - Oral cephalosporin (e.g. cefuroxime, cefixime) for 7 days; or
    - Oral co-amoxiclav for 7 days.
- Advise the patient to see their primary care physician if symptoms do not improve with treatment[19].

Continuous Prophylaxis

Based on local antibiogram data in Qatar, the recommended antibiotic regime is [8][**L3, R-GDG**]:

- Oral nitrofurantoin once at night for 6-12 months.
- The patient should be under specialist review and should be followed up after the period of continuous antibiotic prophylaxis has ended [19].
- NB: Nitrofurantoin is contraindicated in patients with G6PD deficiency [34].

10.4 Asymptomatic Bacteriuria

Adequate hydration and watchful waiting before antibiotic administration is an appropriate approach in asymptomatic bacteriuria – except in elderly patients with rapidly deteriorating medical status (e.g. fever, rigors, or increased confusion or falls) or those on fluid restriction [27] [**L1, RGA**].

Treatment and prophylaxis of asymptomatic bacteriuria are recommended immediately before performing high-risk urological procedures [16][**L2, RGA**]. For patients scheduled for low-risk urological procedures, treatment and prophylaxis are not recommended [16][**L2, RGB**]. After kidney transplantation, the screening and treatment of asymptomatic bacteriuria is only recommended in the first month [16] [**L2, RGB**].

Do not treat asymptomatic bacteriuria in [1,3,4,6,12,13][**L1, RGB**]:

- Non-pregnant women.
- Female residents of nursing homes.
- Diabetic women.
- Elderly women (>65 years).
- Patients with spinal cord injuries.
- Patients with indwelling urinary catheters.
- Patient scheduled to undergo low-risk urological procedures.

Asymptomatic bacteriuria in women over 65 years should not be treated with antibiotics [1,3,14][**L1, RGA**].

View Pathway

10.5 Women with Catheters

The duration of catheterisation is strongly associated with an increased risk of infection [3]. All patients with a long-term indwelling catheter are bacteriuric, often with 2 or more organisms [16]. Antimicrobial prophylaxis is not effective at preventing catheter-associated UTI [3,13][**L1, RGB**].

If a catheter-associated UTI is suspected [1,3,25]:

- Change the long-term indwelling catheter prior to initiating treatment [25][**L1, RGA**].
- The choice of an empirical narrow spectrum antibiotic for treatment of a catheter-associated UTI should be guided by local hospital policies.

Patients with indwelling catheters should be admitted to hospital if systemic symptoms, such as fever, rigors, vomiting, or confusion appear [3][**L3**].

10.6 Follow-Up

In patients with a long-term indwelling catheter, who have undergone treatment for a catheter-associated UTI, consider seeking advice from a urologist and review after 48 hours of treatment (or as clinically appropriate) to assess the following [25]:

- Response to treatment.
- Review of urine culture results for microorganism sensitivity.

When the single-dose or continuous antimicrobial prophylaxis is given to a patient with recurrent UTI, advice the patient returning for review within 6 months [36].
Routine post-treatment urine dipstick testing or urine culture are not indicated in non-pregnant asymptomatic women [1,3,12,14][**L1, RGA**]. However, perform urine culture with sensitivity testing if [3,4,12,13]:

- Patient is suspected for pyelonephritis.
- Patients exhibits atypical symptoms.
- Symptoms do not resolve by the end of treatment.
- Symptoms did not improve or resolve but recur 2-4 weeks after completion of a course of antibiotics.

11 Management of Lower UTI in Pregnancy

Follow general principles of management (see *Section 10.1*).

In all cases perform a urine culture 7 days after completion of antibiotic treatment as a 'test of cure' [1,3].

11.1 Acute Lower UTI in Pregnancy

Offer an immediate antibiotic prescription for pregnant women with lower UTI [15][**L1, RGA**]. Based on local antibiogram data in Qatar, the recommended antibiotic treatments are[8][**R-GDG**]:

- A beta-lactam for 7 days; or
- Oral amoxicillin for 7 days, if bacteria are susceptible; or
- Oral nitrofurantoin for 7 days[44]:
    - Should be avoided in early pregnancy if possible[45].
    - Should also be avoided during 38 to 42 weeks gestation, labour and delivery, or when the start of labour is imminent[44,46].
    - Short-term use is unlikely to cause problems to the foetus[28].
    - Is contraindicated in patients with G6PD deficiency[34].

If Group B *Streptococcus* is cultured in urine:

- **The patient will also require intrapartum antibiotics** [47].
- The patient should be advised to present early in labour in order to receive adequate doses of antibiotics [47].

Other considerations for pregnant women:

- Fluoroquinolones (e.g., ciprofloxacin) are contraindicated in pregnancy [**R-GDG**].
- Septrin (trimethoprim and sulfamethoxazole) should not be used in the two-week period prior to the expected date of delivery due to the risk to the neonate of hyperbilirubinaemia [**R-GDG**].
- Co-amoxiclav should be used with caution because of the increased risk of necrotising enterocolitis in the neonate [48].

11.2 Recurrent Lower UTI in Pregnancy

The evidence on antibiotic prophylaxis during pregnancy is controversial [29,49]. In general, antimicrobial treatment is not recommended to prevent recurrent UTIs in pregnant women but may be justified in certain cases and in the context of rigorous research [49].

If behavioural and personal hygiene measures (see *Section 10.4.1* for details) are not effective, consider a trial of daily antibiotic prophylaxis [15] [**L1**]. If continuous or post-coital prophylaxis (see *Section 10.4.3* for details) is required, consider nitrofurantoin or cephalexin, except during gestational weeks 38 to 42 [29].

11.3 Asymptomatic Bacteriuria in Pregnancy

Treatment of asymptomatic bacteriuria is necessary in pregnant women [3,14,15][**L1, RGA**].

For all pregnant women with asymptomatic bacteriuria confirmed by two consecutive urine cultures, offer a 4- to 7-day antibiotic regimen (nitrofurantoin, amoxicillin, or cefalexin) (see *Section 11.1* above) according to urine culture sensitivities [3,6,15,16,50] [**L1, RGA**].

12 Multidrug Resistant Bacteria

Community multidrug resistant bacteria (e.g. extended spectrum beta-lactamase (ESBL) *E.coli* and carbapenamase-producing organisms) are increasingly prevalent worldwide [28].

Risk factors for increased antimicrobial resistance include [28]:

- Overuse of antibiotics with history of recurrent UTI.
- Hospitalisation for more than 7 days in the last 6 months.
- Previous use of antibiotics.

If multi-drug resistant gram-negative bacteria are suspected, seek advice from Infectious Disease [R-GDG]. If positive methicillin-resistant *Staphylococcus aureus* (MRSA) is detected, the Infection Control Team must be informed immediately.

13 Referral

13.1 Indications for Admission to Hospital

Inpatient admission for a UTI is indicated for any of the following [51–56]:

- Upper UTI is suspected.
- Outpatient treatment has failed or is not feasible (e.g. multidrug-resistant organism).
- Presence of fever or infection requiring inpatient admission, e.g.:
    - Documented bacteraemia.
    - Temperature greater than 39.5°C (103.1°F).
- Inpatient IV hydration, or IV antimicrobial treatment, is required.
- Pregnancy beyond 24 weeks' gestation.
    - Refer pregnant women with a lower UTI who are beyond 24-weeks gestation to hospital for management by either obstetrics or urogynaecology [**R-GDG**].
- Haemodynamic instability (e.g., sepsis).
- Acute renal failure.
- Known renal or urological abnormalities (e.g. structural abnormalities, renal calculi, urinary stent, previous urological surgery).
- Condition that requires drainage procedure, e.g.:
    - Urinary obstruction.
    - Renal or perinephric abscess.
    - Emphysematous pyelonephritis.
    - Pyonephrosis.
- Immunocompromised state (e.g., AIDS, diabetes, sickle cell disease).

13.2 Outpatient Referral to Urology

Outpatient referral to Urology may be indicated for patients with UTI symptoms and any of the following [14,17,23,53,57–59]:

- Recurrent UTI where antimicrobial prophylaxis is considered.
- Pregnant patient with history of recurrent UTI.
- Renal transplant recipient.
- Abnormal finding on renal ultrasound or other imaging (e.g. hydronephrosis or stones).
- Recent history of urinary tract surgery or urogenital trauma.

- Urinary tract obstruction, known or suspected.
- Kidney, ureter, or bladder stones.
- Negative cultures (e.g. to rule out interstitial cystitis, mycobacterium infection).
- Neurogenic bladder, known or suspected.
- Persistent frank or microscopic haematuria after antibiotic treatment.
- Renal or perinephric abscess.
- Unclear diagnosis.

13.3 Outpatient Referral to Gynaecology or Urogynaecology

Outpatient referral to Gynaecology or Urogynaecology may be indicated for patients with UTI symptoms and any of the following [5,14]:

- Urinary Incontinence.
- Pelvic organ prolapse.
- Atrophic vaginitis.
- Suspected gynaecological malignancy (see *Section 13.6*).
- Unclear diagnosis (e.g., tubo-ovarian abscess).

13.4 Outpatient Referral to Infectious Disease

Outpatient referral for shared care with Infectious Disease may be indicated for patients with a UTI and any of the following [1,14,17,23,58]:

- Antimicrobial management needed for:
    - Anaerobic microorganism isolated from urine culture.
    - Multidrug-resistant organism.
    - Patient has drug allergy.
    - Unusual organism is isolated from urine culture.
    - Urea-splitting microorganism (e.g. *Proteus*, *Yersinia*).
    - Negative cultures (e.g. to rule out interstitial cystitis, mycobacterium infection).
- Failure of antibiotic therapy.
- Considering the use of nitrofurantoin in elderly patients or in patients with a low eGFR.
- Immunosuppressed patient (e.g. renal transplant recipient).
- Patient has long-term indwelling urinary catheter.

13.5 Outpatient referral to Nephrology

Outpatient referral to Nephrology, may be indicted for patients with a UTI and any of the following [1,14,23,57]:

- History of chronic renal failure.
- Persistent frank or microscopic haematuria after antibiotic treatment.
- Polycystic kidney disease.
- Renal transplant recipient.
- Chronic dialysis patients.
- Deteriorating renal function.

View Pathway

13.6 Referral for Suspected Malignancy

If cancer is suspected, refer urgently, to be seen within 48 hours, using the USC referral form, available from: www.ncp.qa [32].

Consider referral in patients with [31,32,60]:

- Frank haematuria that persists or recurs after successful treatment of a UTI.
- Unexplained microscopic haematuria of any age, with risk factors for malignancy, i.e.:
    - Aged over 35 years.
    - Past or current smoking.
    - Exposure to chemicals, dyes (benzene or aromatic amines), or other carcinogenic agents (e.g. chemotherapy with alkylating agents).
    - Analgesic abuse.
    - History of frank haematuria, urological disorder or disease, pelvic irradiation, or chronic indwelling foreign body.
    - History of irritative voiding symptoms.
- Recurrent or persistent UTI symptoms in the absence of a UTI if aged over 60 years.

14 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.

15 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
LUW01	Number of patients prescribed appropriate antimicrobials.	All women aged ≥18 years diagnosed with an uncomplicated lower UTI.
LUW02	Number of patients treated with antimicrobials.	All non-pregnant women aged ≥18 years diagnosed with asymptomatic bacteriuria.
LUW03	Number of patients treated with antimicrobial prophylaxis.	All women aged ≥18 years, with long-term indwelling catheter in-situ and no current symptomatic urinary tract infection and no history of recurrent or severe urinary tract infections.

Table 15.1: Performance Measures.

16 References

1. Grabe, M. *et al. Guidelines on Urological Infections*. (European Association of Urology, 2015).
2. Ronald, A. The etiology of urinary tract infection: traditional and emerging pathogens. *Dis.--Mon. DM* **49**, 71–82 (2003).
3. Scottish Intercollegiate Guidelines Network (SIGN). *Management of suspected bacterial urinary tract infection in adults: a national clinical guideline*. (SIGN, 2012).
4. Kang, C.-I. *et al.* Clinical Practice Guidelines for the Antibiotic Treatment of Community-Acquired Urinary Tract Infections. *Infect. Chemother.* **50**, 67–100 (2018).
5. Public Health England. *Diagnosis of urinary tract infections - quick reference tool for primary care*. (Public Health England, 2019).
6. McNulty, C. *Diagnosis of UTI. Quick reference guide for primary care: For consultation and local adaptation*. (Public Health England, 2017).
7. Michigan Hospital Medicine Safety (HMS) Consortium. Guidelines for Treatment of Urinary Tract Infections. (2018).
8. Hamad Medical Corporation. Annual cumulative report of the antimicrobial susceptibility rates of common microbial pathogens to antimicrobials available in Hamad General Hospital Formulary. (2019).
9. Huttner, A. *et al.* Effect of 5-Day Nitrofurantoin vs Single-Dose Fosfomycin on Clinical Resolution of Uncomplicated Lower Urinary Tract Infection in Women: A Randomized Clinical Trial. *JAMA* **319**, 1781 (2018).
10. Gupta, K., Grigoryan, L. & Trautner, B. Urinary Tract Infection. *Ann. Intern. Med.* **167**, ITC49 (2017).
11. The Canadian Agency for Drugs and Technologies in Health & Technologies in Health (CADTH). *Fluoroquinolones for the Treatment of Urinary Tract Infection: A Review of Clinical Effectiveness, Cost-Effectiveness, and Guidelines*. https://www.cadth.ca/sites/default/files/pdf/htis/2019/RC1101%20FQ%20for%20UTI%20Final.pdf (2019).
12. Anger, J. *et al.* Recurrent Uncomplicated Urinary Tract Infections in Women: AUA/CUA/SUFU Guideline. *J. Urol.* (2019) doi:10.1097/JU.0000000000000296.
13. National Institute for Health and Clinical Excellence (NICE). *Urinary tract infections in adults. Quality standard [QS90]*. (NICE, 2015).
14. Dason, S., Dason, J. T. & Kapoor, A. Guidelines for the diagnosis and management of recurrent urinary tract infection in women. *Can. Urol. Assoc. J.* **5**, 316–322 (2011).
15. National Institute for Health and Clinical Excellence (NICE). *Urinary tract infection (lower): antimicrobial prescribing. NICE guideline NG109.* (NICE, 2019).
16. de Cueto, M. *et al.* Executive summary of the diagnosis and treatment of urinary tract infection: Guidelines of the Spanish Society of Clinical Microbiology and Infectious Diseases (SEIMC). *Enfermedades Infecc. Microbiol. Clínica* **35**, 314–320 (2017).
17. Gupta, K. & Trautner, B. W. Diagnosis and management of recurrent urinary tract infections in non-pregnant women. *The BMJ* **346**, (2013).
18. Foxman, B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. *Am. J. Med.* **113 Suppl 1A**, 5S-13S (2002).
19. Hummers-Pradier, E. & Kochen, M. M. Urinary tract infections in adult general practice patients. *Br. J. Gen. Pract.* **52**, 752–761 (2002).
20. Little, P. *et al.* Presentation, pattern, and natural course of severe symptoms, and role of antibiotics and antibiotic resistance among patients presenting with suspected uncomplicated urinary tract infection in primary care: observational study. *BMJ* **340**, b5633–b5633 (2010).
21. Minardi, D., d'Anzeo, G., Cantoro, D., Conti, A. & Muzzonigro, G. Urinary tract infections in women: etiology and treatment options. *Int. J. Gen. Med.* **4**, 333–343 (2011).
22. Dhabalia, J. V. *et al.* Emphysematous Pyelonephritis: Tertiary Care Center Experience in Management and Review of the Literature. *Urol. Int.* **85**, 304–308 (2010).
23. Gupta, K. & Trautner, B. In the clinic. Urinary tract infection. *Ann. Intern. Med.* **156**, ITC3-1-ITC3-15; quiz ITC3-16 (2012).

24. Yan, L., Jin, Y., Hang, H. & Yan, B. The association between urinary tract infection during pregnancy and preeclampsia. *Medicine (Baltimore)* **97**, (2018).
25. Hooton, T. M. *et al.* Diagnosis, Prevention, and Treatment of Catheter-Associated Urinary Tract Infection in Adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clin. Infect. Dis.* **50**, 625–663 (2010).
26. Public Health Agency. Decision aid for diagnosis and management of suspected urinary tract infection (UTI) in older people. (2017).
27. Toward Optimized Practice (TOP). *Diagnosis and management of urinary tract infection in long term care facilities. Clinical practice guideline.* (TOP, 2015).
28. Public Health England (PHE). *Management of infection guidance for primary care for consultation and local adaptation*. (2016).
29. Epp, A. & Larochelle, A. No. 250-Recurrent Urinary Tract Infection. *J. Obstet. Gynaecol. Can.* **39**, e422–e431 (2017).
30. Giesen, L. G., Cousins, G., Dimitrov, B. D., van de Laar, F. A. & Fahey, T. Predicting acute uncomplicated urinary tract infection in women: a systematic review of the diagnostic accuracy of symptoms and signs. *BMC Fam. Pract.* **11**, 78 (2010).
31. National Institute for Health and Clinical Excellence (NICE). *Suspected cancer: recognition and referral. Guideline 12.* (NICE, 2017).
32. Ministry of Public Health of Qatar. Guidelines for Management of Bladder Cancer in the State of Qatar. (2015).
33. Medicines and Healthcare Products Regulatory Agency (MHRA). Nitrofurantoin now contraindicated in most patients with an estimated glomerular filtration rate (eGFR) of less than 45 ml/min/1.73m2. *GOV.UK* **8**, A3 (2014).
34. Youngster, I. *et al.* Medications and glucose-6-phosphate dehydrogenase deficiency: an evidence-based review. *Drug Saf.* **33**, 713–726 (2010).
35. Hooton, T. M. *et al.* Effect of Increased Daily Water Intake in Premenopausal Women With Recurrent Urinary Tract Infections: A Randomized Clinical Trial. *JAMA Intern. Med.* **178**, 1509–1515 (2018).
36. National Institute for Health and Clinical Excellence (NICE). *Urinary tract infection (recurrent): antimicrobial prescribing. NICE guideline NG112.* (NICE, 2018).
37. Smith, A. L. *et al.* Treatment and Prevention of Recurrent Lower Urinary Tract Infections in Women: A Rapid Review with Practice Recommendations. *J. Urol.* **200**, 1174–1191 (2018).
38. Goddard, J. C. & Janssen, D. A. W. Intravesical hyaluronic acid and chondroitin sulfate for recurrent urinary tract infections: systematic review and meta-analysis. *Int. Urogynecology J.* **29**, 933–942 (2018).
39. Oberg, J., Verelst, M., Jorde, R., Cashman, K. & Grimnes, G. High dose vitamin D may improve lower urinary tract symptoms in postmenopausal women. *J. Steroid Biochem. Mol. Biol.* **173**, 28–32 (2017).
40. Gupta, V., Nag, D. & Garg, P. Recurrent urinary tract infections in women: How promising is the use of probiotics? *Indian J. Med. Microbiol.* **35**, 347–354 (2017).
41. Shaheen, G. *et al.* Therapeutic potential of medicinal plants for the management of urinary tract infection: A systematic review. *Clin. Exp. Pharmacol. Physiol.* **46**, 613–624 (2019).
42. Flower, A., Harman, K., Willcox, M., Moore, M. & Stuart, B. The RUTI trial: A feasibility study exploring Chinese herbal medicine for the treatment of recurrent urinary tract infections. *J. Ethnopharmacol.* 111935 (2019) doi:10.1016/j.jep.2019.111935.
43. Crivelli, J. J., Alhalabi, F. & Zimmern, P. E. Electrofulguration in the advanced management of antibiotic-refractory recurrent urinary tract infections in women. *Int. J. Urol. Off. J. Jpn. Urol. Assoc.* **26**, 662–668 (2019).
44. Cimolai, N. & Cimolai, T. Nitrofurantoin and pregnancy. *CMAJ Can. Med. Assoc. J.* **176**, 1860–1861 (2007).
45. Ailes, E. C. *et al.* Antibiotics Dispensed to Privately Insured Pregnant Women with Urinary Tract Infections — United States, 2014. *MMWR Morb. Mortal. Wkly. Rep.* **67**, 18–22 (2018).
46. Squadrito, F. J. & del Portal, D. Nitrofurantoin. in *StatPearls* (StatPearls Publishing, 2019).
47. Royal College of Obstetricians and Gynaecologists. Prevention of Early-onset Neonatal Group B Streptococcal Disease: Green-top Guideline No. 36. *BJOG Int. J. Obstet. Gynaecol.* **124**, e280–e305 (2017).

48. Kenyon, S. L., Taylor, D. J. & Tarnow-Mordi, W. Broad-spectrum antibiotics for preterm, prelabour rupture of fetal membranes: the ORACLE I randomised trial. *The Lancet* **357**, 979–988 (2001).
49. World Health Organization (WHO). WHO recommendation on antibiotic prophylaxis to prevent recurrent urinary tract infections. (2018).
50. World Health Organization (WHO). WHO recommendation on antibiotics for asymptomatic bacteriuria. (2018).
51. Lane, D. R. & Takhar, S. S. Diagnosis and management of urinary tract infection and pyelonephritis. *Emerg. Med. Clin. North Am.* **29**, 539–552 (2011).
52. Kang, C. *et al.* A risk stratification model of acute pyelonephritis to indicate hospital admission from the ED. *Am. J. Emerg. Med.* **31**, 1067–1072 (2013).
53. Jolley, J. A. & Wing, D. A. Pyelonephritis in pregnancy: an update on treatment options for optimal outcomes. *Drugs* **70**, 1643–1655 (2010).
54. Ubee, S. S., McGlynn, L. & Fordham, M. Emphysematous pyelonephritis. *BJU Int.* **107**, 1474–1478 (2011).
55. High, K. P. *et al.* Clinical practice guideline for the evaluation of fever and infection in older adult residents of long-term care facilities: 2008 update by the Infectious Diseases Society of America. *Clin. Infect. Dis. Off. Publ. Infect. Dis. Soc. Am.* **48**, 149–171 (2009).
56. Ministry of Public Health (MOPH) Qatar. The Diagnosis and Management of Sepsis. National Clinical Guideline. (2019).
57. Wang, A., Nizran, P., Malone, M. A. & Riley, T. Urinary tract infections. *Prim. Care* **40**, 687–706 (2013).
58. Gradwohl, S., Bettcher, C., Chenoweth, C., Van Harrison, R. & Zoschnick, L. *Urinary tract infection. Guidelines for clinical care*. (University of Michigan Health System, 2016).
59. Dielubanza, E. J. & Schaeffer, A. J. Urinary tract infections in women. *Med. Clin. North Am.* **95**, 27–41 (2011).
60. Davis, R. *et al.* Diagnosis, evaluation and follow-up of asymptomatic microhematuria (AMH) in adults: AUA guideline. *J. Urol.* **188**, 2473–2481 (2012).

Appendix: Detailed Description of the Literature Search

A systematic search for existing literature on hypothyroidism was performed in the period June 9th-16th, 2019.

The search for clinical practice guidelines on dementia diagnosis and/or management was performed in the *PubMed* database and websites of relevant organisations and societies including the *Public Health England*, *Canadian Agency for Drugs and Technologies in Health*, and *World Health Organization (WHO)*.

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 on 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 woman". All hits were reviewed.

The date limit for the search was set up as March 19th, 2017 based on the last update of the present guideline.

Figure A.1 on the next page demonstrates graphically the results of the search and application of exclusion criteria.

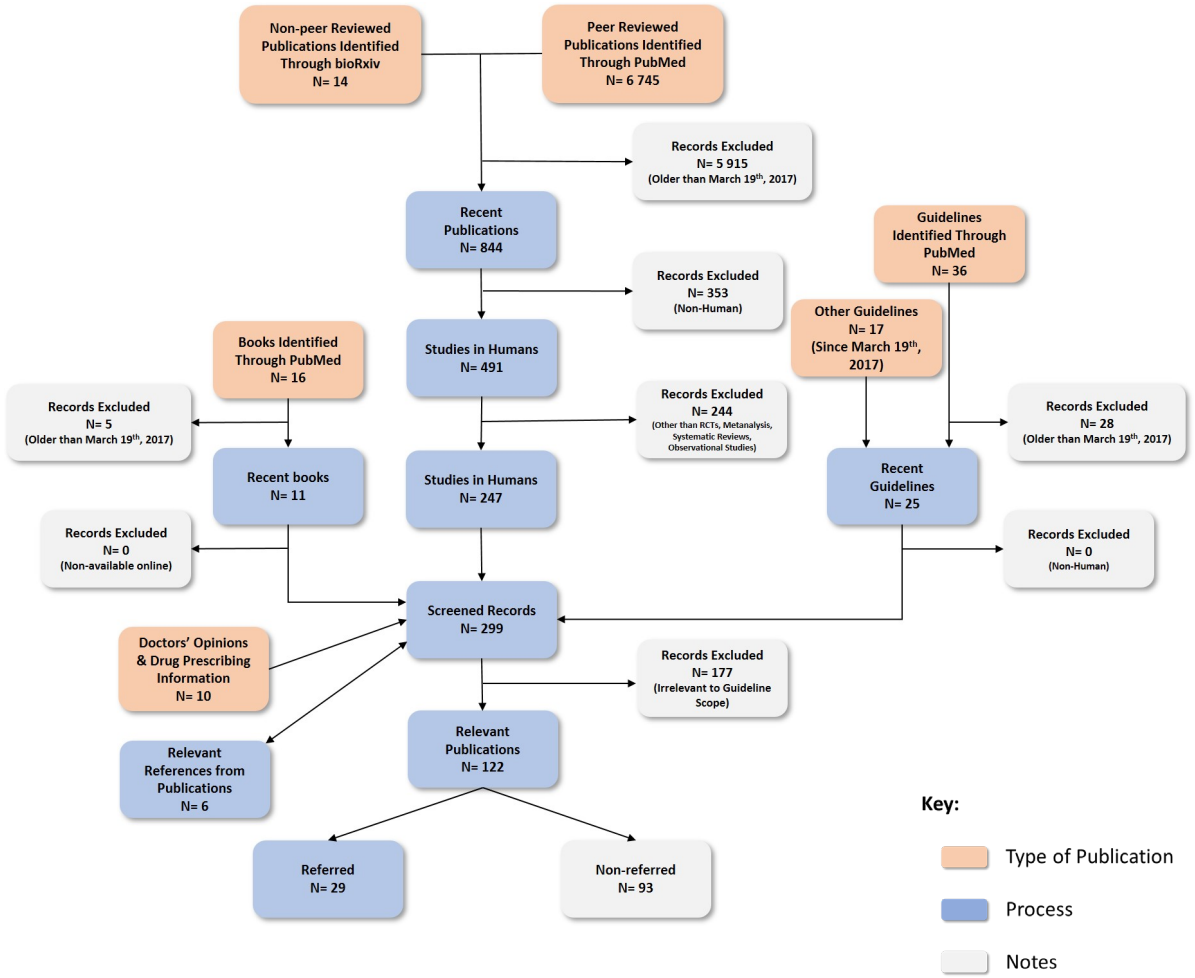


Fig A.1: Literature search results and application of exclusion criteria.

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